An Insight into an Ancient Technology (Lost Wax Casting Technique) Through an Ethnographic Approach: Case Study of Mannar, Kerala

Diya Mukherjee[1]

1. Heritage Science and Society Programme, School of Humanities, National Institute of Advanced Studies, Bengaluru, Karnataka – 560 012, India *(Email: diyamukherjee.nias@gmail.com)*

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Abstract: *The paper attempts to understand the age-old technology of casting technique that still exists today. The traditional method of the Lost Wax technique practised by the hereditary craftsmen in some pockets of India is an integral part of the intangible heritage of India. The antiquity of the Lost Wax technique can be traced back to Harappan cultural people. At present this traditional practice is known as folk art in West Bengal; sculpture-making technique in South India, etc. In this paper, the focus is on the Lost Wax technique used for sculpture making. The technical process followed in the Mannar region has been documented and analysed in this paper through ethnography and ethno- technology.*

Keywords: Mannar, Lost Wax Casting, Ethnography, Technology, Artisans, Sculpture Making, Crucible

Introduction

The Lost Wax technology is an age-old casting method followed by the traditional craftsmen from the Harappan times. The technology is practised even today in some pockets of India; in West Bengal, Odisha, and Andhra Pradesh it is known as Dokra brassware casting whereas in Tamil Nadu, and Kerala this method is used for sculpture making. Some of the finest examples of Lost Wax techniques are the Dancing Girl of Mohenjo-Daro, the Chola Bronzes casting, etc. The name Lost Wax is derived from the wax being lost, that is, when the mould is heated the wax melts out thereby leaving a negative impression of it. Hence, the name is derived. Lost Wax casting (also called "investment casting", "precision casting" or *Cire perdue* in French) is the process by which a duplicate metal sculpture (often silver, gold, brass or bronze and copper) is cast from an original sculpture. Dependent on the sculptor's skills, intricate works can be achieved by this method. The method of manufacturing an object starts when the artisan designs a desired shape for an object.

The paper attempts to understand the technology and how the artisans are trained from childhood belonging to the hereditary craftsmen and how their identity fuses

with the craft and becomes one. The conversation with the artisans has brought to light the tale-tell titbits of the technology they acquired through hereditary training. The conversations with the artisans have highlighted the challenges that they are facing in the modern scenario for sustenance - all these points will be discussed in this paper.

Ethnography and Ethno-archaeology

The product of ethnoarchaeology enters the interpretation cycle in basically three ways. One is more direct: specific models or correlates that are generated based on the observation of a given living society are applied to interpret the material record of some extinct society or to illuminate some dimensions of its cultural pattern, on the bases that both societies share some elements which make logical the analogical argumentation (Politis 2015). Ethnography helps to understand the missing link between the past and the living parallel and thereby, gives a glimpse of how certain things may have been in the past. Ethnography throws light on the minor aspects of the technology which is otherwise impossible to understand from solely archaeological excavations. The archaeological excavations provide information such as finished products (artefacts), miscasts, and unfinished/ discarded objects. Similarly, the recycling of objects was a common phenomenon; ethnography comes in aid in this situation and offers light for ethnoarchaeological research.

