



Journal of Arts & Humanities

Volume 09, Issue 07, 2020: 39-64

Article Received: 06-11-2019

Accepted: 25-12-2019

Available Online: 29-07-2020

ISSN: 2167-9045 (Print), 2167-9053 (Online)

DOI: <http://dx.doi.org/10.18533/journal.v9i7.1784>

Kwame Nkrumah University of Science and Technology Landmarks made in Asante casting

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ABSTRACT

Landmarks are essential geographical features that give easy identification to a specific location. Although landmarks serve very important purposes, most of these landmarks could only be seen at the site they are found. These landmarks can be made handy as souvenir items which will intend advertise and showcase the beauty of these landmarks. The Kwame Nkrumah University of Science and Technology (KNUST) has a wide array of “two dimensional” souvenirs already available for purchase and distribution. However most of them lack originality and a deeper sense of connection to the prestigious university. Souvenir items can be produced using the Asante casting technique to depict the various landmarks in KNUST. This study is therefore geared towards adding a few more landmarks to the list of available souvenirs as well as landmarks that have been changed completely. This research is qualitative and employs studio base research design for the execution of the project. It was found that during periods of increase in rainfall, Plaster of Paris (P.O.P.) moulds serve as the best investment material because it dries and hardens quickly. Also, the addition of sand to P.O.P makes it cost efficient and durable. It is recommended that, technology such drones can be used to capture bird’s view of very large landmarks to improve designs and three dimensional computer aided software can be used to produce detailed designs within a short period of time.

Keywords: Asante casting, Landmarks, Souvenir item, KNUST, Three dimensional.

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1. Introduction

Astonishing landmarks are the pride of any famous vacation destination. From Tsuji, Lindgaard & Parush (2005), the lack of landmarks in the environment degrades navigation and orientation performance. Example of these magnificent works of art can be seen in locations like Paris in France, Dubai in the United Arab Emirates, Rome in Italy, Accra in Ghana, New York in the United States of America and many more. The Burj Al Arab Jumeirah, the Eiffel tower, the Akosombo Dam, the Statue of

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Liberty, and the Colosseum are but a few examples of famous man-made landmarks. As magnificent as they all are, the experience of these landmarks lasts for only a short period of time for travelers and tourists. This is because all they have left after their trip are fading memories and/or flat (two dimensional) pictures, customized mugs, shirts and the like which can even be purchased from the comfort of your home. Swanson & Timothy (2012) put it this way that souvenirs can be purchased via the internet and these don't have direct connection to a special memory or experience. But Wilkins (2011) opines that, the purchase of mementos and souvenirs is an established behavior associated activities including travel and other leisure trips. He adds that, people like to be reminded of special moments in their lives and to hold evidence of those special moments. Souvenirs as material objects link people with places and memories (Morgan & Pritchard, 2005; Ramsay, 2009). And souvenirs play a very important role in any successful tourist trip or vacation.

Some souvenirs that once carried value when purchased lose their relevance or meaning with time (Cave, J. and Jolliffe, L. eds., 2013). Some travelers purchase "mass produced" three dimensional representations of landmarks that are made in plastic or wood from the location of the landmark. But their luck quickly runs out when upon arrival at their final destinations the souvenir article is either damaged, looks like 'cheap' locally purchased product on their shelves or just doesn't last the test of time. Other times people collect certain found objects from tourist sites to keep as a souvenir. Unfortunately these objects lack any physical representation and connection with any prominent landmark. After a couple of trips, travelers become more interested in purchasing souvenirs that have unique characteristics and features compared to previously bought souvenirs (Cave, J. and Jolliffe, L. eds., 2013).

Landmarks are usually greater than life size and are quite impossible to carry home with you, hence the need for miniature representations of these landmarks to give people a chance to 'carry' the said landmark home with them. The Asante lost wax casting technique has proven to be very effective in casting or producing miniatures of anything you can think of, Kissi, Fening, & Adom (2016). The Asante lost wax casting technique is a revered casting technique that is admired by many across the globe for its connection to the Asante tribe of Ghana and its unique handmade qualities. In spite of the lack of clear evidence as to the origin, brass casting is considered an ancient craft of the Asante (Kissi et. al., 2016). Some of the popular Asante castings include kudoku containers, fine gold jewellery and gold weights. Despite the fact that these works were produced a long time ago, they still retain their durability and aesthetic appeal because they are made from metal. The longevity of the cast material (metal) allows for current day art enthusiast, historians, and the everyday person to admire and appreciate the meaning and symbolism of these objects. In simple terms, metal art is a good preserver of history.

The Kwame Nkrumah University of Science and Technology (KNUST) has a wide array of souvenirs already available for purchase and distribution. However most of them lack originality and a deeper sense of connection to the prestigious university. That being said, the university has a number of eye catching monuments that have become landmarks in the university. Most of these landmarks are unique to the university alone, and examples are the "KNUST Main Entrance Stool", the statue of Dr. Kwame Nkrumah –which was made uniquely by the university and for the university, the statue of "father John" found in the famous "University Hall". In time past most souvenirs of the university have been tie clips, brooches, mugs, sashes etc with only the logo of the university found on them.

This study employs the Asante lost wax metal casting method and appropriate finishing techniques to create "in the round" souvenirs of selected land marks in KNUST. A similar study was conducted by Mensah and Oppong-Adjei (2017), in which they argue that, landmarks play an important role in our everyday life and that no one wants to visit a memorable place and leave without taking a part of it along. The previous study succeeded in producing souvenirs of some landmarks on KNUST campus but due to time constraint not all major landmarks were captured. As well, some old landmarks have been changed entirely due to the fast growing nature and development of the university, hence the need for this research.

KNUST boasts of world class landmarks produced by the university and about the university. This makes it easy for visitors to relate to the rich history and culture of the university. Three dimensional souvenirs of these landmarks will serve as excellent gifts to visitors and also as a means for tourists and other people to preserve wonderful memories created during their stay or visit to the

campus. This research studies existing landmarks on KNUST campus, creates unique designs of the selected landmarks, and produces original prototype souvenirs of these landmarks. This study is unique in the sense that it takes advantage of landmarks on KNUST campus that were not captured in the previous study, newly put up monuments and monuments that have replaced old ones entirely. As well, the study provides souvenirs that will serve functional purposes. The introduction of functionality to the souvenirs keeps them from becoming redundant after a while.

