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Statistical Analysis of Defective Artisanal Sand-Cast Aluminium Pots at PantekaTudunwada in Kaduna Metropolis, Nigeria

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***Abstract**: Artisanal green sand casting of aluminium pots is a highly profitable avenue for small to medium scale self-employment as well as technological and economic development in Kaduna metropolis. The casting process had nevertheless been observed to be characterized with reruns before attaining defect-free castings. This was seen to be capable of increasing the unit casting cost and lowering productivity and profitability and morale of the involved shop floor personnel. The aim herein is to statistically provide basic insight into the total defects level of artisanal cast aluminium pots at Panteka Tudunwada, the main area of aluminium pot casting activities in Kaduna metropolis. The statistical analysis was conducted with Microsoft Excel tools using 10-week collated number of defect-free and defective pot castings produced from the 10 most productive foundry shops in the area. Collated information indicates that within the 10-week period, 25611 defect-free and 9639 defective pot castings were produced in the area. Analyses of the information indicated that the number of defective pot castings varied from shop to shop to overall level of 27.3%. This defect level was seen to be rather high compared to what is obtainable from foundries with Research and Development (R&D) units where better control of casting variables are achieved through research efforts, and defects levels are usually kept in 3 to 15% range. The analyses also showed that the skills used in controlling foundry variables were not the same among the artisans; and there is high correlation between the number of defective and defect-free pot castings within the foundry shops. The identified common types of defects that resulted in the defective castings included open blow holes, burnt skin, cracks, and hard spots. The information is hereby posited for any improvement strategy in the pot-casting business and for relevant research interests.*

***Keywords:** Sand-cast aluminium pots, importance, artisanal technology, defects, productivity and profitability, improvement concern.*

1. INTRODUCTION

Production of sand castings entails control of many steps such as mould design, pattern making, moulding, material sourcing and melting, pouring, shake out, fettling, inspection, and finishing [1]. It is not unusual for any one or more of these steps to be performed unsatisfactorily due to use of defective material or equipment, carelessness of the workmen or lack of consistent skill. Such unsatisfactory operations are more expected from artisanal sand casting where no research inputs are used for production improvement than in modern foundries where research efforts are used to keep defects level to minimum [2]. Lack of good control of all casting variables can result in unusual number of defective castings which may be rejected at the final stage with much business loss. Since repair of defective castings is often costly and sometimes impossible, it is needful that care should be taken in the first instance to avoid occurrence of casting defects. Defects are undesired irregularities or characteristics in a casting that need to be corrected or removed without which the casting can be rejected or the quality, marketability, and profitability of the casting are lowered [3]. It is therefore necessary to know the effects of defects on any casting business and ways of technologically dealing with the defect types. There is also need to know various defects that can occur to particular types of sand castings and the main factors that are responsible for their occurrence as well as possible remedies for them [3]. Generally, defects in sand casting can be due to faults in the pattern, moulding box, equipment, moulding sand, cores, gating system or molten metal, human skills, etc [1, 4]. The specific defects that can occur and result in defective aluminium sand castings have been found well documented in the literatures. These defects include scabs, drops, incomplete casting or pour shot, rat tails and buckles, cuts, sand washes, shrinkages, fins and flashes, fusion, hot tears, hard spots, burnt spots, open blows, blow holes, core shift, pin hole porosity, voids, swells, run-outs, burst-outs, mismatches, cracking, and bending [5, 6].

