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Assessment of Key Challenges of Micro, Small and Medium Foundries (MSMFs) in Sabon Gari and Zaria Local Government Areas of Kaduna State, Nigeria

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ABSTRACT

This study was carried out to identify the key challenges of micro, small and medium foundries (MSMFs) operating in Sabon Gari and Zaria Local Government Areas (LGAs) of Kaduna State, Nigeria. Questionnaire was distributed to respondent as the Primary sources of data collection. A sample size of 196 (managers of micro, small and medium scale Foundries in Kaduna State the respondents sample size was determined using the Yamane's formula, which is widely applied in survey-based social and industrial research for a population size of 490 managers using stratified random sampling method for the purpose of questionnaire administration. margin of error (-e) was set at 5% for a 95% confidence level. The demographic result revealed that the micro-scale foundries category is majority representing 72.9%, followed by Small-scale foundries (22.5%) while the medium-scale foundry account for only 4.6%. The analysis carried out showed that MSMFs face a lot of challenges. This was evident by the overall mean of 2.72 and standard deviation of 1.04 which marks the severity of specific challenges, as individual variables exhibit extreme values ranging from very low to high. The large standard deviation reflects the divergent nature of challenges. some relating to severe resource deficits, others to operational conditions. This implies that MSME foundries have profound challenges that cannot be remedied through improved management alone but require systemic interventions from government, commercial banks and organizations.

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INTRODUCTION

One of the oldest metal shaping processes is casting to desired shape of the consumer. It dates approximately to four thousand (4000) B.C." (Khanna, 1997). In Nigeria, Micro, Small and Medium Enterprise (MSME) foundries referred to as Nok-culture have been practiced in Kaduna state, Nigeria for over the past 200 years (Jemku,1992; Inuwa,1995; Abioye et al., 2003).

The importance of the micro, small and medium scale foundry cannot be underestimated in any economy given the fact that the world economic development trend in recent time indicates that the largest casting producers such as China, India, USA, Germany, Russia, Brazil, South Korea, Italy and France are also leading the world economy (Metalurgija et al.,2012). Nigeria cannot be an exception. Casting involves the manufacture of metal products in a single step from liquid to solid without intermediate operation of mechanical workings such as rolling, fabrication or forging. The process involves pouring out of molten metal into a prepared mold cavity of the desired shape and allowing the molten metal to solidify. Foundry industry can be a hub for economic development in Nigeria because a considerable number of the foundry products serve as equipment or replacement materials for all other industries such as agriculture, transportation, petrochemical, cement and quarrying (Atanda & Ibitoye, 2004).

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Advantages of metal casting over other manufacturing:

Casting provides the greatest freedom of design in terms of shape, size and product quality. It impacts uniform directional properties and better vibration damping capacity to the cast part. Shapes difficult and uneconomical to produce through other manufacturing processes could be achieved at low cost through casting processes. Metal casting enables product to be cast in one piece, thereby eliminating the need of metal joining processes. Very heavy and bulky parts (like those of power plants and mill housing), that are sometimes difficult to fabricate can be easily cast. Casting can be designed for equal distribution of loads (on all members of a product) and for minimum stress concentration in order to achieve more strength and increase service life.

Classification of Casting processes

Casting processes can classify into four groups: micro, small, medium large-scale enterprise. The small-scale foundry enterprise consists of individual entrepreneur who are self-employed and have some skilled labor and also apprentices to make the job smooth and faster. In order to aid achieving sustainable development and growth in the metal casting industry, it is pertinent to assess the performance of the foundry enterprises in the economy, identify the factors militating against its growth and possible ways to minimize them, identify the efforts being made by the industry to improve its growth and possible assistance from the government in developing the sector.