One importance of the study is that it provides a means through which the nation can generate income by the production and sale of souvenirs. Yuksel (2014) opines that huge revenue can be generated from the production sale of souvenirs for a nation. The study also confirms the usefulness of Plaster of Paris (P.O.P.) as an investment material in Asante casting as stated in (Kissi, Fening, & Adom, 2016). The results of this research add to the list of available three dimensional souvenirs in KNUST and serves as a means of preserving the history and culture of the university. Lin, & Mao (2015) argue that souvenirs connect people to the culture of a place.

The qualitative research approach and studio based research methodology were adopted throughout the project. To begin the process of producing the prototype souvenirs, the idea development process was employed. For the purpose of this research the idea development process constituted: taking of photographs of selected landmarks, developing designs of landmarks using sketches and selecting final designs. The fabrication process included making of wax models, “investing” the models to create moulds, casting, and “finishing”.

From the study it was found that the idea development process is necessary for arriving at suitable designs. Also, P.O.P moulds help best in unfavorable weather conditions, where humidity is high and clay and charcoal moulds would take longer than normal to dry and harden. P.O.P moulds become cost efficient when sand is added to create the mould. As well, brazing helps correct defects and can be used to join components of a cast piece together. And finally, the oxidation or patina finish does not only protect the surface of the cast piece but is aesthetically pleasing. The study adds to the body of literature available on three dimensional souvenirs and serves as excellent reference material on the current day Asante casting technique.

The rest of the study presents the methodology, the idea development process, the fabrication or production process from start to finish and finally the findings, conclusion and policy implementation.

1.1 Kwame Nkrumah University of Science and Technology (KNUST)

The Kwame Nkrumah University of Science and Technology is a world-class academic centre of excellence, leading West Africa’s pursuit of technological advancement. The campus is located at an archetypal place inside the city of Kumasi. With an estimated eight-mile square of aesthetic beauty, a rising and falling landscape, state of the art buildings, a wide range of trees, long stretches of well-cut lawns and very conspicuous flora prettification, the community provides the right atmosphere for the holistic development of students.

According to Kwame Nkrumah University of Science and Technology (n.d.), the University of Science and Technology succeeded the Kumasi College of Technology which was established by a Government Ordinance on 6th October, 1951. It was however, opened officially on 22nd January, 1952 with 200 Teacher Training students transferred from Achimota, to form the nucleus of the new College. In October, 1952, the first students were admitted to the School of Engineering and the Department of Commerce. From 1952 to 1955, the School of Engineering prepared students for professional qualifications only. In 1955, the School embarked on courses leading to the University of London Bachelor of Engineering External Degree Examinations. In January 1953, the Pharmacy Department was established with the transfer of the former School of Pharmacy from Korle-Bu Hospital, Accra, to the College. The Department ran a two-year comprehensive course in Pharmacy leading to the award of the Pharmacy Board Certificate. The Department of Agriculture was opened in the same year to provide a number of ad hoc courses of varying duration, from a few terms to three years, for the Ministry of Agriculture. The Department of General Studies was also instituted to prepare students for the Higher School Certificate Examinations in both Science and Arts subjects and to give instruction in such subjects as were requested by the other departments. Once it was established, the College began to grow and in 1957, the School of Architecture, Town Planning and Building was inaugurated and its first

students were admitted in January, 1958, for professional courses in Architecture, Town Planning and Building. As the College expanded, it was decided to make the Kumasi College of Technology a purely science and technology institution. In pursuit of this policy, the Teacher Training College, with the exception of the Art School, was transferred in January, 1958, to the Winneba Training College, and in 1959 the Commerce Department was transferred to Achimota to form the nucleus of the present School of administration of the University of Ghana, Legon.

In December, 1960, the Government of Ghana appointed a University Commission to advise it on the future development of University Education in Ghana, in connection with the proposal to transform the University College of Ghana and the Kumasi College of Technology into an independent University of Ghana. Following the report of the commission which came out early 1961, Government decided to establish two independent Universities in Kumasi and at Legon near Accra. The Kumasi College of Technology was thus transformed into a full-fledged University and renamed Kwame Nkrumah University of Science and Technology by an Act of Parliament on 22nd August, 1961. The University's name was changed to University of Science and Technology after the Revolution of 24th February, 1966. The University of Science and Technology was officially inaugurated on Wednesday, 20th November, 1961. However, by another act of Parliament, Act 559 of 1998, the University has been renamed Kwame Nkrumah University of Science and Technology, Kumasi.

KNUST has, since January 2005, transformed from its previous centralized system of administration into a significantly decentralized one called the Collegiate system. Under this system, the various faculties have been condensed into six colleges. Since its inception, the University has been administered on the Faculty-based system. This naturally led to a situation where new Faculties and Institutes were created to meet the ever-growing academic pursuits of students. The resultant collection of Faculties largely hampered efficient administrative and academic operations, as duplication of efforts and long administrative processes were rampant. The need to deal with these complexities and harmonize the operation of the existing structures became apparent and unavoidable. This was more so, with the ever-increasing numbers in student population. True to the vision to make KNUST the model for technological education in Africa and the Vice-Chancellor's commitment to academic excellence, the Collegiate System came into being with the promulgation of the statutes on November 29, 2004. It has within the short period of its existence become an important centre for the training of scientists and technologists not only for Ghana, but also for other African countries as well as for other parts of the world.

There are six Halls of residence and a number of hostels in the University. They are Queen Elizabeth II Hall, Unity Hall, Independence Hall, Republic Hall, University Hall, and Africa Hall. All Halls of residence are mixed i.e. they have both male and female residents. Of the five hostels, two are for postgraduate students, one for both undergraduate and graduate students and managed by the Ghana Universities Staff Superannuation Scheme (GUSSS).

The Act establishing the University defines its mandate, which essentially is to provide higher education, undertake research, disseminate knowledge and foster relationships with the outside persons and bodies. The strategic mandate of the University is derived from Science and Technology in its name. The vision of the university is to be globally recognized as the Premier Centre of excellence in Africa for teaching in Science and Technology for development; producing high caliber graduates with knowledge and expertise to support the industrial and socio-economic development of Ghana and Africa. It may be simply stated as "Advancing knowledge in Science and Technology for sustainable development in Africa". The mission statement of the university is to provide an environment for teaching, research and entrepreneurship training in Science and Technology for the industrial and socio-economic development of Ghana, Africa and other nations. KNUST also offers service to the community, is open to all the people of Ghana and positioned to attract scholars, industrialists and entrepreneurs from Africa and other international community. Leadership in Innovation and Technology; Culture of Excellence; Diversity and Equal Opportunity for all; Integrity and Stewardship of Resources are the core values of the university.