Artisanal green sand casting of aluminium pots is a highly profitable flourishing business in Kaduna metropolis with total annual worth estimate of 500milion Nigerian Naira [7]. The casting business is practiced at shop level with the main business area at Panteka in Tudunwada district of the city. The pots are cast using unmodified green sand that is usually harvested close to the banks of river Kaduna in the vicinity of Kaduna metropolis. Many Nigerians in Kaduna metropolis are gainfully self-employed in the business and many more profitably trade with the cast pots [7]. The pots are cast in small, medium, and large sizes with capacities that vary from about 4 to 450 liters [8]. The major buyers and end users of the pots are people from homes and restaurants where firewood is the main source of energy. The pot users prefer the pots because of their affordability in various customized shape and capacities or traditional appeal, cheaper rates, and fair qualities relative to those produced from industries which are also available for sale in the market. Those involved in the pot casting business are however not engineers or holders of degrees or advanced certificates in foundry technology [8]. They are mostly people who once worked in foundries where they experientially acquired their foundry knowledge. Some are technical school leavers or trade centre trainees who acquired some extent of casting knowledge elsewhere or through apprenticeship in the pot casting business itself. The workers also do not have research laboratories, and do not depend on any research inputs to advance their castings. Moreover, the workers do not deliberately carry out post-casting heat treatments of their products. Such workers were seen to lack optimum engineering control of the casting variables to maximize productivity and business profit returns. Visually, over 98% by estimation of their successfully cast pots look good but many do end up with unacceptable level of defects or as scraps during the casting process. Such scraps or irreparable defective castings were often observed to be recycled sometimes up to three or more times before pots of satisfactory quality are cast from them [8, 9]. This practice is considered inconsistent, more labour-intensive, unpredictable, unproductive, and unprofitable compared to standard foundry practices where research inputs are used to prevent or minimize scraps and defects and labour-intensiveness [8, 9].

Considering the great contribution of artisanal sand casting of pots and other cookwares to economic development of Kaduna metropolitan area, there have been some engineering research inputs within the last decade all with the aims of improving productivity and product quality in the business. However, no research has provided quantitative test information on defects level in the castings as the first requirement for conducting the other researches.

Statistical methods are used to describe and understand variability. By variability, successive observations of a system or phenomenon do not produce exactly the same result. Variability is encountered in our everyday engineering practice [10]. Statistical thinking in terms of the mean, standard deviation, range, coefficient of variation, correlation coefficient, and test of hypothesis can easily enable any concerned person to incorporate variability into decision-making process to minimize defects in the artisanal pot castings.

The aim of this paper is to provide basic statistical insight into the overall defect level of green-sand-cast aluminium pots at PantekaTudunwada in terms of total number and percentage, average number per production shop per week, and variation characteristics in correlation with the defect-free pot castings and artisanal skills used in the casting processes for; any quality-improving strategy of the castings for greater business productivity and profitability, and general useful information of research interests in sand casting of aluminium products.

1.1 Previous Researches with Motives of Improving Artisanal Pot Casting Business in Kaduna Metropolis

In order to contribute in modification of Kaduna river sand to better properties for casting ferrous and non-ferrous metals; Guma [7] conducted a study on effect of Nigerian 'Illo' clay and corn flour additives on the foundry properties of the sand. His research results with various percentages of the clay additions by weight in the range of 2-10% alongside corn flour from 1-5% showed appreciable modifications of the sand's strength, green permeability, and hardness to satisfactory levels; and recommended the modifications to be exploited for the purpose.

In contribution to disseminate applicable research information for public interest on the use Kaduna river sand by artisans and industries in Kaduna metropolis such as the foundry department of Defence Industries Corporation of Nigeria, Golden U Foundry, and Kaduna Machine Works Ltd for sand casting of cookware and many ferrous industrial spare parts; Guma [11] conducted a laboratory investigation on four critical foundry properties namely green strength, dry strength, green permeability, and hardness of unmodified samples of the sand. He found that:

i. The sand's green permeability compares favourably with the established practical values required for casting some of the common metals.
ii. The hardness of the sand is higher when its moisture content is low.
iii. The sand is weak in strength and does not meet the practical value for casting heavy metals such as steel.
iv. The sand is however a cheap source of dependable moulding sand that can easily be controlled to particular practical foundry requirements for casting different types of metal.

Guma and Uche [9] emphasized and exemplified the need for using basic engineering design procedure to supplement artisanal green sand moulding practices for improving consistency and productivity, minimizing laboriousness and casing defects, and higher profitability in the business. They designed a sand mould for casting 30litre-capacity cylindrical aluminium pot of internal diameter 314.7mm, depth 386mm, and wall thickness 4mm with handling lugs alongside its cover using unpressurized gating system ratio of 1:3:3. Their design provided suitable specifications of; the ladle position, mass and pouring time, in-flow rate of molten aluminium, layout for the mould components, means of compensating process cooling shrinkages of aluminium during solidification, patterns for the castings, and the moulding box.