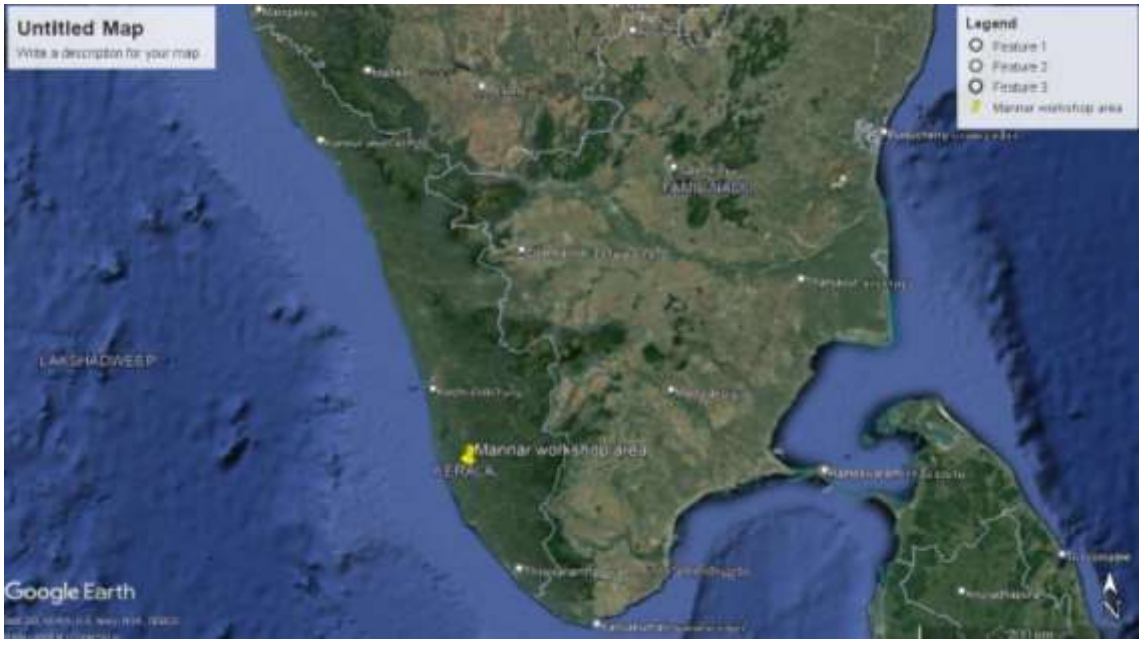

Figure 1: Location of Workshop, Mannar, Kerala

Study Area/Field Survey

In this paper, the area selected for the survey is the Mannar region of Kerala. The region is famous as Mannar ---- the bell metal town of Kerala. The area is famous for brass, bronze and silver work. It is situated at Chengannur taluk in the Alappuzha district of Kerala. It is situated at the confluence of Pampa, Manimala and Achankovil (Figure 1).

Methodologies

The methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically, it encompasses concepts such as paradigms, theoretical models, phases and quantitative or qualitative techniques (Irny and Rose, 2005). The methodologies adopted for this paper are the following:

Archaeological Sources: Including excavation reports and published books about the Lost Wax casting technique. It is an essential part of the research to understand the past from the present. Excavations though yield fragmentary provide a useful insight into the past culture. This evidence along with multidisciplinary approaches helps to reconstruct past societies.

Literary Sources: A great deal of knowledge can be learnt from literary sources like *Mānasollāsa, Śilpasāstras* and *Mānasāra*. These texts not only give detailed information about the technique but also lay down the rules and rituals to be followed by the artisan before and during the casting process. It was the Cire Perdue or Lost-Wax method that was recorded in the *Śilpasāstras*, *Mānasāra*, and *Mānasollāsa* technical- cum-canonical texts used by the metal craftsmen in their production of bronze images. (Krishnan 1976; Sivaramamurthi 1962). But the literary texts are from a much later period - from Gupta Period onwards.

Ethnography: It is an important aspect of archaeology focusing on the surveys and interviews and witnessing the technology of the living parallel to understand how it may have been in the past; although there is no direct connection between the two, nevertheless, it forms a missing link between the two. Ethnography is a qualitative research method for the in-depth study of a culture or a facet of culture. This extended period of participant observation in the field (the time spent living in another culture) is often used in conjunction with other data collection methods, like interviews, focus groups, or surveys. However, much ethnographic data come from the ethnographer's field notes.

Conversation with an Artisan

While conversing with the artisans their interest in the subject and their nurturing of the field from childhood was revealed. The artisans who were interviewed offered their interest in the field and how formal training had further enhanced their interest in knowledge. Also, the modifications that the craft has adopted over time have been noted. The role of women in these workshops is strictly prohibited. They cannot take any part in the casting process (Figure 2).