1.2 Landmarks

Procter (1978) defines a landmark as anything easily recognizable in nature or man-made that helps with navigation. For as long as can be remembered landmarks have been necessary to humans, in

the sense that it plays a vital role in navigation and identifying a place. Booker (2018) defines historical landmarks as places where significant events took place and have monuments that honor that event.

Gollegde (2002) opines that, landmarks are used to determine location of a place and to determine the route to a place. Landmarks also help boost tourism in a community. Goldstein (2012) puts it this way, “landmarks always play a big part in attracting visitors. Sometimes, a landmark is even the only reason for some people to pack their bags and give the place a visit”.

1.3 Asante lost wax casting

Casting in metal refers to the pouring of molten metal into a mould so the metal takes the form and design in the mould (Rao, 2007). Also from Rao (2007), the casting process can simply be put as: pattern making, sand preparation, molding, melting of metal, pouring in molds, cooling, shake-out, fettling, heat-treatment finishing and inspection.

“In West Africa, lost wax casting is practiced in countries such as Nigeria (Benin, Ife), Ghana (Ashanti Region) and La Cote d’Ivoire”, Kissi (2011:14). The people of the Asante kingdom in Ghana employ the lost wax casting technique in the making of various metal items. “In Ghana, the craft itself is associated with the Asante kingdom, just as gold weights and lost wax casting are synonymous, hence the name ‘Asante castings’”, (Kissi, Fening & Adom, 2016:8). In time past the craftsmen of Asante were primarily concerned with making all the jewelry of the Asante King. This trade was passed down from generation to generation to the present day Ashante region, where the trade is now employed in making cast pieces on a large scale and for customers from all walks of life. The lost wax casting technique employs the use of wax patterns to make the mould. Then the wax pattern or wax model is invested in a mould, after which the wax is melted out and molten metal takes its place.

“Lost-wax process, also called “cire-perdue”, method of metal casting in which a molten metal is poured into a mould that has been created by means of a wax model. Once the mould is made, the wax model is melted and drained away”, (Encyclopaedia Britannica, 2018). The traditional Asante casting follows the same procedure but what makes it unique is primarily the investment material used and the craftsmanship of the wax modeler. The Asante lost wax casting uses primarily clay, charcoal and palm fibre for making moulds. “A new core composition comprising cow dung, charcoal powder and clay was introduced to improve the existing clay and charcoal powder composition”, Kissi (2011:24). Using this technique the local craftsman is able to produce cast pieces with intricate and complex designs.

1.4 Souvenirs

The Cambridge Dictionary (1995) defines souvenir as something that is bought or kept to help one remember a holiday or a special event. According to the Oxford Dictionary (1844), souvenirs can also be known as memento or memorabilia which also connotes objects kept or collected because of their associations with memorable people or events.

Wilkins (2011) opines that, the purchase of mementos and souvenirs is an established behavior associated with many activities, including travel and other leisure activities. He adds that, people like to be reminded of special moments in their lives and to hold evidence of those special moments. In this way, souvenirs as material objects link people with places and memories (Morgan & Pritchard, 2005; Ramsay, 2009). There are indications and records (Lasusa, 2007; Swanson & Timothy, 2012) that souvenirs existed in the ancient world. It is also known that during the 17th century rulers of Germanic states started to formulate the ‘Wunderkammer’ (wonder chamber), a room where they placed their private collections of curiosities that comprised exotic material objects and artifacts (Hume, 2013). However, a transitional period for souvenirs was the 17th and 18th century, when Grand Tour participants brought back home miniature replicas of the European sites they visited, as well as the 19th century, when Thomas Cook marked the beginning of modern tourism (Corrigan, 1997; Lasusa, 2007; Swanson & Timothy, 2012). The industrial revolution, during the later part of the 18th century and the 19th century, marked the beginning of mass production of material objects, which has also affected the production of souvenirs. However, mass production of souvenirs became a global phenomenon only after World War II, when tourism movements started to become a privilege of the middle-class in the western societies (Lasusa, 2007). In brief, the industrial revolution and the expansion of tourism activity transformed the search for antiquities and authentic artifacts of pre-industrial era to increased demand

for mass-produced souvenirs. The main difference between pre-mass produced and mass-produced souvenirs is that the former functioned as genuine representations of sites and other artistic works, whereas the latter are identified as cheap and inauthentic commercial objects (Thompson, Hannam & Petrie, 2012).

Swanson (2014) mentions that, there are many themes that are associated with the phenomena of souvenirs including: perception, craft production, cultural property, geographical representation, gift-giving practices, gift distributor, locally made products and outsourced merchandise. Souvenirs can be used as gifts, evidence or awards and may serve aesthetics or functional purposes. Paraskevaidis and Andriotis (2015), suggests that, from a tourism perspective, the use and value of souvenirs have a dual functionality for tourists as reminders of the tourism experience as well as products for use in daily life, for instance a souvenir-cup purchased at the destination can be used at home for drinking coffee and also serve as an object for remembrance.

Souvenirs are not always connected to the tourism experience, because souvenirs are also on sale through the internet and in antique shops (Swanson & Timothy, 2012). Consequently, someone can purchase a souvenir depicting a landmark of a certain destination, which he/she has never visited.

2. Materials and methods

The qualitative research approach and studio based research methodology were adopted throughout the project. This research determines how KNUST landmarks can be produced using the Asante casting technique. Therefore there wasn't a need for the collection of numeric data. Studio based experiments and observations were used to determine the best possible means of achieving the desired results for the study. This section of the study contains a detailed description of the entire production process, from start to finish. The idea development process was employed to begin the process of producing the prototype souvenirs. For the purpose of this research the idea development process constituted: taking of photographs of selected landmarks, developing designs of landmarks using sketches and selecting a final design for each selected landmark. The production process comprised making of wax models, investing the models, casting, and finally 'finishing' the cast pieces.