Guma and Uche [8] casted a defect-free cylindrical flat-bottom 60-litre capacity pot of internal diameter 314.7mm and depth 386mm, wall thickness 4mm and mass 6.19Kg alongside the pot cover and handling lugs using artisanal facilities at PantekaTudunwada. Their casting process involved design and production of the mould for the pot, local souring and melting and pouring of aluminium into the mould cavity, solidification monitoring, and removing and trimming the casting. To understand the quality of the pot, they conducted analyses of its chemical composition and strength. The analyses indicated a pot of sound quality on the basis of health-safe aluminium make and strength integrity. They intended their work to serve as foundry procedure that should typically be followed for any entrepreneurial or research interests in minimizing laboriousness and scraps, improving consistency and productivity, and maximizing profits in green sand pot casting business.

2. METHODOLOGY

2.1 Data Collection

Visits were made to Tudunwada the main area of artisanal pot casting business in Kaduna metropolis in November and December 2019 to survey the nature of casting activities in the area. Aluminium-pot-casting foundry shops in the area were surveyed. The foundry shops were found to be about 60 in number, out of which 28 were currently involved in production. Out of the 28 shops, the 10 most productive ones were selected for the study. The numbers and owners of the selected shops were; 1081(Alhaji Abubakar Abu), 1228(Aliyu Hamza), 690(Ismail Bukar), 1216(Baba Zico), 1047(Ishaq Mai-awo), 1090(Danbala Kasim), 1214(Lukman Bature), 726(Sadiq Abdullahi), 1309(Danladi Maikudi), and 1225(GarbaDansokoto). The shops were assigned identification names A, B, C, D, E, F, G, H, I, J, and K respectively.

Working with the cooperation and assistances of foundry workers in the 10 selected shops, data was collected on weekly basis for 10 weeks from the shops with regard to the number of defect-free and defective pot castings produced at each shop. In collecting the numbers, a defect-free pot casting was regarded as a pot casting that was produced in a single casting run without any noticeable defect that warranted its rejection or recasting to produce correct casting. On the other hand, a defective pot casting was the one that had noticeable defects that could make it unacceptable and unmarketable in that form so needed to be rejected or re-melted and recast to correct form. The weekly collated number of defect-free pot castings for the i^{th} week and j^{th} shop $\left(DFS_{ij}\right)$ and number of defective ones $\left(DS_{ij}\right)$ at each of the 10 foundry shops were documented. Pictures of some of the defect-free and defective aluminium pot castings were also taken with a hand-held Japanese Nikon-made digital camera. The common critical defect types on the defective pot castings were also noted.

2.2 Data Analysis

The weekly collated data were analyzed statistically in terms of the percentage number of the defective castings relative to the total number of pot castings, mean of the defect-free pot castings ($\overline{DFS}_{ij}$), mean of the defective pot castings ($\overline{DS}_{ij}$); and standard deviation (σ), range (R_i), and coefficient of variation (V_i) for each of the defect-free and defective post casting data values using Microsoft Excel tools according to equations to 1-5 respectively [13] The Pearson's correlation coefficient (r) between the 100 number of DFS_{ij} and DS_{ij} pair data values was also determined using the Excel tools according to equation 6 [12, 13].

