

Entrepreneurial Challenges and Productivity of Sand Dredgers in South-East Nigeria

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Abstract.

This study examined the influence of identified entrepreneurial challenges of capital, technology, infrastructure, regulations and environment; on productivity of sand dredgers in South-east, Nigeria. The study adopted a mixed-method approach of combining quantitative survey data and qualitative interviews. Using purposive and snowball sampling techniques, questionnaires validated by experts and pre-tested for reliability (with all constructs above the 0.7 Cronbach's alpha values threshold) were personally administered to about 25 sand dredgers drawn from each of the 5 South-East states of Abia, Anambra, Ebonyi, Enugu and Imo. Data analysis was carried out on a total population of 120 sand dredgers using descriptive statistics, correlation analysis, and Ordinary Least Squares (OLS) regression models. The information collected via structured interview was analysed using thematic content analysis. It was found that sand dredging which is an informal sub-sector in the extractive entrepreneurship has become a major entrepreneurial initiative due to increasing demand for construction materials driven by rapid urbanization, population growth, and infrastructure development. Despite its economic importance, the sector faces numerous operational challenges defined by small-scale operations, low capital investment, and high exposure to environmental risks; which affect productivity, defined as the efficiency with which resources are transformed into sand volumes. Specifically, the study finds that access to capital ($\beta = 0.452, p < 0.01$), infrastructure ($\beta = 0.412, p < 0.01$), and technology ($\beta = 0.381, p < 0.01$) have positive and significant influence on productivity, while regulatory bottlenecks ($\beta = -0.294, p < 0.05$) and environmental degradation ($\beta = -0.331, p < 0.05$) negatively impact productivity. The study concludes that structural and institutional barriers remain critical impediments to efficiency in the dredging sector and advocated the following policy recommendations to improve productivity and sustainability: expanded access to finance, simplified regulatory reforms, increased investment in modern dredging technologies, improved infrastructural facilities and adoption of sustainable environmental practices. Acknowledging limitations in terms of sample size and bias associated with self-reported data, among others; the study contributed to entrepreneurship literature by providing sector-specific evidence from an under-researched extractive SME subsector while advocating for more studies.

Keywords: *Entrepreneurial Challenges of Sand Dredgers; Productivity of Sand Dredgers*

1.0 Introduction

1.1 Background of Study

Entrepreneurship is all about risk-taking, innovation, and resource utilization targeted towards value creation that can command effective demand. It is widely recognized as a catalyst of economic development, particularly in developing economies where formal employment opportunities are limited (Acs et al., 2018). In Nigeria, informal and extractive entrepreneurship plays a significant role in job creation, income generation, wealth redistribution and rural development. Sand dredging entrepreneurship involves the commercial extraction of sand from riverbeds using manual, semi-mechanized, or fully mechanized systems. The South-East region of Nigeria, particularly Anambra State, has experienced significant dredging activities along its river systems such as the River Niger and its tributaries, including the Omabala and Ezu rivers. The sand dredging which is a sub-sector in the informal and extractive entrepreneurship.; though characterized by small-scale operations, low capital investment, and high exposure to environmental risks; has become a prominent economic activity due to increasing demand for construction materials driven by rapid urbanization, population growth, and infrastructure development risks. Despite its economic importance, the sector faces numerous operational challenges. These challenges affect productivity, defined as the efficiency with which inputs (labor, capital, technology, etc.) are transformed into outputs (sand volume). Traditionally, these inputs were recognized as the 3 Ms of factor of production (money, men and materials) but contemporarily, particularly with the recognition of entrepreneurship as the fourth factor of production and the universal role of capital in acquisition of other factors of production, they become baptized as the 4 Cs of financial Capital, human Capital, social Capital, and intellectual Capital. The efficacy with which their combination metamorphous into sand volume is a measure of productivity. Productivity in dredging is measured as:

- Output per day (tons or cubic meters)
- Trips per week
- Revenue per operational cycle

In South-East Nigeria (comprising Abia, Anambra, Ebonyi, Enugu and Imo), the productivity of sand dredgers is significantly sub-optimal and oscillates like a pendulum in consonance with the dictates of equipment type, river conditions, and operator expertise. Empirical studies comprising field observations and hitherto researches reveal that:

- Many operators rely on archaic dredging infrastructures, including outdated dredging machines, towing boats and pumping systems.
- Accessibility to formal lending channels are frustrating.
- Regulatory demands from National Inland Water Agency(NIWA) and other governmental agencies and hierarchies are volatile and intimidating.
- Environmental hazards degrade dredging efficiency.