The selected landmarks for the project include:

- a. The KNUST Main Entrance Stool
- b. Paa Joe statue
- c. Peace Pole
- d. The Eagle Monument
- e. Monument of Dr. Kwame Nkrumah

Selection of landmarks for this research was done based on various considerations. Below is a brief description of each landmark, reason for selection, history or available documentation, its location and any other necessary information. As well, photographs taken and all sketches that were made are included under each landmark.

2.1 KNUST Main Entrance Stool

This is a conspicuous structure built to welcome people to KNUST. It has the basic form of an old Ashanti stool used by chiefs and other prominent people. The monument which can be seen in Figure 1.1 is built over the two way road leading in and out of the campus and serves as the university's main entrance.

This land mark was selected particularly because of its location. It is almost impossible to visit the university's campus without catching a glimpse of this monument. Due to this fact it was considered as an excellent landmark souvenir. The stool is a symbol of traditional authority, reinforcing the maxim: "Knowledge is Power", Kwame Nkrumah University of Science and Technology (n.d.).



Sketches were made of the monument and Figures 1.2a and b show all the sketches made.

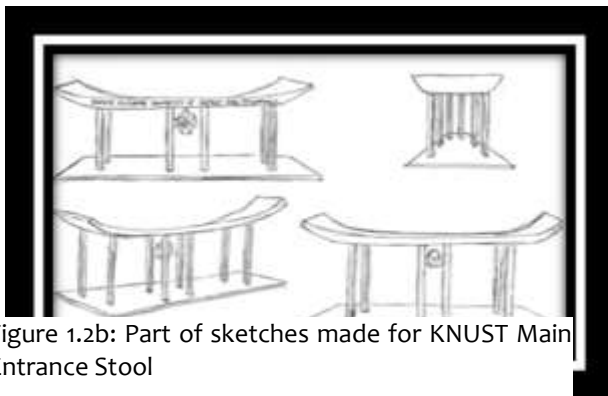
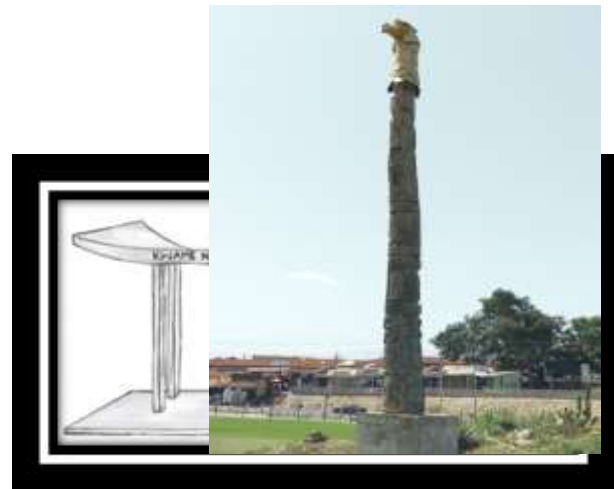


Figure 1.2b: Part of sketches made for KNUST Main Entrance Stool



2.2 Paa Joe Statue

Figure 1.3 shows the monument built in honor of Arthur Hercules Ratnadurai Joseph, commonly known as Paa Joe. The monument features Paa Joe in a sprinting posture while firmly holding onto a baton. It is located at the 'Paa Joe Sports Stadium.

This monument was selected because it is a new monument added to the university's rich collection and also because of the popularity of the sports stadium in the city of Kumasi. According to Zando (2018), Ratnadurai served as the first Director of Sports of the Kumasi College of Technology now KNUST, from 1952-1957. "He was an astute athlete who devoted his life selflessly to the development of Sports and Education in Ghana", (Zando, 2018). Due to this, the university's prestigious sports stadium was given the name Paa Joe Sport Stadium.

Sketches were made of the monument and Figures 1.4a, b and c show all the sketches made.



Figure 1.3: Paa Joe Statue



2.3 Peace Pole

This pole currently stands as the tallest Peace Pole in the world at 16.7meters, Wikipedia Commons (2008). The creative carvings on the peace Pole illustrate the history of Kwame Nkrumah

University of Science and Technology as well as some landmark events in Ghana and some key individuals whose lives have exemplified and or promoted peace including Dr Kofi Annan- the former United Nations Secretary General, who is an alumnus of the University. It is located just off the Accra-Kumasi highway close to the university's main entrance.

This landmark which can be seen in Figure 1.5 was selected because of its rich history and connection to the university. From Wikimedia Commons (2008), the Peace Pole was erected on the campus of the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana on 21st September, 2007 on the International Day of Peace.

Figure 1.5: Peace Pole

As part of refurbishment works at the university's main entrance the peace pole was relocated from "Commercial Area" on the campus to a new site at the university's entrance, (Ellis, 2011). Sketches were made of the monument and Figures 1.6a and b show all the sketches made.

Figure 1.6a: Sketches made for Peace Pole.

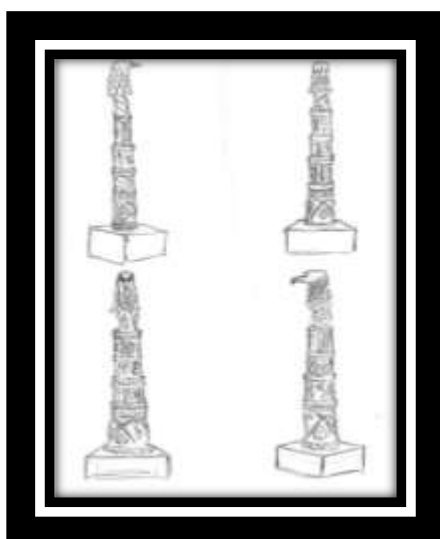


Figure 1.6b: Part of sketches made for Peace Pole.



2.4 The Eagle Monument

This monument consists of an eagle standing on a four sided pedestal with its wings spread wide. The pedestal bears the inscription “KNUST” on all four sides. This monument is located at the roundabout adjacent the KNUST main Administration block. Figure 1.7 shows the Eagle monument.

This monument was selected because it is a modified version of the one captured in the previous research. The old monument consisted of two individuals each holding an opened book in their hand while sitting on a pedestal base with the inscription “UST” (which means University of Science and Technology – the university’s former name). The old monument was changed to conform to the university’s current image and vision. As well, the new monument bears the current name of the university. The eagle can be seen as the predominant image in the KNUST Emblem. This eagle signifies the fact that the University has a wider view, clearer view and better understanding of the many problems confronting the country as well as the capacity to solve them effectively and efficiently, (Kwame Nkrumah University of Science and Technology, [n.d.]).