Overview of Production Process

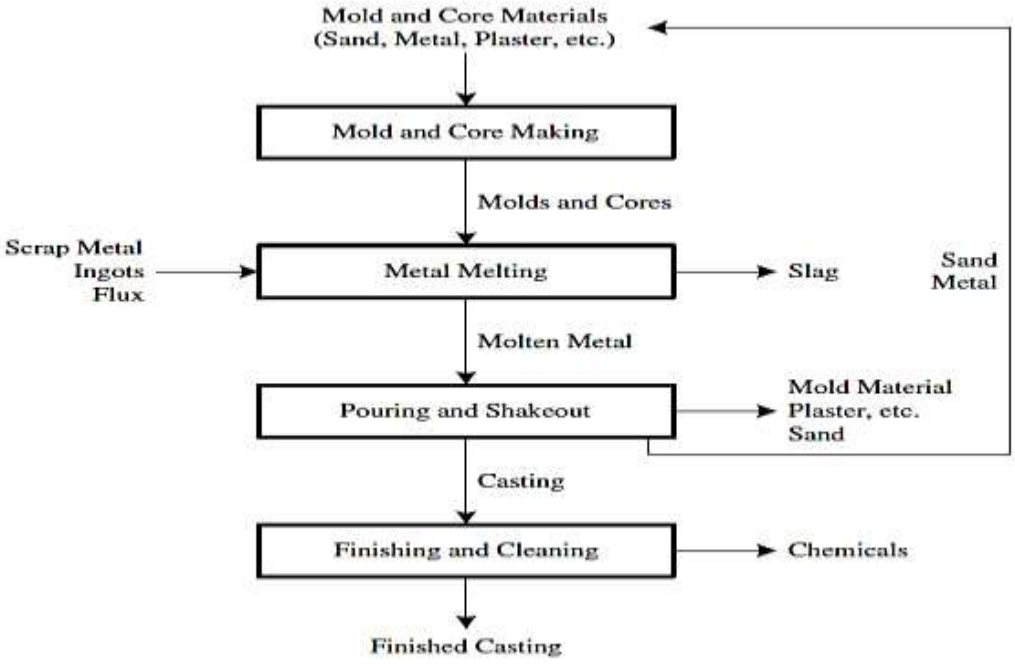


Figure 1. Overview of the Foundry Casting Processes

Statement of the Problem

In 2014, Nigeria's economy emerged as Africa's largest economy and the 26th in the world amidst expectations that if the Federal Government harnesses the potentials of the economy, especially the metallic extractive industry, it may hit the trillion-dollar mark. Two years later, Nigerian economy went into recession and Nigerian became poverty capital of the world. This could be attributed to near absence of

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efficient foundry industries resulting from inadequate planning. It is in the light of the above that this paper x-rays the. challenges of scale foundries (SSFS) and the factors influencing the development and sustainability of the foundry enterprises in Nigeria.

Micro Small and medium Scale foundries often lack the necessary financial and technical resources to adopt sophisticated production management systems. This has resulted in reduced productivity, increased operational costs, and an over-reliance on imported automotive components, contributing to economic stagnation in the local manufacturing sector, the level of awareness on its role on the economic development in Nigeria is low. In Nigeria, the contribution of the small-scale foundry enterprise is almost insignificant. This can be attributed This has led to some of the foundry firms folding up thereby leading to increase in unemployment rate for those already trained to work in the enterprise.

REVIEW OF LITERATURE

The Concept of SMEs:

Small and medium scale enterprises (SMES) have been generally acknowledged as the bedrock of the industrial development of any country. Apart from the numerous goods and services produced by SMES, they provide a veritable means of largescale employment, as they are usually labour intensive. They also provide training grounds, for entrepreneurs even as they generally rely on the use of local raw materials. If well managed, SMES can gradually transform into the giant corporations of tomorrow. These contributions thus explain why government and international agencies mobilize efforts towards the realization of sustainable industrial growth and the creation of mass employment through the rapid growth and development of the small and medium enterprises (Nnanna, 2005).

Problems and Challenges of SMEs in Nigeria

The fact that SMEs have not made the desired impact on the Nigerian economy in spite of all the support of succeeding administrations of governments gives a cause for concern. It underscores the belief that there exists fundamental issues or problems, which confront SMEs but which hitherto have either not been addressed at all or have not been wholesomely tackled. Most SMEs die within their first five years of existence (Basil, 2005). Another smaller percentage goes into extinction between the sixth and tenth year thus only about five to ten percent of young companies survive, thrive and grow to maturity (Basil, 2005). A review of literature reveals indeed the following plethora of problems, which are enormous, fundamental and far-reaching (Basil, 2005):

1. Inefficient, and non-functional infrastructural facilities, which tend to escalate costs of operation as SMEs are forced to resort to private provisioning of utilities such as road, water, electricity, transportation, communication, etc.
2. Bureaucratic bottlenecks and inefficiency in the administration of incentives and support facilities provided by the government.
3. Lack of easy access to funding/credits, from commercial banks owing to poor and inadequate documentation of business proposals, lack of appropriate and adequate collateral, high cost of administration and management of small loans as well as high interest rates
4. Discrimination from banks, which show apathy towards lending to SMEs.