These challenges occasions:

- Reduced output per dredging cycle.
- Escalating operational costs.
- Diminished profit margins.
- Untenable business operations

The essence of the study is therefore to identify key operational and institutional challenges faced by sand dredgers and proffer evidence-based policy recommendations for enhancing

productivity.

To achieve the above, four research questions were structured, viz:

- What socio-economic factors influence dredging productivity?
- What are the major entrepreneurial constraints?
- What is the level of productivity among dredgers?
- What is the impact of these constraints on productivity?

To establish the nexus between the Entrepreneurial challenges and productivity, the under-listed hypotheses were postulated and tested:

- H₀: Entrepreneurial challenges do not significantly affect productivity
- H₁: Entrepreneurial challenges significantly affect productivity

The study which focused on sand dredging operators in Abia, Anambra, Ebonyi, Enugu and Imo States between 2020 and 2025 is significant because of its emphasis on:

- Increasing environmental concerns about dredging.
- Lack of empirical productivity analysis in the sector.
- Policy gaps in regulating extractive entrepreneurship.

1.2 Objectives

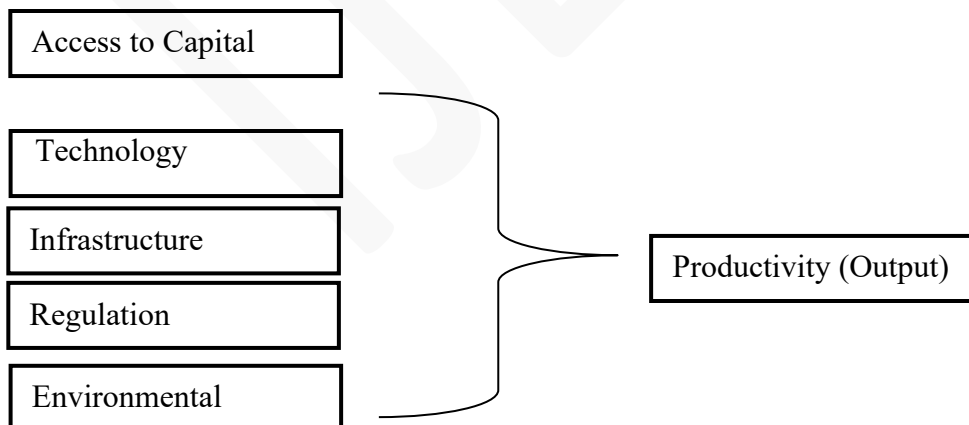
The main objective of the study is to examine the influence of designated entrepreneurial challenges of capital, technology, infrastructure, regulations and environment on productivity of sand dredgers in South-east Nigeria. The specific objectives are to:

- Highlight the socio-economic characteristics of dredging entrepreneurs.
- Identify key operational and institutional challenges faced by sand dredgers.
- Measure productivity levels of dredging enterprises using output indicators.
- Evaluate statistical relationship between identified challenges and productivity.
- Provide evidence-based policy recommendations for enhancing productivity.

2.0 Literature Review

2.1 Title: Conceptual Model of Entrepreneurial Challenges and Productivity of Sand Dredgers:

Entrepreneurial Challenges (Independent Variables) Productivity (Dependent Variables)



The conceptual framework presented above provides a clear depiction of the specific objectives of the study by outlining the respective entrepreneurial challenges influencing productivity of sand dredgers in South-East Nigeria.