Figure 1.7: Eagle Monument

Sketches were made of the monument and Figures 1.8a and b show all the sketches made.



Figure 1.8a: Sketches for Eagle Monument.



Figure 1.8b: Part of sketches for Monument.

2.5 Monument of Dr. Kwame Nkrumah

Figure 1.9 shows the Monument of Dr. Kwame Nkrumah holding a rod in his left hand and waving with his right hand. This statue is located at a place called the Kwame Nkrumah Memorial Park at the university’s main entrance and has five small figures drumming and dancing around it, Wikimedia Commons (2011).

This monument was chosen because it was made to honor the founder of the university and also because of its popularity. Osagyefo Dr. Kwame Nkrumah was the first president of Ghana and is famously known for his tremendous role in the independence of the nation. Ghana’s first President, Osagyefo Dr. Kwame Nkrumah, was born on September 21, 1909 to Kofi Ngonloma of the Asona Clan and Elizabeth Nyanibah of the Anona Clan at Nkroful in the Western



Figure 1.9: Monument of Dr Kwame Nkrumah.

Region, (Graphic Online, 2016). One major achievement of Dr. Kwame Nkrumah is the establishment of the Kwame Nkrumah University of Science and Technology, (Agyen-Gyasi, 2011).

Sketches were made of the monument and Figures 1.10a and b show all the sketches made.

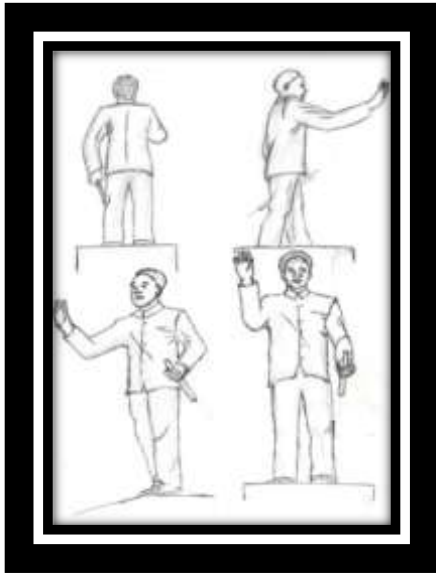


Figure 1.10a: Sketches made for Kwame Nkrumah statue.



Figure 1.10b: Part of sketches made for Kwame Nkrumah statue.

3. Fabrication processes used by the researcher

In executing the work, different tools, equipment and materials were used depending on the task to be completed.

3.1 Tools used

Different tools were used in executing the work. Some of the tools were for modeling while others were used for casting and clean up of cast pieces.

Below are the basic tools used in the production process:

- I. Knife: this is used for cutting wax during the modeling process.
- II. Tape measure: this is used for measuring correct dimensions.
- III. Straight edge: this is used for drawing straight lines.
- IV. "Shishiba": this is a simple metal rod with a flat end used to weld wax pieces together by heating the rod in fire and melting the wax at the joint.
- V. Modeling tool: this is used for modeling wax figures.
- VI. Block of wood: this is used to roll out wax wire.
- VII. Wax wire extruder: this is used to draw thin long continuous wax wire.
- VIII. Round glass bottle: this is used to roll out wax into sheets.
- IX. Crucible: this is used to melt the metal.
- X. Jeweler's saw: this is used to cut off excess metal.
- XI. Chisel: this is used to divide or cut the metal.
- XII. Grinding machine: this is used to remove excess metal.
- XIII. File: this is used to remove scratches and excess material from the metal's surface.
- XIV. Metal brush: this is used to clean the cast pieces.
- XV. Flexi shaft: this is used to polished the cast pieces.

3.2 Materials used

The materials employed to execute the work include primarily bee's wax and brass. Others include Plaster of Paris, sand, clay and palm kernel husk. Below is the list of materials and their uses:

- I. Bee's wax: wax is used for making the model.
- II. Brass: brass is used in casting the final piece.

- III. Plaster of Paris: this is used together with sand as the investment material to create the mould. The P.O.P. and sand mix was used for the first and subsequent coatings.
- IV. Sand: sand is mixed with P.O.P. to strengthen the mould.
- V. Clay: clay is mixed with palm kernel husk to make the final coating for the mould.
- VI. Palm kernel husk: this is mixed with clay and used for the final coating
- VII. Liver of sulfur: this is used for patina solution
- VIII. Caustic soda: this is used for patina solution
- IX. Hydrochloric acid: this is used for patina solution

3.3 Production processes

The next task after the idea development was the making of wax models, investing the models, casting and finishing. The materials were acquired for the project and work begun in producing the prototypes. Below is the step by step procedure followed to accomplish the said task.

3.3.1 Making of Wax Models

First, wax was softened in warm water and rolled into basic forms such as sheet or a wire. Figure 1.11 and 1.12 shows the preparation of wax into sheet and wire respectively.

A perfectly rounded glass bottle is used to roll out the sheet. The surface of the glass bottle was coated with a little warm water from time to time to keep the wax from sticking onto it. After, a block of wood is used to roll the wax into a wire form to be used for the various forming processes. The surface of the wood is also wet with warm water from time to time.



Figure 1.11: Rolling of wax sheet



Figure 1.12: Rolling of wire



Figure 1.13: Wax rods

According to Kissi, Fening and Adom (2016:13), wax patterns “can be produced from direct source: as print from either natural or man-made designs, by carving the design from a block of wax, by wax build up and by forming or wax build up around a core”. Also Kissi et al (2016) stated that there are two main types of wax patterns, namely hollow and solid.

In executing the project, the wax build up and carving technique was employed to form the patterns for the selected landmarks in wax.

The wax build up technique is an additive process and involves softening the wax and gradually shaping it into the desired form while adding on more wax where necessary. The carving technique on the other hand involves cutting away or chipping off the unwanted parts of either a block of wax or

sheet of wax. It's therefore a subtractive process. In some cases both techniques were employed to obtain the desired form.

