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Evaluation of quality control in the aluminium scrap foundries in Mubi, Adamawa State

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Abstract
The increasing use of non-ferrous metals for more sophisticated application has led to the ever greater demands for major improvement in the quality of foundry products. Quality control reduces reject and increase production in a foundry. Use of high standard equipment, technique and competitive workforce result in good quality products. A survey was conducted with the aim of assessing the level of quality control and categorising the local foundries in Mubi. A total of seven foundries located in Tsamiya, Wuro-patuji, Kwacham, Wuro-gude, Lamorde, Federal Polytechnic Mubi and Gaya were studied. These foundries were using aluminium scrap as a raw material. Data was gathered by use of questionnaires, interviews and site visit to foundries. The foundries were classified into small scale foundries, medium scale foundries and large scale foundries. This classification was based on a parameter which focused on human resources, capital investment, and volume of scrap consumed, energy consumed, safety and environmental conservation. The result of the survey shows that the quality control practices such as chemical analysis, material testing and melt treatment (use of additives, degasser and fluxes) were not implemented in six foundry shops. It was also discovered that 53.3 percent of the workforce lacked formal training in foundry practices and the highest capital utilization was about 33.6 percent. This has led to low quality product with no competitive edge in the market.

Keywords: foundries, quality control, aluminium scrap

Introduction

The need for quality control and quality assurance in all areas of industrial production as well as in the service industry is ever greater today than ever. It is no possible to produce a desired quality and maintain it consistently over length of period unless adequate control is exercised at every stage, quality can affect all the vital functions of a company such as cost, productivity, delivery, skills and expertise of the employees and management. It exerts overwhelming influence on other factors such as environment, social structure and ethics of the people. In general, the overall culture of a company is affected by quality of the product [1]. Buyers today expect levels of quality and service which far exceed those of even decade ago. Foundrymen, therefore must conform to this concept of continual improvement or go out of business [2].

Aluminium is light weight, resistant to corrosion and has a low melting point. When alloyed with elements like silicon, manganese and copper, its strength increases. During melting controlled additives are added to molten metal improve cast ability, fatigue and impact properties. As a result the aluminium alloy have a wide application in automobile, house hold utensils, aeronautical industry and general engineering work. Quality control reduces reject and increases production in a foundry. Use of high standard equipment, techniques and competitive workforce result in quality products. Industries can be classified on the basis of raw materials, size and ownership, the size refers to the amount of capital invested, number of people employed and the volume of production.

The aluminium industry has moved towards complete integrated melt and melts treatment systems as a total process in order to provide continuous quality metal for casting operations [3]. The demand to provide high quality casting has cause aluminium foundries to look at more integrated melting and metal treatment process systems to provide continuous controlled metal quality output.

The quality of cast product directly depends on the quality of molten metal from which the products are cast. Comprehensive understanding of the melt quality is of vital importance for the control and prediction of actual casting characteristics. Any defect added or created during the melting stage will be carried to the final microstructure, and certainly affect the quality of the cast products. Therefore it is apparent that the control of the quality of the cast products begins with the control of the quality of the melt [4].

The numerous challenges facing the small scale industry in Ghana have been identified. These include quality issue due to lack of technical know-how, access to funding from both government and financial institution and foundry waste management [5]. However, every manufacturing organisation is concern with quality of product. While it is important that quality requirement be satisfied and production schedules met, it is equally important that the finished product meet established specifications. Because, customer's satisfaction is derived from quality products and services Stiff competition at national and international level and consumer's awareness require production of quality goods and services for survival and growth of the company. Quality and productivity are more likely to bring prosperity into the country and improve quality of works of life [6]. This study is aimed at assessing the level of quality control practices in the aluminium scrap foundries in mubi,which in turn will encourage both government and private financial institution to come on board, policies be established and proper training programme developed to improve and promote this technology.

2. Materials and Methods

The method used in data collection for this study involved a site visit to the seven foundries situated in Wuro-patuji, Tsamiya, Gaya, Federal Polytechnic Mubi Foundry, Kwacham, Wuro-gude and Lamorde. A structured questionnaire was also designed to collect data in six areas which bothers on (a) capital investment, (b) level of employees (c) the level of technology applied and aluminium scrap melt treatment, (d) Quantity of scrap consumed, (e) energy consumed and (f) safety. Oral interview was conducted to collect more data from those firms during the site visit. This was aimed at gathering more information from those firms which may not have filled the questionnaire.