Technology

The ancient casting process is categorised into hollow and solid casting. The workshop that was surveyed used only solid casting. The process of manufacturing an object through the Lost Wax casting technique requires the following steps:

Figure 2: Artisan Insights

Figure 3: Wax Modelling

Wax Modelling: This is the initial stage for making an object by this method. The wax used in this process is known as sculpture wax since in the Southern part of India this process is used to make sculptures. The mixture composition of wax defers in each region (particularly the sculptors decide the proportions according to need) but in general, the consistency that followed is resin 85%, yellow wax 15% and oil (coconut oil is preferred) 250ml. oil is used to increase elasticity. The wax preparation takes 4-5 hours to complete. The mixture has to be boiled at around 800°C and then with the help of a strainer it is purified the purified mixture is left to cool and when it becomes leather hard (in between fluid and solid) it is used for wax preparation. It is imperative to remember, the wax is to be used when it is quite hot otherwise it loses its elasticity and hence a model is not suitable to be made out of it (Figure 3).

Figure 4: Clay Moulding

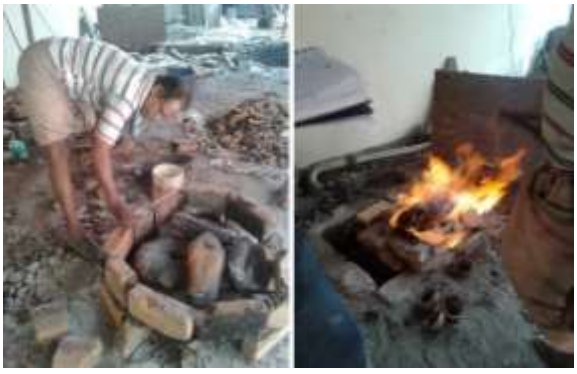

Figure 5: De-waxing

Clay Moulding: It is a very crucial process of applying layers of clay ranging from finer to rough clay. Each layer is applied and sun-baked. The total process required a minimum of 7 days depending on weather conditions. When the mould is half-dried or in leather hard condition small potsherds are stuck to it; it supports the clay from falling apart (Figure 4).

De-waxing: The process involves heating the mould so that the wax could escape and create a negative impression in the clay mould. The hollow moulds will then be filled

with molten metal. The entire processes take almost 2 hours of heating the clay mould. For this particular process coconut shells and skin are used as fuel (Figure 5).