3.3.1.1 Modelling of the KNUST main Entrance Stool

To create this model, sheet wax of even thickness is used. A tape measure is used to measure out the right dimensions. A measurement of 10.6 inches by 2.3 inches is cut out using a straight edge and a knife to form the 'seat' or top part of the stool and 3.6 inches by 9.45 inches to form the base of the stool. Then the sides of the seat is formed and attached to the sheet using the "shishiba". The completed 'seat' of the stool can be seen in Figure 1.14.



Next the block of wood is used to flatten the sides of a piece of wax wire to give it square edges. This is used as the pillars for the stool.

After, the square wire is cut into heights of

inc
hes
and



Figure 1.14: Completed stool seat.

attached to the seat of the stool using the "shishiba", as seen in Figure 1.15 and 1.16 respectively.

Figure 1.15: Measuring the height of the supporting bars.

Figure 1.16: Attaching the supporting bars to the seat.

Then the base is attached to the upper part of the stool and the inscriptions "KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY" is cut out and attached to the side of the stool. Finally, the KNUST logo is modeled and fixed to the front part of the stool. The completed wax model can be seen in Figure 1.17.



Figure 1.17: Final wax model of KNUST Main Entrance Stool.

3.3.1.

2 Modelling of Paa Joe Statue

The wax build up process was used primarily to make this model. Modeling of the figure began from the thorax of the human figure. Modeling was done very carefully and a lot of attention was given to detail. The wax is softened in warm water and little by little pieces of wax is added together to get the basic form of the thorax. Next the limbs are modeled and attached to the thorax using the “shishiba”. Figure 1.18a and 1.18b show the modeled thorax and limbs of the miniature statue.

Figure 1.19: Final wax model of Paa Joe Statue.



After that, the head, feet and hands are modeled and attached to the main piece. Next, the details are defined properly using a wooden modeling tool and room temperature water. Then the entire piece is

smoothened with water and the “shishiba” where necessary. Finally a rectangular base of 6.9 inches by 5.1 inches is modeled to support the main piece. A rod is attached to the soles of the human figure to be

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This is
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in height is

3.3.1.3 Peace

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The final
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Pole

model the
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some parts
First of all,
sheet is cut
various



cut into the pedestal.
two parts can be cast
wax model, measuring
approximately 10 inches
Figure 1.19.

Modelling of

Peace Pole in wax, a
core is needed. This is
of the design were

Figure 1.20: Hollow cylinder

heights depending on the
section of the Peace Pole it is to be used for. To form the cylinders, the wooden core was coated with water and the wax sheet is wrapped round it to get a perfectly rounded shape. Next, the wax was taken off and the seam is welded using the “shishiba”. Figure 1.20 shows a modelled cylinder.

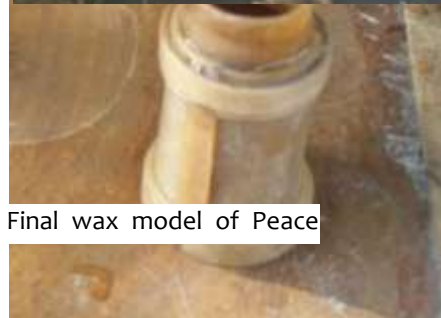
Next the eagle head and the base are modeled and fixed to the rest of the piece. This is shown in Figure 1.21. The base is made out of sheet wax instead of a block of wax to reduce the weight of the final brass cast piece.

Strips of wax are woven to form some of the designs round the cylinder. Also designs are traced directly onto the sheet wax with a pointed tool and the design is cut out using a knife. Finally the designs are fixed onto the main body of the piece using the “shishiba”. The finished wax model can be seen in Figure 1.22. The final model measured approximately 12 inches in height.



Figure 1.21: Modelling of Peace

Figure 1.22: Final wax model of Peace



3.3.1.4 Modelling of the Eagle Monument

To make this monument in wax, sheet wax is used to form the base and the flat sides of the piece. The right dimensions are measured and cut out. Each side measures 6.3 inches by 1.7 inches and each side of the base measures 2.3 inches by 1.4 inches. The pieces are brought together and joined using the “shishiba”. After, the top of the base is sealed and the middle section of the entire piece is attached to the base. Next, the eagle on top of the entire structure is modeled using the wax build up technique. Then the cover for the middle section of the piece is made and the eagle is attached to it. Finally the text around the piece is cut out from a sheet of wax and fixed onto the middle section of the

piece using the “shishiba”. The final wax model can be seen in Figure 1.23. The final model measured approximately 10 inches in height.



Figure 1.23: Final wax model of Eagle Monument.



3.3.1.5 Modelling of Dr. Kwame Nkrumah Statue

First, the thorax area and part of the limbs are formed gradually. Then the basic structure of the head and feet are formed and the entire piece is fixed together. Figures 1.24a, b and c show the basic form of the piece during modeling.



Figure 1.24a: Modelling of statue.



Figure 1.24b: Modelling of statue

Next, the details are inserted using a wooden modeling tool and some water. After, a thin rod is made to be placed in the left hand of the statue. The pedestal is made and attached to the main piece. The completed model is then smoothed properly using the modeling tool. Figure 1.25 shows the final wax model which measured approximately 10 inches in height.

After the modeling process, “sprues” are attached to the models to serve as a passage way or “runner” for molten wax to flow out and molten brass to flow into the mould. The “sprues” are formed using wax wire. After, they are attached to the wax models using the “shishiba”.

Upon completion, the wax models are immersed in a large bowl of water to harden before coating with the investment material. This is shown in Figure 1.26.

Figure 1.24c: Modelling of statue



Figure 1.25: Final wax model of Dr. Kwame Nkrumah statue.



Figure 1.26: Soaking of wax models in water bath.

3.3.2 Making the Mould

The investment material is prepared to begin the making of the moulds for the wax models. The



Figure 1.27a: Mixing of sand and P.O.P



Figure 1.27b: Mixing of sand and P.O.P



Figure 1.27c: Mixing of sand and P.O.P

investment material is made up of a mixture of Plast

er Of Paris and sand for the first coat and clay mixed with palm fiber for the final coat. Figures 1.27a, b and c show the mixing of P.O.P. and sand to make the investment material. A ratio of one part P.O.P. and one part sand is used for the mix.

After, sufficient water is added to the mixture and stirred to get a very runny paste. First the models are given a light wash to make sure every detail as covered with the mix and left to dry for a brief period. The coating is done basically by fetching and pouring the P.O.P. mix onto the wax models with the hands. A fresh mixture of the investment material is made from time to time. Figures 1.28a, b & c show the coating process.