Table 1: Capital Invested on Aluminium Scrap

Foundry Location	Amount Invested ()	Percentage (%)
Wuro Patuji	6,324,000	33.6
Fed. Poly. Mubi	1,224,000	6.5
Gaya	3,447,600	18.3
Wuro Gude	3,023,280	16.0
Lamurde	3,182,400	16.9
Kwacham	1,591,200	8.4
Tsamiya	53,400	0.3
Total	18,845,880	100

Table 2: Quantity of Aluminium Scrap Melted

Foundry Location	Quantity(Kg)	Percentage (%)
Wuro Patuji	36,500	26.9
Fed. Poly. Mubi	18,250	13.4
Gaya	23,752	17.5
Wuro Gude	20,805	15.3
Lamurde	21,900	16.1
Kwacham	10,950	8.1
Tsamiya	3,650	2.7
Total	135,807	100

Table 3: Manpower Available

Foundry Location	No Of Workers	Percentage (%)
Wuro Patuji	7	18
Fed. Poly. Mubi	6	16
Gaya	6	16
Wuro Gude	5	13
Lamurde	8	21
Kwacham	3	8
Tsamiya	3	8
Total	38	100

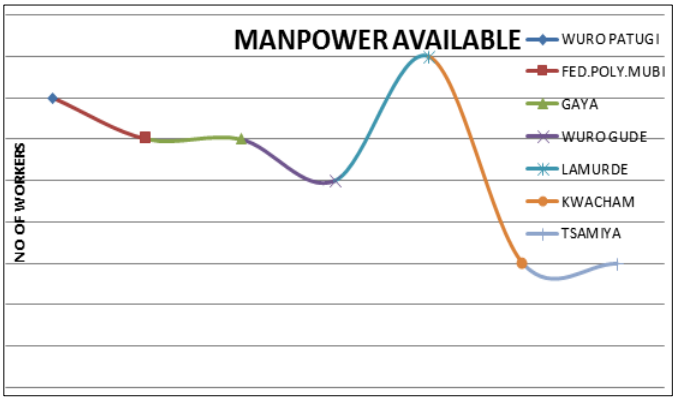

Fig 1: Manpower available in the seven foundries

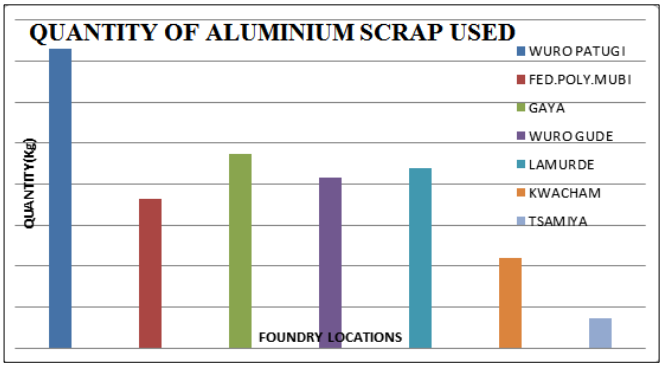

Fig 2: Quantity of aluminium scrap consumed by foundries

Result and Discussions

All the seven foundries responded to the questionnaire. The various question related to the parameter a-f were analyzed statically using frequency count, percentage as shown in table 1,2 and figure 1,2.

The response to the parameter a-f derived from the data collected was analyzed as follows:

1. **Capital based investment:** Most of the foundries visited had sand moulding equipment, pattern making tools, sheet metal work tools and melting furnace. Majority of the foundries did not have standard pattern design/making equipment. Melting furnaces used by most of the foundries include pit furnace and crucible. The capacity of these foundries ranged between 10kg and 100kg.most of foundries lacked modern material testing equipment.
2. **Level of Employee:** The seven foundries were found to be controlled by male workers. Majority of the workers had apprenticeship training. The manpower found in the foundries constitutes 5% of engineers, technologist 11.7%, craftsmen 30% and unskilled labour has 53.3% being the highest. The foundry shop located in the federal polytechnic was found to have the highest skilled personnel ranging from craftsman to engineer cadre. The wage bill of the small firm was less than the big organisation.
3. **Quantity of scrap used and energy consumed:** The seven foundries used aluminium scrap which was purchased locally at average cost of N170 per kilogram for the production of their products. A kilogram of casting sold at an average of N200- N20, 000 depending on the type of product quality. Annual aluminium scrap cost was found to be proportional to the size of foundry and varied between N20, 400 and N2, 108,280.The use of industrial oil was substituted by the use of charcoal which cost N1200 per bag. Electricity was been used by one foundry occasionally due high cost of gasoline.
4. **Technology applied and melts treatment adopted:** The common method of production adopted by all the foundry shops was Sand casting. The control of chemical composition, melt treatment and proper quality control was ignored in many of the foundries. Heat treatment, material testing, micro structure, and chemical analysis were not carried out in most of the foundries. Some of the foundries visited have no device for measuring the moisture content of the sand mould. Foundry men use their hand to feel the texture of the sand and tell from experience whether the sand has enough moisture content and therefore suitable for used to make sand mould. Most

foundry units have limited capacity to evaluate the technology they are currently using and make changes as when needs be. This is due to lack of technical know – how and this has affected the quality of cast product.

5. **Safety measure and environmental conservation:** safety awareness was high in only one foundry located in the federal polytechnic mubi as opposed to the other small foundries. both safety awareness and environmental conservation were lacking in small foundries whose workers were exposed to the danger of heat and dust. Small firms due to financial constraint and lack of stick regulations led to poor work environment. Foundry wastes are disposed on site without proper control to ensure that they do not have adverse effect on the environment.

B. Classification of Foundries

Small scale industries: These foundries are mostly owned by individual. Almost all the raw materials used by foundry men are obtained locally. This category was made up of foundries that service small engineering workshop that repair automobile and other household utensils. Environmental conservation and safety was observed at about 40 percent level. They had six workers with apprenticeship. Most of the foundries are not fully equipped.

Medium scale foundries: only one of the foundries visited belongs to this category. This was found to be a foundry with the highest consumption of aluminium scrap. There engaged in mass production and their found their way into the market inside and outside mubi.High number of workforce was observed compared to other foundries visited. The perform melt treatment without carrying out chemical analysis and material testing.

Large scale foundries: This category include foundries which service large engineering firms which demand advanced spare parts and other important household equipment. These foundries observe high level of safety and environmental conservation. However, there was no foundry found belonging to this category in mubi.

Summary and Conclusion

From the discussion, we can conclude that

- Foundries in Mubi has been categorised into small scale foundry, medium scale foundry and large scale foundry.
- Material testing, melt treatment, chemical analysis were often neglected by about 90 percent of the foundry shops
- Records relating to quality inspection and control and the number of reject were not kept.
- 90 percent of the foundries are not fully equipped.
- Most of the foundry workers lack formal training on foundry technology.
- Capital utilization is minimal in the entire Foundry workshops.

Recommendations

- The quality of equipment should be properly maintained in the foundry
- Government and private institution should develop courses to train foundry workers to upgrade their apprenticeship skills.
- Methods and process of production should be evaluated periodically.
- Machinery for melt treatment, material testing and chemical analysis should be put in place to enhance the production of quality product.

References

1. Andrews A, Gikunoo EE. Small scale foundries in Ghana: The challenge, Leonardo electronic journal of practices and technology, kwame SNkrumah University of science and technology, Kumasi: Ghana. 2011; 19:1-12.
2. Akrani G. Quality control total quality management TQM Quality circles.http://wkalyan-city.bolgspot.com[accessed 26 Sept 2012.
3. Djurdjevic MB *et al.,* Melt quality control at Aluminium casting plant, http://www.metalurgija.org.rs [accessed 11 Oct 2012].
4. Jain PL. Quality control and total management, (sixth edition), New Delhi, Tata Mc Graw-Hill. 2006.
5. Kennedy S. Aluminium melting and metal quality processing technology for Continuous high quality casting, Inductotherm, International aluminium Group. 2001.
6. Foseco. Aluminium Casting productivity increase with predictive technique, www.foseco.com,tr[accessed 12 Oct 2012.