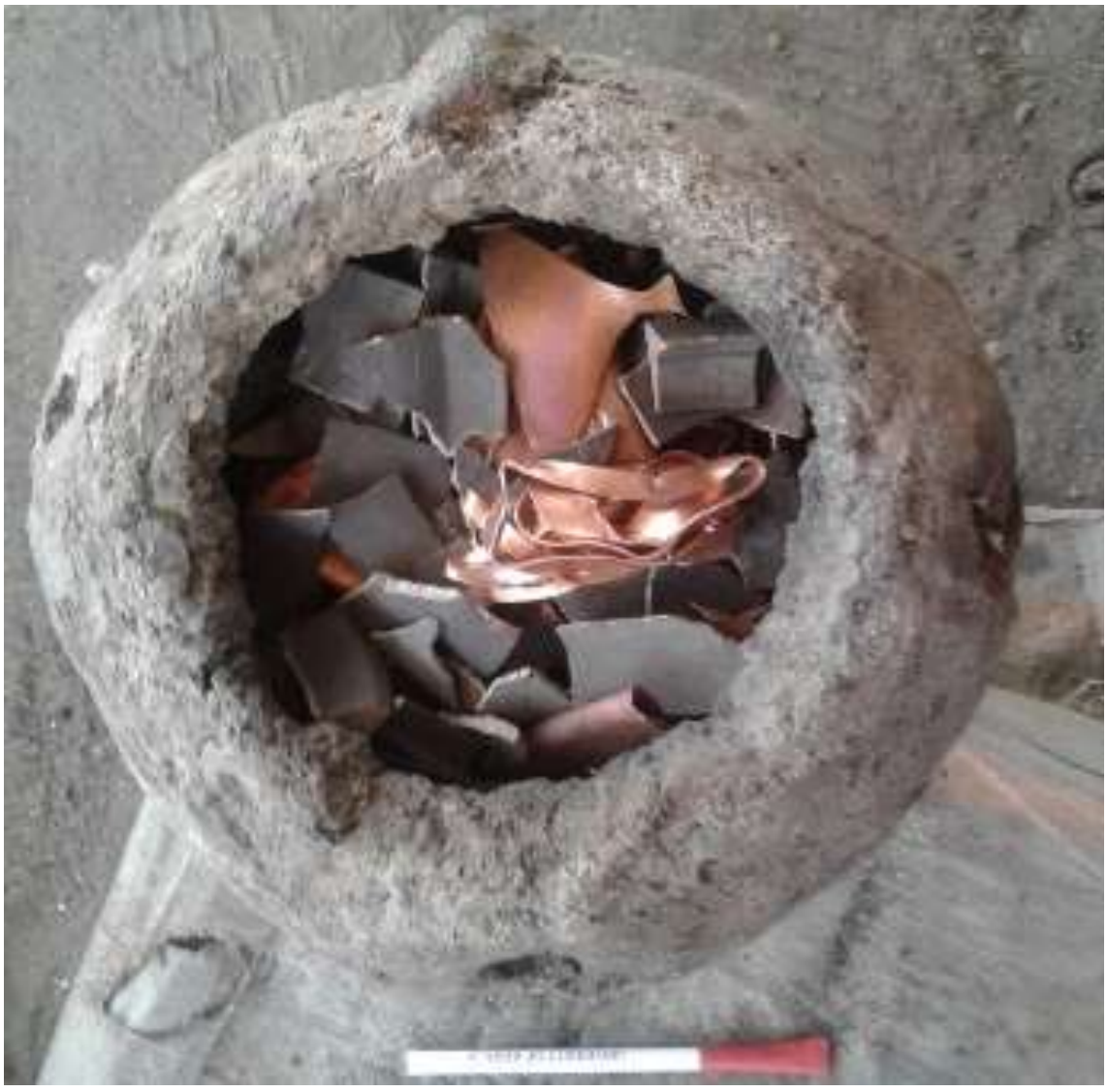

Figure 6: Metal Preparation

Metal Preparation: The metal is heated separately in a crucible. A modern crucible is used for casting purposes. The scrap metal (brass) is collected and the crucible is filled with it. It is heated for two and half hours; then the molten metal is poured into the mould through sprues and runners (a sprue is a large diameter channel through which the material enters the mould. Runners (a runner is a smaller diameter channel that directs the molten metal is directed towards the individual part (particularly common when casting multiple parts at once). The part where the metal reaches its destination and begins to flow into the mould cavity is called the 'gate'. Sprues and runners are some of the largest pieces of excess material that we remove from moulded parts. They are created deliberately during the moulding process as the method by which the molten material enters the mould cavity (Figure 6).