Review of Related Literature

Ifinedo (2006) states that SMEs in Nigeria can increase their market reach, enhance customer services and reduce both marketing and distribution cost through e-business. However, majority of Nigeria SMEs are not utilizing ICT which is the foundation of e-business due to some major barriers as identified in this study. Beyene, (2002) defined micro enterprise a**s a** firm, whose total cost including working capital but excluding cost of land is not more than ten million naira (N10,000,000) and/or with a labor size of not more than thirty (30) full-time workers and /or a turnover of less than two million naira (N2,000,000) only.

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Small Enterprise as **a**n enterprise whose total cost including working capital but excluding cost of land is between ten million naira (N10,000,000 and one hundred million naira (N100,000,000) and/or a workforce between eleven (11) and seventy (70) full-time staff and/or with a turnover of not more than ten million naira (N10,000,000) in a year while Medium Enterprise**,** they defined as a company with total cost including working capital but excluding the cost of land of more than one hundred million naira (N100,000,000) but less than three hundred million naira (N300,000,000) and/or a staff strength of between seventy-one and two hundred (200) full-time workers and/or with an annual turnover of not more than twenty million naira (N20,000,000) only.

Nitani, (2005) defined large enterprise as **a**ny enterprise whose total cost including working capital but excluding cost of land is above three hundred million Naira (N300,000,000) and/or a labour force of over two hundred (200) workers and/or an annual turnover of more than twenty million naira (N20,000,000) only. Ochuokpa et al (2021) developed a unique Aluminum Based Mango Seed Shell Ash (MSSA) Composite for production of Motorcycle hub in Ahmadu Bello University, Mechanical Engineering Department (ABUMED). Ochuokpa et al (2022) carried out production and wear optimization of mango seed shell ash composite for the production of the hub is known as ABUMED motorcycle hub

Guma, & Uche., (2019) Carried out a typification of foundry practices for correct artisanal sand casting of aluminum pots in Kaduna State. The concluded that Artisanal green sand casting of aluminum pots business is characterized with laborious control of many production process variables and uncertainty of clear engineering practices that can raise doubts on the qualities of the castings and reduce confidence of some people in buying them. The economic development of nations can be easily accessed from her established industries infrastructures and indigenous or even acquired technologies (Azodo et al, 2008).

The capacity of the country's foundry industry is put at 152,000 metric tons annually which is made up of about 59.1% (60,178 metric tons) cast iron, 27.3% (41,465 metric tons) of cast steel and 33.1% (51,370 metric tons) nonferrous all valued at about 19.6 billion naira (US $196.3 million). "This output from a total of about 60 active foundries is considered unimpressive with the well over 7,000 active foundry shops, with an annual output of about 3million metric tons per annum in India". (Adejuyigbe, 1979; Ibitoye, 1995).

Manufacturers' Association of Nigeria (M.A.N) reported the result of a survey carried out by the United Nations Industrial Development Organization UNIDO in 2008 on the factors affecting the growth rate of the manufacturing industry. The result showed that lack of infrastructure, lack of access to funds and low demand for product are major factors affecting growth rate. According to Doig (2000), Australian governments are committed to accessible e-commerce for SMEs, and have decided that some intervention was necessary to make participation affordable, particularly for small and remote businesses.

SECTION THREE: RESEARCH METHODOLOGY

Research Design

This study adopts a mixed-methods research design which integrates both quantitative and qualitative approaches within a single investigation Creswell & Plano Clark, 2018). The instrument is developed to align with the study's objectives and hypotheses and is informed by a review of the literature and pilot engagement with key industry actors. Structured and unstructured questionnaires and multiple visits. **T**he study was carried out mainly in Sabon Gari and Zaria Local Government Areas of Kaduna State, Nigeria. This was because small scale foundry enterprises are more prominent in these locations of the state. The study adapted mixed method approach using both quantitative and qualitative methods. Structured and unstructured questionnaires and multiple visit approach were used to collect the information needed. Focus group discussion

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(FGD) Participants in the focused group were the micro, small and medium scale foundry entrepreneurs in the management cadre.