Figure 1.28b: Coating of wax models



Figure 1.28c: Coating of wax models

Figures 1.29a, b models after they have the investment paste.



& c show some of the been given a first wash with

Figure 1.29c: Models after first wash



With time, the P.O.P begins to set and this makes it possible to gradually

have a thicker paste consistency. This is used to

coat the models after the first wash.



Figure 1.30a: coating of wax models.



Figure 1.30b: Coating of wax models.

Figures 1.30a and b show some of the models after they have been coated with paste of a thicker consistency.

After each coating, the piece is left to harden for a brief period in the shade before the next coat is applied. The coating process is continued until an adequate thickness of the mould is obtained. The P.O.P. moulds can be seen in Figure 1.31 after the last coat had hardened a little.

Next the “gates” are created to help with the pouring of the molten metal during casting. This is done by scraping away part of the P.O.P. to reveal a small section of the wax model.

A knife is used for this operation. After that, some of the P.O.P. mix is used to form a cup-like structure on top of the mould to serve as a reservoir to hold molten metal temporarily during casting. This cup-like reservoir is what is known as a “gate”.

Figure 1.32 shows the P.O.P. moulds after the “gates” have been created. Then, the moulds are packed to a secure place in the shade to allow the P.O.P. to “set” completely over a period of time.

Traditionally a mixture of fine charcoal and fine clay is used for the first coat. But this research employed the use of a P.O.P. and sand mould because of the following reasons:

- ☒ Intricate designs can be cast and a superior surface can be obtained after castings.

- ☒ It has a shorter setting time compared to the clay and charcoal mix. This was necessary due to unfavorable weather conditions.

- ☒ Finally, adding sand to the P.O.P. makes the mould material more cost efficient.

The last coating is done with a mixture of course clay, palm fiber and water. This helps with handling the mould after “dewaxing”. It also creates a stronger mould. Figures 1.33a and 1.33b show the preparation of the clay and palm fiber mixture.



Figure 1.31: Mould without “gates”



Figure 1.32: P.O.P. Mould with “gates”

Figure 1.33a: Palm fibre (source: Google)

Figure 1.33b: Mixing palm fibre with clay (source: Google)

Figures 1.34 and Figure 1.35 shows the coating operation of the mould and how the final mould looks like after coating, respectively. After making the clay mould, gates are created in the clay to hold molten metal. The moulds were then left in the shade to harden.



Figure 1.34: Coating of the mould (source: Google)



Figure 1.35: Final moulds



3.3.3 “Dewaxing”

The next process was melting out the wax model which is now completely embedded within the investment material. This is known as “dewaxing”. The well dried moulds are placed in a furnace made from clay and stacked with wood to serve as the fuel for the furnace.

The moulds are placed upside down, i.e. with the “gates” turned downwards, and the wax is melted and burnt out of the mould leaving a hollow space within the mould which now bears the negative impression of model pattern. Figure 1.36 shows the “dewaxing” furnace and the “dewaxing” process.



Figure 1.36: Moulds in “dewaxing” furnace.

3.3.4 Casting

While “dewaxing” is ongoing, the metal to be cast which is brass scraps is loaded into a crucible and placed securely in a pre-heated furnace. The metal is heated to a temperature of about 900°C to 940 °C, which is the flow point for brass. One unorthodox method used to determine if the metal for the cast is molten is by heating until a blue flame is given off from the crucible. This indicates the readiness of the metal to be poured into the mould. Figure 1.37 shows the melting process and the furnace used.

Next, the moulds (now hollow) are brought out of the “dewaxing” furnace and placed in safe spot. While the moulds are still hot, the molten metal is poured into the mould. This is done because the mould would shatter if molten metal is poured into a cold mould. This process is repeated until all the moulds are filled with molten metal. Figures 1.38a and b show the fetching and pouring of the molten metal using a smaller crucible attached to a long metal handle.



Figure 1.37: Melting of brass scraps



Figure 1.38b: Pouring of molten metal into moulds.



metal.



Figure 1.39a: Breaking of mould



Figure 1.39b: Breaking of mould

After cooling for a while, the moulds were gently broken apart to reveal the brass cast piece within. Figure 1.39a and b show the breaking of the moulds.

3-3.5 Finishing

The “sprues” and excess metal is then cut off using a jeweler’s saw, chisel and grinding machine. The cast pieces are cleaned to remove the remaining residue of the mould material. Cleaning is done using a metal brush to remove tiny particles of P.O.P. Figures 1.40, 1.41, 1.42 and 1.43 shows the various cleaning processes.



Figure 1.40: Cutting excess metal with a jeweler’s saw



Figure 1.41: Cutting excess metal with a chisel

Figure 1.42: Cleaning with a metal brush to remove excess metal

Upon assessment it was found that some cast pieces didn’t come out well and needed to be remodeled and recast. Figures 1.44a and b show examples of bad and unsuccessful cast pieces.

The entire piece seen in Figure 1.44a had to be recast. The feet piece in Figure 1.44b had to be remodeled and recast.

3-3-5.1

used to



Figure 1.44a: An unsuccessful cast piece

entire piece in

join two



Figure 1.44b: An unsuccessful cast piece

piece seen in Figure 1.44b had to be remodeled and recast.

Brazing

Brazing is the process of joining two pieces of metal together using a heat source and a filler metal which in this case was a brass rod. Brazing was done using an oxy acetylene welder.

Some cast pieces needed “filling in” in some parts. “Filling in” was done to correct defects such as large pinholes and breaks in the cast pieces. It is done using a brass rod and an oxy acetylene welder. The torch is used to heat up the section of the cast piece to be worked on and the brass rod is melted directly over the defect to fill the gap.

As well, the wax models which were separated into various parts and cast separately needed to be brazed into one piece. Figures 1.45a, b, c and d show the brazing process and cast pieces after brazing.



Figure 1.45a: Brazing process

Figure 1.45b: Brazed cast piece

Figure 1.45c: Brazed cast piece Figure 1.45d: brazed cast piece

welding is



and “fill in”, removed with files and the cast pieces are polished with emery



After the all the excess material

papers and a flexi shaft. Figures 1.46a and b show the process of filing the cast pieces and Figure 1.47a and b show the use of a flex shaft to emery the cast pieces.