$$\%No. = \sum_{i=1}^{i=n} DS_{ij} \Bigg/ \left(\sum_{i=1}^{i=n} DS_{ij} + \sum_{i=1}^{i=n} DFS_{ij} \right) \qquad (1)$$

$$\bar{S}_{ij} = \sum_{i=1}^{i=n} {S_i}/{n} \qquad (2)$$

$$\sigma = \sum_{i=j=1}^{i=j=10} \left(\sqrt{\left(\bar{S}_{ij} - S_{ij}\right)^2} \right) \qquad (3)$$

$$R_i = S_{imax} - S_{imin} \qquad (4)$$

$$V_i = \sigma / \bar{S}_i \qquad (5)$$

$$r = \frac{n\left(\sum \left(DFS_{ij}\right)\left(DS_{ij}\right)\right) - \left(\sum DFS_{ij}\right)\left(\sum DS_{ij}\right)}{\sqrt{\left[n \sum {DFS_{ij}}^2 - \left(\sum DFS_{ij}\right)^2\right]\left[n \sum {DS_{ij}}^2 - \left(\sum DS_{ij}\right)^2\right]}} \qquad (6)$$

The weekly collated data on the number of defective casting for every shop $\left(DS_{ij}\right)$ was also used to conduct analysis of variance (ANOVA) using the F statistical distribution at 95 % level of confidence that is at the α = 5%= 0.05 level of significance by testing two hypothesis;

1. H_0: Control of the casting variables (α_i) is the same among artisanal sand pot casters at Panteka Tudunwada so results in the same mean number of defective pot castings among the different foundry shops in the area against the alternative hypothesis.

2. H_1: Control of the casting variables is not same among the artisanal sand pot casters at PantekaTudunwada so comparatively does not result in the same mean number of defective pot castings among the different foundry shops in the area.

The decision on the two hypotheses was then taken by evaluating the value of F_o for the null hypothesis (H_0) as determined from equation 7, and comparing the value with $F_1$for the alternative hypothesis (H_1) as determined from equations 8-12 for the defective pot castings from the 10 study foundry shops ($j =$ 1 to 10. The decision to be made was that if $F_1 > F_0$ the null hypothesis(H_0) would be rejected if otherwise it would be accepted and the alternative hypothesis (H_1) rejected [13].

$$F_0 = F(\alpha, k-1, N) \quad (7)$$

Where k is the number of foundry shops in the area, and N is the number of observations of the defective pot casings in the collated data [13]. .

$$SSB = \sum_{j=1}^{j=10} n_j\left(\overline{DS}_J - \overline{DS}_{ij}\right)^2 \quad (8)$$

Where; SSB is the sum squares between treatment, n_j is the number of observations of the defective pot casings in shop j, $\overline{DS}_J$ is the mean value of the defective pot castings in shop j, and$\overline{DS}_{ij}$ is the mean of the total number of defective pot casting in all the 10 study foundry shops that is $j = 1 - 10$ [13],

$$SSE = \sum_{i=1}^{i=10}\sum_{j=1}^{j=10}\left(DS_{ij} - \overline{DS}_{ij}\right)^2 = \sum_{i=1}^{i=10}\sum_{j=1}^{j=10}\left(DS_{ij}\right)^2 - 2\overline{DS}_{ij}\sum_{i=1}^{i=10}\sum_{j=1}^{j=10} DS_{ij} + 10\left(\overline{DS}_{ij}\right)^2 \quad (9)$$

$$MSB = \frac{SSB}{k-1} \quad (10)$$

where$k - 1$ is the number of degrees of freedom for the number of foundry shops.

$$MSE = \frac{SSE}{N-k} \quad (11)$$

Where; SSE is the sum square of errors, $N - k$ is the number of degrees of freedom for the total number of observations in the collated data.

$$F_1 = \frac{SSB}{MSE} \quad (12)$$

3. RESULTS AND DISSCUSSION

3.1 Results

Results of the weekly collated data on the number of defect-free pot castings from the 10 most productive foundry shops at PantekaTudunwada Kaduna against defective ones for the 10-week study period is presented in Table 1. The statistically analyzed information on the data is presented in Tables 2-5. The evaluated statistical parameters for taking decision on the two proposed hypotheses (H_0) and (H_1) using equations 7-12 are presented in Table 6.

Plates I (a-e) show some of the defect-free pot castings or those that did not have visually observable important defects on them. On the other hand, Plates II shows some of the defects that made the pot castings defective.