Population of the Study

A population sample is seen as organizations, institutions, group of individuals, objects or items from which samples are taken for measurement (Creswell & Creswell, 2018 ; Sekaran, 2005) .The target population for this study is all Micro, Small, and Medium-Scale Foundry Enterprises (MSMEs) within Sabon Gari, and Zaria . While this study is limited to information collected from three local government areas, the results will be useful to other foundry industries in Nigeria. The population of sample was drawn from the top management staff and foundry professionals. Table3. 1 shows the information about the sampled population

Determination of Sample Size

The sample size is determined using the Yamane's formula which is widely applied in survey-based social and industrial research as reported by Unegbu (2025) as shown in equation 3.1,

Determination of Sample Size

The sample size is determined using the Yamane's formula which is widely applied in survey-based social and industrial research as reported by Unegbu (2025) as shown in equation 3.1,

$$n = N / (1 + N(e)^2) \quad (3.1)$$

Where: - n = sample size- N = population size - e = margin of error (typically set at 5% for a 95% confidence level). Given that available records from KADCCIMA and NAFP suggest an estimated population size of 600 operational personnel involved in PPC-related functions across registered and informal MSME foundries in Kaduna State, the calculation is as follows:

N = 490 / (1 + 490(0.05) ^2)
= 490/ (1 + 600(0.0025))
= 490 / 2.5 = 196

The minimum sample size of 196 respondents is established for this study. Reliability and internal consistency will be verified using Cronbach's alpha, and construct validity will be assessed using Exploratory Factor Analysis (EFA).

Validation Pilot study

A pilot study is a small-scale, preliminary research project conducted to test the methods and feasibility of a larger, main study. It helps identify potential problems, refine research instruments and protocols, assess recruitment strategies, and gather data to estimate the resources needed for the full-scale study. In this research, a pilot study was carried out in two Local Government Areas of Sabon Gari Local government area, (Mukhtar Ismail Mai Tukunya Enterprise and other clusters) Zaria LGA (Nuhu Bamali Polytechnic foundry workshop

Reliability of Instrument

Easterby-Smith (2002) defines reliability as the extent to which data collection techniques or analysis will yield consistent findings. The primary objective should be that if a later investigation followed exactly the same procedures as described, and conducted the same study all over again; he should be able to arrive at the same results and conclusions. Thus, the study is to be tested at 0.05 levels of significance. Cronbach's alpha was to verify the Reliability and internal consistency. Reliability Statistics Cronbach's Alpha of 0. 765 Cronbach's Alpha Based on Standardized Items is 0.805 for the 5 number of Items tested in pilot study. This confirms reliability.

Justification of Method Used

In this research work questionnaire were used. The used of questionnaire will helped in the collection of data from various people with varying opinion. Thus, many people responded to similar questions with different opinions and views. The used of questionnaire also gave the respondents time to think and ponder on the question before they responded in various ways. Above all, anonymity was guaranteed to the respondents so as to get some information, which

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the researcher discovered are of great importance to this research work. In determining the sample for this study, judgmental sampling method was employed as it seemed to be the most appropriate method as regards the nature of the study to select the two sub-sector to study which are the micro, small and medium scale foundries.

RESULTS AND DISCUSSION

Geographically, the research concentrated predominantly in Sabon Gari, which accounted for (74%), reflecting this area's historical role as a major foundry cluster such as found in muchia whilst Zaria local government accounted for (26%). This spatial distribution indicates the agglomeration effects typical of artisanal industries, where knowledge spillovers, shared supplier networks, and established customer relationships encourage clustering. Sabon Gari's dominance suggests it has evolved as the primary hub for foundry activities in the region, possibly due to historical factors, infrastructure availability, or proximity to markets and raw material sources.