Figure 1.46a: Filing excess metal



Figure 1.47a: Polishing with a flex shaft



Figure 1.46b: Filing excess metal



Figure 1.47b: Polishing with a flex shaft.



3-3.5.2 Oxidation

The cast pieces were given a final patina finish to protect the surface and give them an antique appearance. To achieve this, three parts of liver of sulfur and one and a half parts of caustic soda is mixed with two liters of water. The mix is poured into an aluminum bowl and heated with a torch until it begins to boil. Then one part of dilute hydrochloric acid is added to the mix and it is brought to a boil. Next the cast piece is heated slightly and placed in a large bowl. After, the hot patina solution is poured

over the piece to give it a dark finish. This is done for all the large cast pieces. The small cast pieces are boiled directly in the patina solution.

A scratch brush is used with water to remove excess patina. And finally, a soft metal sponge is used to polish the cast pieces to give it highlights and shadows.

4.0 Results & findings

4.1 KNUST Main Entrance Stool

This cast piece which can be seen in Figure 2.1 is the final prototype souvenir designed from the KNUST Main Entrance Stool.

It has the features of the actual landmark and can be used as a card holder in an office. It has a broad flat base which makes it sit securely on any flat surface. The cast piece has a total height of approximately 4.5 inches, length of 9.4 inches and a total width of approximately 3.6 inches. A final oxidation finish was given to the cast piece to give it an antique look and to protect the surface from tarnish.



Figure 2.1: KNUST Main Entrance Stool

4.2 Paa Joe Statue

Figure 2.2 shows the final prototype souvenir designed from the Paa Joe Statue. It features Arthur Hercules Ratnadurai Joseph, commonly known as Paa Joe in a sprinting posture while holding a baton in one hand.

The statue is mounted on a pedestal with a width of 5 inches, length of 6.9 inches and thickness of 0.8 inches. This souvenir was designed to function as a pen hold as well. The cast piece measures approximately 10 inches in height by 9.5 inches in width. The cast piece was also given a final oxidation finish to give it an antique look and to keep the surface from tarnishing.



Figure 2.2: Paa Joe Statue

4.3 Peace Pole

The final prototype souvenir designed from the Peace Pole can be seen in Figure 2.3. The prototype souvenir has the structure of the famous KNUST Peace Pole.

The upper part has an eagle head and the hollow body of the pole is divided into three compartments which can be used as a jewellery container. The different compartments were designed to make casting easier and create a good cast. The compartments also make the souvenir very portable which means it is easy to pack and store for transportation and can be reassembled upon arrival at the final destination. The pole is mounted on a pedestal of 2.5 inches on each side and a height of 0.8 inches. All around the pole different “adinkra” and other local Ghanaian symbols can be seen. The total height of the cast piece is 12 inches and has varied width at each point. A final oxidation finish was given to the cast piece to give it an antique look and to protect the surface from tarnish.



Figure 2.3: Peace Pole

4.4 Eagle Monument

The Eagle Monument prototype souvenir can be seen in Figure 2.4. The souvenir is made up of an eagle standing on top of a four sided pole with its wings widely spread out.

The pole bears the inscription, “KNUST”. Not much was changed from the original landmark. However, the pole was made hollow to serve as a container for keeping any suitable item. The prototype has a total height of 10.7 inches. The cast piece was given a final oxidation finish to give it an antique look and to keep the surface from tarnishing.



Figure 2.4: Eagle Monument

4.5 Monument Of Dr. Kwame Nkrumah

Figure 2.5 shows the final prototype souvenir designed from the monument of Dr. Kwame Nkrumah. The souvenir prototype features a statue of the first President of the Republic of Ghana.

He can be seen holding a rod in one hand and waving with the other hand. This souvenir can be used as a key hanger or holder. The miniature statue is mounted on stepped pedestal with length of 4.4 inches, width of 4.2 inches and height of 1 inch. The total height of the cast piece is 10.6 inches. This cast piece was also given an oxidation finish to protect the surface and give it an antique look.



Figure 2.5: Monument of Dr. Kwame Nkrumah

4.6 Findings

This research adds to the prototype souvenirs produced in the previous study and provides three dimensional souvenirs to guests of the Kwame Nkrumah University of Science and Technology and the entire university population as well. From the study it was also discovered that:

- The idea development process is necessary for arriving at suitable designs.
- P.O.P moulds are very cost efficient when sand is added to create the mould.
- P.O.P moulds help best in unfavorable weather conditions, where humidity is high and clay and charcoal moulds would take longer than normal to dry and harden.
- Brazing helps correct defects and join components of cast pieces together.
- The oxidized or patina finish does not only protect the surface of the cast piece but provides an aesthetically pleasing appearance as well.

5. Conclusion

The objectives of the study were to study existing landmarks on KNUST campus, to create designs of selected landmarks, and to develop designs and produce prototype souvenirs of selected landmarks. To achieve this, an extensive review of literature necessary for the study was done. Then a comprehensive idea development process was used to come out with final designs which suit the requirements of the research. After the design process, the researcher went ahead with the production of the three dimensional souvenirs by employing the traditional Asante lost wax casting technique. This technique proved to be very useful and the final results were good enough despite all the challenges faced. This casting technique was used in time past to make miniature figurines to be used as gold weights. This makes it suitable for creating miniatures of landmarks as well. This casting technique is also widely admired around the world because of its connection with famous ancient African cast pieces. This project therefore employed the Asante lost wax casting technique to give tourists the chance to own and appreciate a souvenir produced using the traditional lost wax casting technique. The research proved to be very useful by adding to knowledge and learning. And the study adds to the

body of literature available on three dimensional souvenirs and serves as excellent reference material on current day Asante casting.

Policy implementation section

- One key function of The Ghana Tourism Authority, established by Tourism Act, 2011 (Act 817) is the promotion and marketing of Tourism, both in Ghana and outside Ghana. This research should be adopted by the agency to create souvenirs using popular landmarks in the country. This will greatly market tourist sites found in Ghana. The souvenirs produced from the study gives a vivid three dimensional representation of landmarks made in Asante casting, giving tourists the chance to own and admire a cast piece made from this unique technique. The use of this research work to produce souvenirs of landmarks found at various tourist sites in the country will greatly increase the revenue earned by the country through tourism and the sale of souvenirs.

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