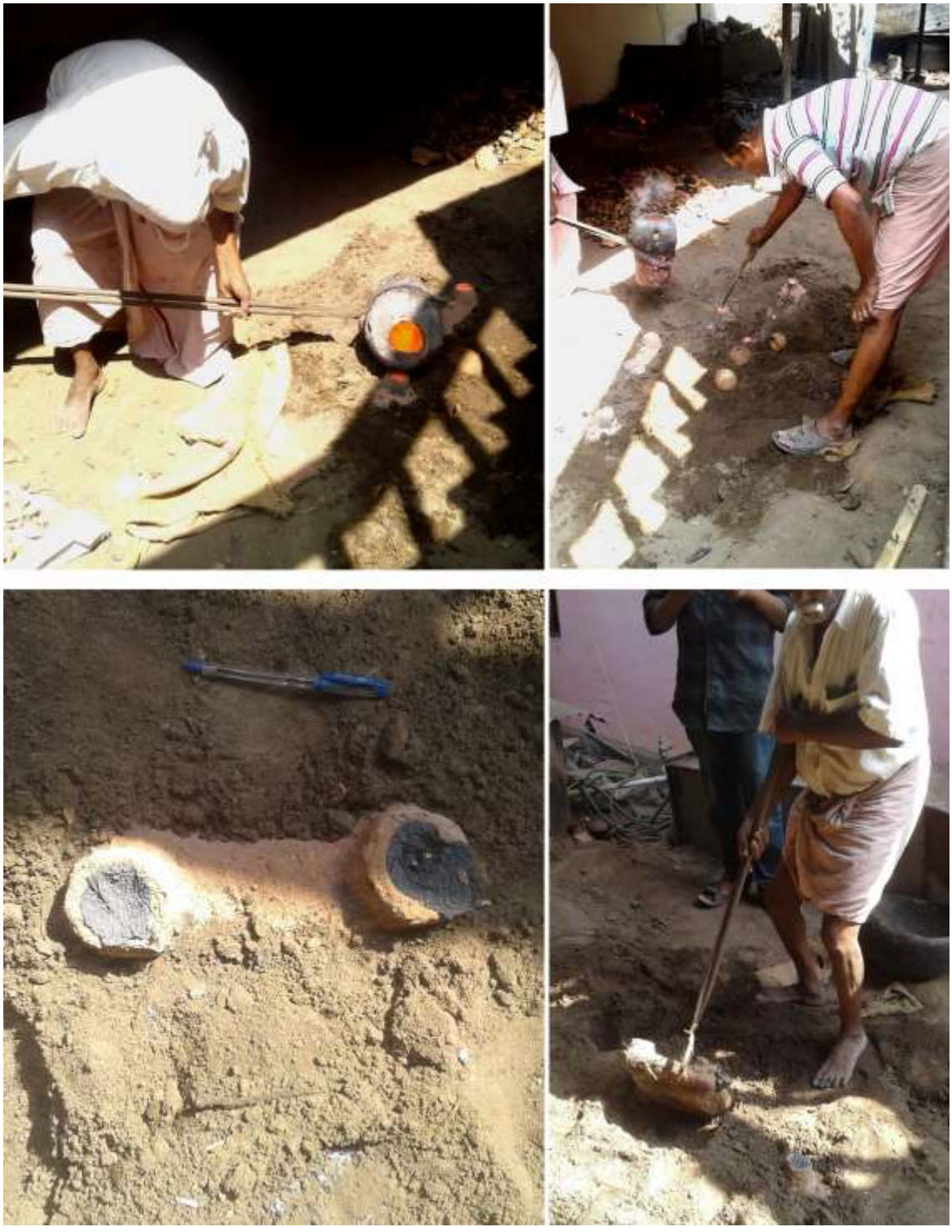

Figure 7: Casting

Casting: The moulds are heated for two hours and the crucible is heated for two and a half hours at the same time in two different furnaces (depending on the quantity of metal required). Thereafter, a pit is dug and the moulds are kept inside it raising the channels from the pit. The pit is covered and the molten metal is poured and allowed to cool down for the day (Figure 7).

Breaking Moulds: The mould is broken to release the cast image. The casted metal image that is retrieved is blackish and the golden-brassy tinge appears only after several times polishing (Figure 8).

Figure 8: Breaking the Mould

Chiseling and Polishing: It is the final process in the casting process. However, before polishing chiseling is done to scrap out the extra metal, mark the prominent features, etc. Generally, machine polishing is used for the purpose but intricate designs are still polished by file/hand polishing. Polishing requires repeated attempts to give a shiny finish (Figure 9).