2.2 Entrepreneurial Challenges of Sand Dredgers:

Sand dredging entrepreneurship involves the commercial extraction of sand from riverbeds. The above framework identified five entrepreneurial challenges encountered by sand dredgers in their extraction activity. These are: Capital, Technology, Infrastructure, Regulation, and Environment. Capital is interpreted wholistically in terms of financial, human, social, and intellectual empowerment to mobilise the requisite resources to anchor the enterprise on a loftier pedestal. Technology refers to the extraction mechanism in terms of whether it is manual, semi-mechanized, or fully mechanized systems. Infrastructures call to mind, facilities like the dredging machines, towing boats and pumping systems in terms of whether it is archaic, outdated or modern. Regulations refers to regulatory demands from National Inland Water Agency (NIWA) and other governmental agencies and hierarchies which are volatile and often-times intimidating. Environment is seen from the perspective of environmental hazards like flooding, erosion/ landslides, etc. which degrades dredging efficiency.

Capital, Technology, Infrastructure may be described as **Positive drivers** because their optimality imparts productivity positively while Regulation and Environment may be described as **Negative constraints** because their presence retards productivity,

2.2 Productivity of Sand Dredgers

Productivity, generally, is defined as the efficiency with which inputs are transformed into outputs. Entrepreneurship in Nigeria is, generally, constrained by infrastructural deficits, weak institutions, and limited access to finance (World Bank, 2020). Informal sector entrepreneurs, including sand dredging operators, face higher risks due to lack of regulatory protection and environmental hazards. Productivity is therefore sub-optimal, being characterized by small-scale operations, low capital investment, and high exposure to environmental risks. In sand dredging, it may be measured, practically, as:

- Output per day (tons or cubic meters)
- Trips per week
- Revenue per operational cycle

In this study, productivity is measured as the efficacy with which inputs metamorphous into sand volume. In South-East Nigeria, the productivity of sand dredgers is significantly sub-optimal and depends, among other things, on equipment type, river conditions, and operator expertise. Empirical studies comprising field observations and hitherto researches reveal that:

- Many operators rely on archaic dredging infrastructures, including outdated dredging machines, towing boats and pumping systems.
- Accessibility to formal lending channels are frustrating.
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2.3 Theoretical Framework

A number of theories may be applicable to this study:

- **Schumpeterian Theory of Entrepreneurship**, which emphasizes innovation and risk-taking while positing that Innovation improves productivity through better equipment and processes
- **Production Theory**, which explains output as a function of inputs such as capital, labor, and technology.
- **Institutional Theory** which explains that government regulations shape business outcomes.
- **Entrepreneurial Orientation Theory** which focuses on personal traits of the entrepreneur such as innovativeness, pro-activeness, and risk taking,
- **Resource-Based View Theory (RBV)** which posits that firms with competitive advantage over requisite resources outperform others.

The Entrepreneurial Orientation Theory would have been a fertile pedestal to anchor this study but given its overly broad and somewhat idealized focus on individual traits such as innovativeness, proactiveness, and risk-taking, which may not fully capture the complex, resource-constrained sub-sector like sand dredging in South-East Nigeria, we expect more yield from Resource-Based View theory (RBV). The RBV which originated from strategic management, was first proposed by Edith Penrose, though popularized by Jay Barney. It emphasizes the role of resources within a firm as a critical factor for gaining a competitive advantage. This theory departs from traditional approaches that focus on external market factors and instead highlights the importance of leveraging on a company's internal resources for sustained success (Miller, 2019). Barney's 1991 paper titled "*Firm Resources and Sustained Competitive Advantage*" was particularly instrumental in establishing RBV as a prominent framework in the study of organizational strategy. Since then, the theory has become widely recognized in both academic and practical fields for explaining how firms can create and sustain value through the effective utilization of their unique resources. The RBV theory posits that the key to gaining a sustainable competitive advantage lies in the ownership and control of valuable, rare, inimitable, and non-substitutable resources (Miller, 2019). These resources can take various forms, including physical assets (e.g., equipment, land), human capital (skills, expertise), social capital (networks, relationships), and intellectual capital (knowledge, patents). The theory suggests that firms with such resources are better positioned to outperform competitors, as these resources enable them to exploit opportunities and navigate challenges that others may not be able to (Adnan, Abdulhamid & Sohail, 2018). According to the RBV, it is not merely the possession of resources that matters, but how these resources are managed and utilized effectively. Organizations must ensure that their resources are continuously updated and leveraged to maintain their competitive edge in a dynamic business environment.