Table 1:Weekly collated numbers of defect-free (DFSij) and defective (DSij) pot castings in 10 foundry shops named A to J at PantekaTudunwada

Week	Casting	A	B	C	D	E	F	G	H	I	J
1	DFS_{ij}	242	301	189	263	276	208	179	280	330	156
	DS_{ij}	93	130	61	101	120	84	57	126	136	49
2	DFS_{ij}	198	278	245	327	214	251	217	260	294	203
	DS_i	66	223	94	132	90	73	82	103	114	64
3	DFS_{ij}	320	291	219	278	195	302	245	274	296	169
	DS_{ij}	80	105	102	114	137	117	79	128	90	67
4	DFS_{ij}	229	304	184	312	206	220	183	285	312	194
	DS_{ij}	66	97	110	116	133	71	72	143	97	64
5	DFS_{ij}	244	195	207	325	264	311	211	206	330	217

	DS_{ij}	53	60	91	109	118	97	69	88	140	66
6	DFS_{ij}	301	211	194	290	227	296	267	253	287	249
	DS_{ij}	75	58	79	113	102	73	107	94	129	72
7	DFS_{ij}	213	390	209	241	266	235	249	311	402	178
	DS_{ij}	81	137	77	96	113	79	104	120	141	61
8	DFS_{ij}	190	308	291	307	254	271	215	274	281	213
	DS_{ij}	53	133	89	111	83	80	62	105	102	66
9	DFS_{ij}	315	296	240	261	213	333	253	282	259	194
	DS_{ij}	118	97	92	107	93	128	101	113	98	67
10	DFS_{ij}	312	301	223	286	260	294	188	295	302	192
	DS_{ij}	112	93	75	108	96	110	70	116	112	61

Table2: Proportion of the total number of castings that were defective

$\sum DS_{ij}$	$\sum DFS_{ij}$	$\sum DS_{ij} + \sum DFS_{ij}$	$[\%No.]$
9639	25611	35250	27.3

Table 3: Statistical parameters of all the defect-free pot castings (DFS_{ij}) from the foundry shops

$\sum DFS_{ij}$	$\overline{DFS}_{ij}$	σ	V_i	Max.	Min.	Range
25611	256	49.7182	19.4%	402	156	246

Table 4: Statistical parameters of all the defective pot castings (DS_{ij}) from the foundry shops

$\sum DS_{ij}$	$\overline{DS}_{ij}$	σ	V_i	Max.	Min.	Range (R)
9639	96	27.42	28%	223	49	174

Table 5:Correlation coefficient between the defect-free and the defective pot castingsof the various shops

n	$\left(\sum (DFS_{ij})(DS_{ij})\right)$	$\left(\sum DFS_{ij}\right)$	$\left(\sum DS_{ij}\right)$	$\sum DFS_{ij}{}^2$	$\sum DS_{ij}{}^2$	r
100	2554700	25611	9639	6803951	1002763	0.8

Table 6: Evaluated values of F_0 and F_1 for the hypotheses test

Parameter to be evaluated	Calculation and/or value
$F_0 = F(005,9,90)$	$F_0 = 1.9995$
$SSB = \sum_{j=1}^{j=10} n_j(\overline{DS_\iota} - 96)^2$	$SSB = 10(-16)^2 + 10(17)^2 + 10(-9)^2 + 10(15)^2 + 10(13)^2 + 10(-5)^2 + 10(-16)^2 + 10(18)^2 + 10(20)^2 + 10(-32)^2 = 30490$
$SSE == \sum_{i=1}^{i=10}\sum_{j=1}^{j=10} \left(DS_{ij}\right)^2 - 2\overline{DS}_{ij}\sum_{i=1}^{i=10}\sum_{j=1}^{j=10} DS_{ij} + 10\left(\overline{DS}_{ij}\right)^2$	$SSE = 1002763 - 1843224 + 959457.1 = 118996.1$
$MSB = \frac{SSB}{k-1}$	$MSB = \frac{30490}{9} = 3387.$
$MSE = \frac{SSE}{N-k}$	$MSE = \frac{118996.1}{90} = 1322$
$F_1 = \frac{MSB}{MSE}$	$F_1 = \frac{3387.8}{1322.2} = 2.5622$