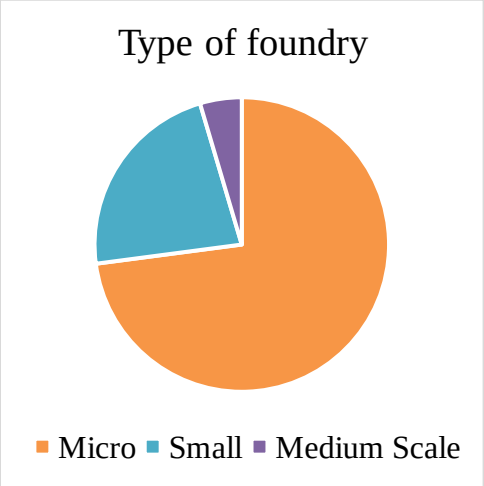


Figure 1: Type of foundry. Source: Researchers' work, 2025

Table 1: The key Challenges of MSME Foundry industries in Kaduna state Nigeria

S/N	Variable	SA	A	N	D	SD	N	Mean±S.D	Rank	Remark
1	We have well trained and qualified skilled labour force to produce discrete automobile parts like Motorcycle hub	7	10	5	84	90	196	1.90±1.04	3	Very Low
2	We have good foundry workshop layout with Storage facilities for sand, pattern, raw materials & finished goods	5	6	9	94	82	196	1.85±0.94	4	Very Low
3	We have access to government support and loans from financial institutions	6	4	8	91	87	196	1.84±0.94	5	Very Low
4	Raw Material are cheap and readily available for our Production targets	68	62	6	30	20	196	3.74±1.33	2	High
5	Our machines and equipment are too obsolete to cope with modern casting techniques.	91	86	4	8	7	196	4.28±0.95	1	High
	Overall Mean							**2.72±1.04**		**Moderate**

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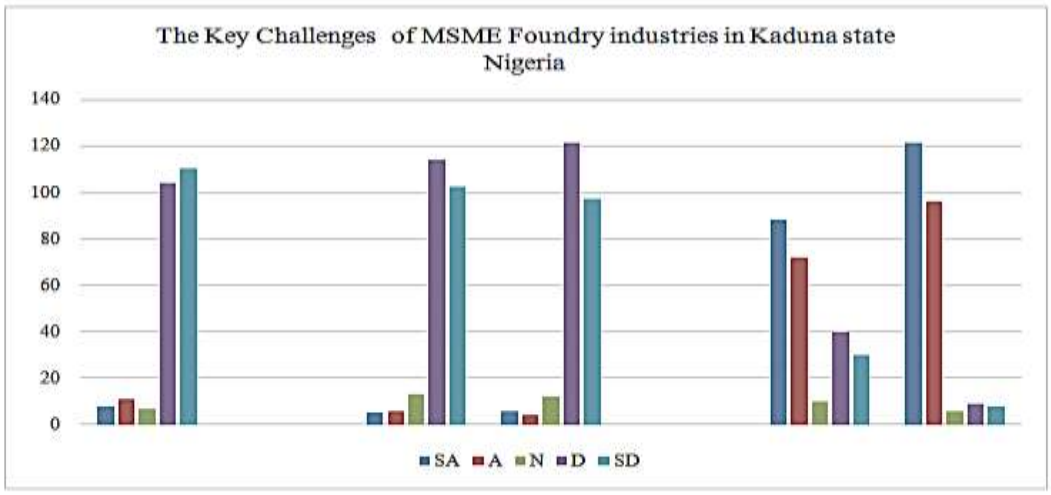


Figure 2: challenges confronting MSME foundry industries in Kaduna State, Nigeria

Table1 and examines critical challenges confronting MSME foundry industries in Kaduna State, revealing a sobering portrait of structural constraints that threaten long-term sustainability. The overall mean of 2.72±1.04 (Moderate category) masks the severity of specific deficiencies, as individual variables exhibit extreme values ranging from very low to high. The relatively large standard deviation reflects the divergent nature of challenges some relating to severe resource deficits, others to operational conditions. Notably, three of the five variables received 'Very Low' remarks, indicating foundries operate under profound disadvantages that cannot be remedied through improved management alone but require systemic interventions.