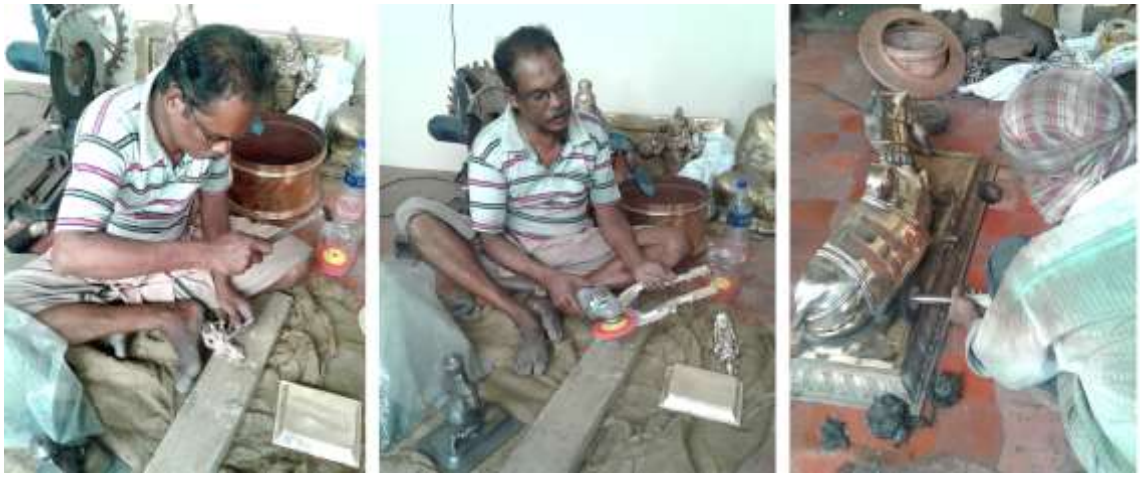

Figure 9: Chiseling and Polishing

Workshop Area

The workshop area surveyed was distributed into two to three units and partial open-air space for casting only. Specific areas are used for a specific purpose such as wax model working area, polishing area and chisel working area, etc. All the artisans working there belong to the Vishwakarma community and sculpture-making to temple decorations are conducted in the workshop area. The role of women in these crafts practised in the southern part of India is not found.

Equipment

The tools and equipment used in the entire process are simple. They include various kinds and shapes of chisels, an anvil of different sizes, hammers, and tongs of different sizes, modern crucibles, a polishing machine, and files of different sizes for hand polishing (Figure 10).