The RBV is highly relevant to the study of Entrepreneurial Challenges and Productivity, particularly in the context of Sand Dredging in South-East Nigeria. Entrepreneurs in this sector can significantly improve productivity by leveraging on requisite resources: modern dredging infrastructures, including dredging machines, towing boats and pumping systems; sustainable regulatory and environmental control mechanism; and increased access to capital in all its ramifications - financial capital to invest in up to date dredging equipment; human capital to boost productivity through skilled and experienced expertise; social capital to gain access to markets and business opportunities, particularly in the block and construction industry; intellectual capital to exploit the benefits of innovations and research.

The theory suggests that entrepreneurs with access to rare and inimitable resources, like unique dredging techniques or strong networks with suppliers and distributors, can outperform

competitors and achieve higher levels of productivity. Additionally, the theory supports the notion that productivity in sand dredging, is not just about having resources but about strategically utilizing them to improve productivity and create value. By aligning their internal resources with the demands of the market, sand dredgers can enhance their competitiveness, increase profitability, and sustain long-term growth in a challenging business environment.

2.4 Empirical Literature

Empirical studies highlight key challenges:

- Abam et al. (2023) emphasized infrastructural risks and poor regulatory enforcement in the Niger Delta.
- **Acs et al. (2018)** identified entrepreneurship as a catalyst for economic growth.
- Ogbo et al. (2024) found that environmental degradation and weak regulation negatively affect dredging sustainability in Anambra State.
- HKJOSS (2023) reported that over 65% of dredgers rely on multiple income sources due to instability in the sector.
- **World Bank (2020)** fingered infrastructural deficits as hindrance to SMEs.
- **Sowunmi et al. (2016)** opined that environmental inefficiency reduces dredging output.
- **Udoinyang, N., et al. (2023)** posits that environmental hazard affects dredging activities.

These studies suggest that productivity is constrained by both economic and institutional factors and that sand dredging enterprise is relatively under-researched. Aside the above-mentioned citations which dwelled more on the environmental implications of sand dredging; there is virtually no known study that integrated entrepreneurship, sand dredging and quantitative productivity modelling. This study fills that gap by discussing with personal experience the effect of identified entrepreneurial challenges of capital, technology, infrastructure, regulation, and environment on productivity of sand dredgers.

3.0 Methodology

The study focused on South-East Nigeria, particularly Anambra State riverine communities of Ogbaru, Onitsha, Nsugbe, Umuleri, Umuoba-Anam, Aguleri, Ikem-Ivite and Igbariam. It adopted a mixed-method approach of combining quantitative survey data and qualitative interviews which enabled the researchers to observe and document how the respective independent variables of capital, technology, infrastructure, regulations and environment; influence the dependent variable of productivity of sand dredgers in South-East Nigeria.

Using purposive and snowball sampling techniques, questionnaires validated by experts and pre-tested for reliability were personally administered to about 25 sand dredgers drawn from each of the 5 South-East states of Abia, Anambra, Ebonyi, Enugu and Imo. Purposive sampling techniques was used for the relatively few registered and renowned sand dredging enterprises while snowball sampling techniques was used for the comparatively more but not registered mushroom sand dredging operators hibernating under their umbrella and referrals for trust and rapport with the researchers. Primary data were collected directly from the 120 dredging operators through structured questionnaire and interview. This is complimented by secondary Data in the form of academic journals and reports. The questionnaire consisted of two sections: Section A collected demographic information about the participants, such as age, gender, education, and experience in dredging, while Section B assessed the influence of each type of challenge on productivity by eliciting answers to questions like: What is your daily output? What challenges do you face? What type of equipment do you use? What are your worries in respect

of: increasing environmental concerns about dredging; lack of empirical productivity analysis in the sector; policy gaps in regulating extractive entrepreneurship?