"Our machines and equipment are too obsolete to cope with modern casting techniques" achieved the highest mean of 4.28±0.95, with 121 strong agreements and 96 agreements. This represents a damning assessment of technological capability, indicating that equipment obsolescence constitutes a severe constraint. The near-consensus (only 17 disagreements) suggests this problem transcends individual foundries and characterizes the sector broadly. Several implications emerge from this finding. First, obsolete equipment limits the range of products foundries can manufacture, potentially excluding them from higher-value market segments requiring precision or complex geometries. Second, outdated machinery typically consumes more energy, operates less safely, and produces more defects, thereby increasing costs and risks. Third, equipment obsolescence signals insufficient capital accumulation or reinvestment over time, reflecting either inadequate profitability or capital diversion to non-productive uses. Fourth, the technological gap may be widening as global foundry technology advances whilst local capabilities stagnate, progressively marginalizing Nigerian foundries from modern supply chains.

"Raw Material are cheap and readily available for our Production targets" ranked second with a mean of 3.74±1.33. Interestingly, this positive framing receives moderate agreement, indicating that material availability represents a relative strength compared to other challenges. The 88 strong agreements and 72 agreements suggest many foundries can access necessary materials reasonably. However, the 70 disagreements/strong disagreements and substantial standard deviation (1.33) indicate significant variation in material access experiences. This dispersion possibly reflects several factors. Geographical location matters foundries in Sabon Gari, near the big market. Material suppliers, may experience better access than those in Zaria or Kaduna metro. Financial

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capability influences material access foundries with stronger cash flow can purchase when prices are favorable, whilst capital-constrained operators must buy at prevailing prices. Supplier relationships also differ established foundries with reliable payment histories receive preferential treatment during shortages, whilst newer or financially unstable operations face supply uncertainties.

"We have well trained and qualified skilled labour force to produce discrete automobile parts like Motorcycle hub" received a mean of merely 1.90±1.04, ranking third with a 'Very Low' remark. The 110 strong disagreements and 104 disagreements represent a devastating skills deficit assessment. Only 19 respondents agreed or strongly agreed, indicating that skilled labour shortages plague the sector pervasively. This finding carries profound implications for industry sustainability and growth prospects. Several dimensions of this skills crisis warrant examination.

"We have good foundry workshop layout with Storage facilities for sand, pattern, raw materials & finished goods" achieved a mean of 1.85±0.94, ranking fourth with a 'Very Low' remark. The 102 strong disagreements and 114 disagreements indicate grossly inadequate physical infrastructure. Only 11 respondents agreed, suggesting infrastructure deficiency is nearly universal. This finding illuminates several operational constraints observed in figure3.



Plate A, Bad storage and ergonomics problem



Plate B. Bad storage of tools & raw materials



Plate C. Furnace & sand are together



Plate D Storage problems for Finished products.

Plate A- D: The problems of the existing in MSM Small-Scale Foundries in Kaduna, Nigeria Plate A- D reflects lack of proper storage facilities and space for raw materials, work equipment and finished goods are kept on the street. Poor workshop layout disrupts workflow, contributing to the worker waiting problems

Access to government support and loans from financial institutions;

This research finding clearly shows that most foundry enterprises in Kaduna state do not have access to government support and loans from financial institutions. This is reflected in the low mean of 1.84 and standard deviation of 0.94. The result show 97 strong disagreements and 121 disagreements, with only 10 agreements. It reveals the almost total absence of formal support. This lack of capital access represents the most fundamental constraint that explains the inability of foundries to purchase modern equipment

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(addressing the obsolescence problem) and construction of proper workshops (addressing the infrastructure deficit). They cannot invest in training (addressing the skills shortage).

CONCLUSION AND RECOMMENDATIONS

The development and sustainability of the foundry enterprise in Kaduna State is considered poor due to some factors which include among others, lack of well trained and qualified skilled labor force, poor foundry workshop layout, lack of access to government support and loans from financial institutions and obsolete machines and equipment to cope with modern casting techniques. Others are weak infrastructural base.

Based on these findings, the study recommended that easy access to loans at low interest rate should be made available to the foundry entrepreneurs to assist them to improve and maintain a good product standard through financial institutions like microfinance banks, bank of the industry (BOI). Grants and training should also be made available by Kaduna state government as part of initial capital investment to sponsor individual to establish new foundries and improve their foundry layout.

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