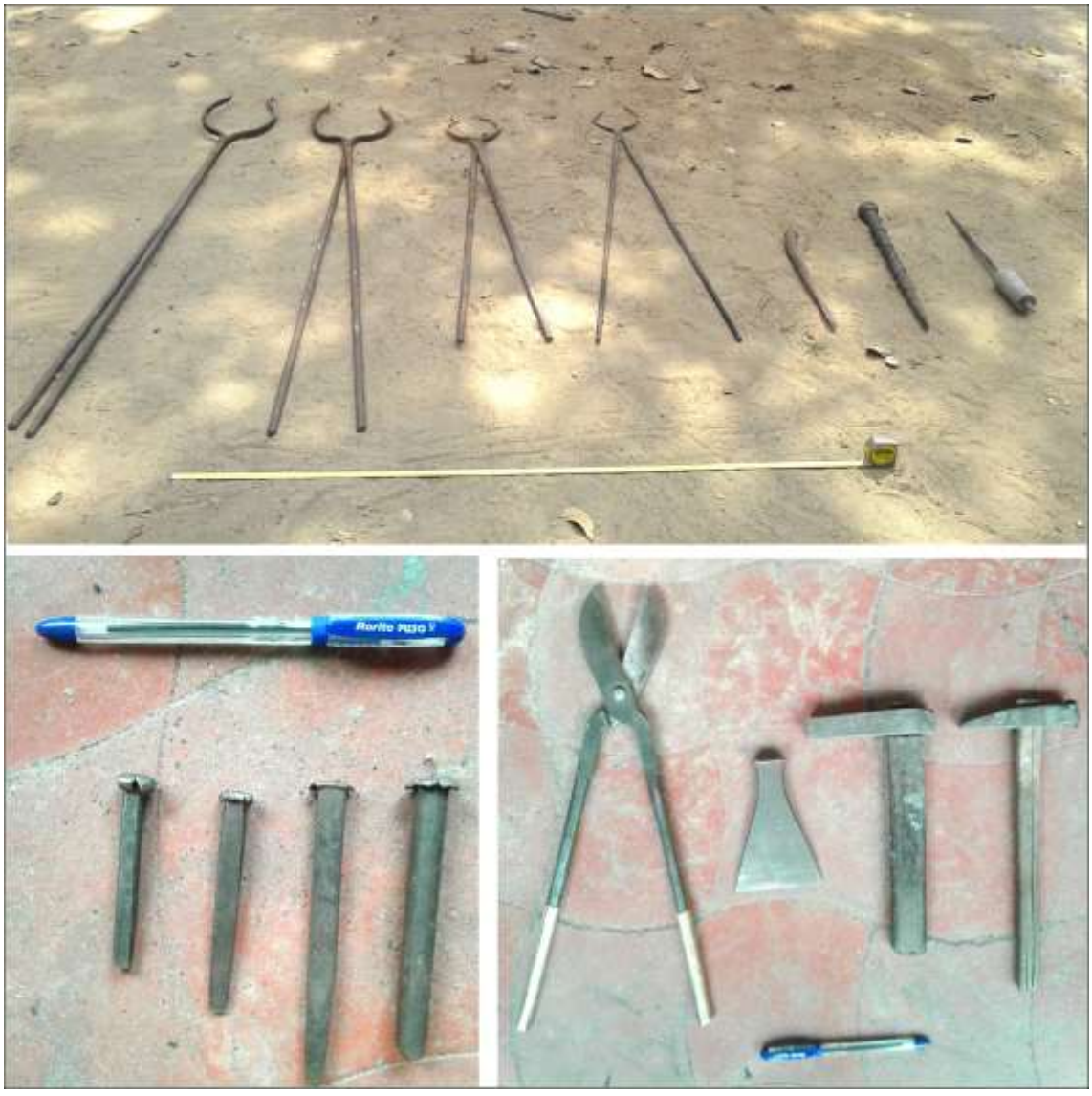

Figure 10: Equipment

Furnace

Simple brick furnaces have been chosen by the artisans for de-waxing and casting. The use of a separate furnace helps in reducing time consumption and speeding up production. However, the furnaces are not similar to each; they are designed according to their functionality. The furnace for de-waxing is built in a circular structure and repaired in every single process. The moulds are organized according to size. Another furnace is a rectangular shape used for casting purposes. It contains a square inner chamber. The crucible is placed inside this inner chamber for melting metal. A strainer is placed to collect the ashes in the bottom of the furnace and it is cleaned periodically (Figure 11).