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Plate I Piles of some of the observed defect-free pot castings from the foundry shops at PantekaTudunwada

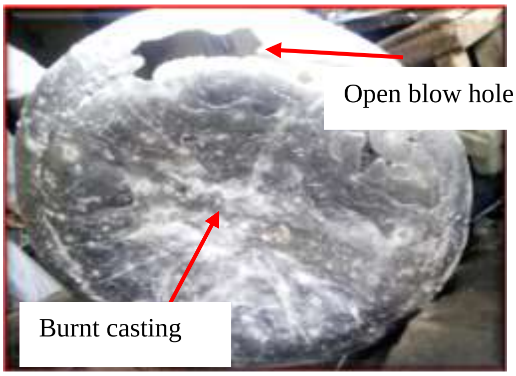

Plate IIa: Burnt casting with open blow hole

Plate IIc: Casing with blow holes and swell

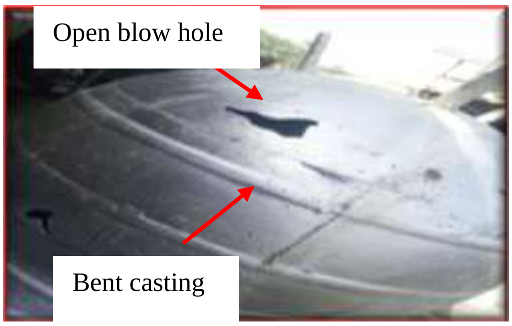

Plate IIb: Bent casting with blow holes

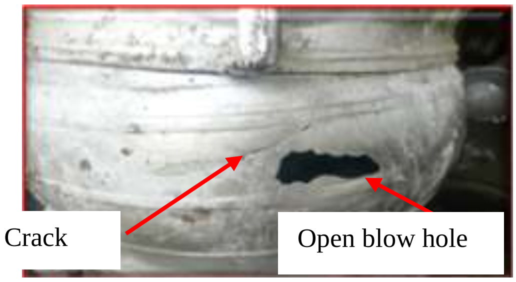

Plate IId: Casting with cracks, blow holes and soft spots

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Plate IIe: Burnt castings with hard spots, and blisters

Plate II (a-e): Some examples of the defective pot castings from the foundry shops at PantekaTudunwada

3.2 Discussion

From Table 1, it can be seen that the number of defect-free and defective pots cast by the foundry artisans vary from foundry shop to foundry shop. The typical defect-free and defective pot castings observed during the study are respectively shown in Plates I and II. The total number of pots cast by the 10 study foundry shops within the 10-week study period was 35,250, out of which 25,611 were defect-free and 9639 were defective as can be seen from Table 2. The number of defective castings translated to 27.3% of the total number of pots casted as can be seen from Table 2. According to CVE INC [14], the exact rate of casting failure varies from foundry to foundry; but in most foundries there are R & D departments so defects are controlled and the level of defective castings is kept in the range of about 3 to 15% depending on the quality control levels achieved by the foundries [14]. From this, it is understandable that the defect level of 27.3% in the pot castings is rather high compared to foundries where research inputs are employed in casting processes. Nevertheless, Tables 1 and 2 indicate that a large number (25,611) of defect-free pot castings were produced by the study foundry shops in just about two and half months. This indicates that much more number of defect-free pots are produced by all the foundry shops at PantekaTudunwada in a year and the economic worth of the castings in terms of conserving foreign exchange for acquiring imported pots in Nigeria is much and significant. It is also seen that in the absence of these much pot castings from the Nigerian economy, there can be greater demand for industry-produced pots in the country which can lead to rise in their prices beyond affordability of many poor Nigerians. Also, sales profits made from these pots can enhance the purchasing power of many Nigerians to acquire variety of other goods in Nigerian economy.