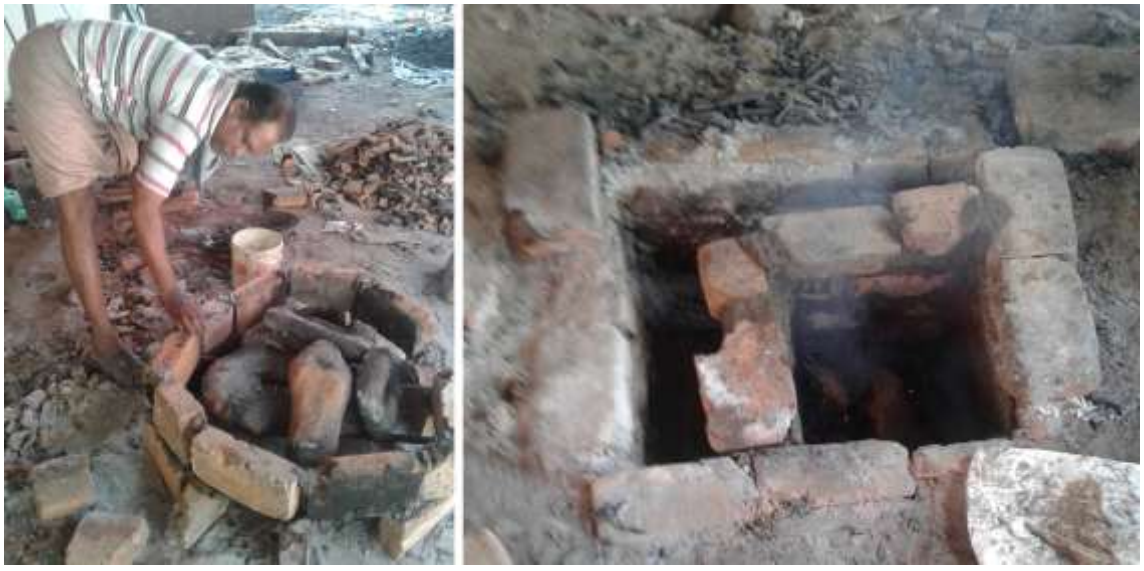

Figure 11: Furnace

Figure 12: Crucible Preparation

Crucible

The workshop surveyed uses a modern crucible like many other workshops. A crucible is a ceramic or metal container in which metals or other substances may be

melted or subjected to very high temperatures. While crucibles were historically usually made from clay, they can be made from any material that withstands temperatures high enough to melt or otherwise alter its contents. The crucible is covered with clay and a lid is made with a small hole in the middle of the lid to access the melting stage of the metal. Each crucible can be used three to four times in the casting process. Crucibles are available in the market in various sizes depending on the quantity of metal to be melted by the artisans - they select the size of the crucible (Figure 12).

Nature of Workmanship

Sculpture-making is an age-old tradition being practised from the days of the Chola-Pandya period. An aspect of this tradition that is being followed today is following of the ancient texts of *Śilpasāstras*, *Mānasāra*, and *Mānasollāsa*. It is to be noted that the rules and regulations laid down in the texts are followed before, during and after the casting process. The process involves intricate details of the casting of large size idols to be placed in temples. As it has already been established the Lost Wax casting process is a complex casting process which requires a high percentage of intricate workmanship; it is to be pointed out that all the artisans are traditional/ hereditary artisans who are involved in this process.

Challenges and Sustainable Measures

The artisans practising the traditional method of the Lost wax technique had to adhere to several challenges in their life. Thrive for sustenance is one of the major problems the artisans have to face. The lack of government-funded aid to the artisans makes it difficult for them. Funding/investment in metal is higher than in other crafts like stone, wood, etc., therefore, many artisans are switching their fields which will help them to maintain their sustenance. It is high time to draw the attention of the government to the sustainable development of the artisans and their crafts.

Discussion and Conclusion

The earliest craftsmen no doubt learnt by trial and error the need to provide adequate runners or sprues, also made of wax, to allow the molten metal to flow readily into the mould. The metal smith would also have had to make suitable risers for the escape of air when the metal was poured in (Hunt 1980). The Lost Wax casting process is a complex of all casting processes. There are two different kinds of Lost Wax casting methods --- direct and indirect. This ethnographic field survey deal with direct investment casting. A different technique, known as indirect casting, was to take a model in any material such as stone or wood, to form a mould, probably in several pieces, made of clay or some other plastic material, and then to coat the inner surfaces with a thick layer of wax by painting or brushing in several applications. This method had the advantage that much larger castings could be produced, and it is the procedure still used today in producing bronze or gold statuettes (Hunt 1980). The ethnographic survey brought out minute details about the Lost Wax casting process which is difficult

to understand solely from archaeological excavations. Recycling of mould, use of potsherds, and use of coconut shells and skin as fuel can be known only through ethnographic studies only. The technological process is similar all over India but each region has its variation and that is the reason why we call India a land of diversity. Its diversity flows not only in language or culture but also in its technology.

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