From Tables 3 and 4, it can be seen that the mean value of 256 for the defect-free pot castings from the 10 study foundry shops is much greater than the mean value of 96 for the defective pot castings from the shops. From this mean values and results from Table 2, it is understandable that artisans involved in casting the pots exhibited great and recommendable skills for attaining that much level of defect-free castings. This can be attributed to basic technical education and many years of experience in foundries where some of the artisans worked and acquired their foundry skills before they left and became foundry workers at PantekaTudunwada. It is also attributable to many years of experience which many of the artisans have in the casting business itself and the zeal of competition among them to outdo one another in production and productivity and maximize their profits [8, 9].

The standard deviation values of the defect-free and defective pot castings are 49.7182 and 27.42 respectively as can be seen from Tables 3 and 4. These values indicate that, there is much more productivity variation about the mean of defect-free pot castings than the case of defective castings among the study foundry shops. This indication is upheld by the range values of 246 and 174 for the defect-free and defective castings respectively as can also be seen from Tables 3 and 4. However the co-efficient of variation value of 28% for the defective castings is greater than the value of 19.4% for the defect-free castings as can also be seen from Tables 3 and 4. Hence by proper comparison of the two data sets, the defective pot casting data has greater extent of variability about its mean value than the data on the defect-free castings. This information is helpful when using the risk/reward ratio to invest in artisanal sand-casting business using materials, facilities, and personnel skills typical of what is obtainable at PantekaTudunwada in Kaduna metropolis.

From Table 5, it is indicative that there is high correlation coefficient of 0.8 between the defective and defect-free pot castings. This indicates that in attempt to cast higher number of defect-free pots, the artisans must contend with higher number of defective ones.

From Table 6, it can be seen that $F_0 < F_1$. From this, the null hypothesis (H_0) that the control of casting variables (α_i) is the same among artisanal sand pot casters at PantekaTudunwada so results in the same mean no of defective pot castings among the different foundry shops in the area is rejected against the alternative hypothesis (H_1) that the control of casting variables is not same among the artisanal sand pot casters in the area so does not result in the same mean number of defective pot castings among the different foundry shops in the area. This analysis is clearly in agreement with observations made by Guma& Uche [8, 9] that the skills used by artisans in casting aluminium pots at PantekaTudunwada are not the same, so result in various productivity levels of the defect-free castings among the pot casters. To enhance defect-free pot castings in the area, it is hereby suggested that the foundry workers should be encouraged and supported by the local government, local engineering community, corporate bodies, and individuals for continued training in foundry know-how at foundries and relevant training centres considering their much contribution to economic and technological development in the metropolitan area. Also, visits need to be organized individually or in groups by foundry and other engineering professionals, and local government officials from time to time to the Tudunwada pot casting area to talk to foundry artisans thereat, listen to their problems, and motivate them for skill improvement and greater contribution to self-employment and development in Kaduna metropolis.

From plates I and II, it can be seen that the common defects that made the pot castings defective were open blow holes, burnt skin, cracks, and hard spots. The reason attributed to these defects and many others is due to faults in the casting process such as proportions in the moulding sand mixture, mould design, melting and pouring of aluminium. This shows that despite the commendable knowhow and skills of the pot casters, they are bound to inevitable human mistakes which are the root cause of the faults [1, 5, 15].

4. CONCLUSION

Statistical analysis of the number of defective relative to the defect-free pot castings at PantekaTudunwada in Kaduna metropolis has been conducted using Microsoft Excel tools with 10-week weekly collated number of defect-free and defective pot castings from 10 most productive foundry shops thereat. The analysis indicates that the defects levels in the castings varied from shop to shop with an overall level of 27.3%. The overall defect level was seen to be rather high compared to what is obtainable from foundries with R & D units where better control of casting variables and defect levels of about 3 to 15% are usually achieved through research efforts. The analysis also indicates that, to achieve higher productivity of defect-free castings; the foundry workers have to expend more labour and contend with greater defects. Moreover, the analysis indicates that skills used in controlling the many foundry variables are not the same among the pot casters so can cause variations in defects types and levels of the castings from one production shop to another. This indication is in quite agreement with what was also noted by observation by Guma [11] and Guma and Uche [8]. The different most important types of defects in the castings have been identified and presented in the work. The analysis is hereby posited for any strategy in improving the artisanal casting practices and relevant research interests.

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