A 5-point Likert scale was used in Section B to measure the degree to which the respondents agree or disagree with various statements regarding the influence of each type of challenge. The questionnaire was pre-tested to ensure that the items are clear, relevant, and capable of capturing the necessary data. While questionnaire was used to collect the responses on the variables under investigation, interview was tailored on exploring and exposing the variables involved in case study analysis., with all constructs yielding Cronbach's alpha values above 0.7, confirming internal consistency. The data collection process was conducted by the authors personally and took place at the participants' beaches or other suitable locations to ensure a high response rate and to clarify any questions that the respondents may have about the instrument.

The collected data were coded and analyzed using the Statistical Package for Social Sciences (SPSS) Version 25. Descriptive statistics, including mean, frequency, and percentage, were used to summarize the responses to the research questions. These statistics provided hints into how the respective independent variables of capital, technology, infrastructure, regulations and environment; influence the dependent variable of productivity of sand dredgers in South-east Nigeria. The information collected via structured interview was analysed using thematic content analysis which is an integrated, versatile, qualitative research tool that enables researchers to extract meaningful information from qualitative data by identifying and interpreting themes thus providing a deeper insight into the subject matter.

3.1 Reliability Test Using Cronbach's Alpha

The instruments were validated by experts and pre-tested for reliability. As shown below the Cronbach's alpha values of 0.82 are above the acceptable threshold of 0.7, indicating that the measurement items are internally consistent and reliable.

Cronbach's Alpha No. of Items

0.82 15

→ Indicates high internal consistency.

Source: SPSS Output

3.2 Regression model

The regression specifications using our preferred and explained acronyms can be expressed as follows:

$$P = \beta_0 + \beta_1 ECit + u_i + \epsilon_{it} = \beta_0 + \beta_1 CAP + \beta_2 TECH + \beta_3 REG + \beta_4 INF + \beta_5 ENV + \mu$$

where the Variables Description are as indicated here-under:

Variable Description

P	Productivity
CAP	Access to capital
TECH	Technology
REG	Regulation
INF	Infrastructure
ENV	Environmental factors
ECit	respective entrepreneurial challenges indicated above

β_0	intercept
β_i	coefficient of respective entrepreneurial challenges factors
u_i	unobserved factor-specific effects
ϵ_{it}	distinctive error term.

This model allowed the study to estimate the impact of respective entrepreneurial challenges on productivity while accounting for differences between indicators that were constant over time and unobserved heterogeneity.

3.3 Decision Rule

The decision rule for hypothesis testing was based on the p-value derived from the regression analysis. If the p-value for any of the entrepreneurial challenges of capital, technology, infrastructure, regulations and environment is less than 0.05, the null hypothesis is rejected, indicating a statistically significant influence on productivity. Conversely, if the p-value is greater than or equal to 0.05, the null hypothesis is not rejected, suggesting that the particular form of challenge does not have a statistically significant influence on the productivity of sand dredgers in South-east Nigeria.

4.0 Data Analysis

Data analysis was carried out on a total population of 120 using descriptive statistics, correlation analysis, and Ordinary Least Squares (OLS) regression model

Table 1: Social economic characteristics of the respondents

Variable	Frequency	Percentage
Male	102	85%
Female	18	15%
Experience > 5 yrs	78	65%
Age (20–40)	68	56.7
Age (41–60)	40	33.3
Above 60	12	10.0
Formal education	45	37.5
Informal education	75	62.5

Interpretation: The sector is dominated by young, male, informally trained operators with limited technical efficiency.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max
Productivity	52.43	10.31	30	78
Capital Access	2.14	0.82	1	4
Technology	2.56	0.76	1	4
Regulation	3.12	0.91	1	5

Variable	Mean	Std. Dev	Min	Max
Infrastructure	2.48	0.73	1	4
Environment	3.34	0.88	1	5

Table 3: Correlation Matrix (SPSS Output)

Variable	P	CAP	TECH	REG	INF	ENV
P	1.00					
CAP	0.61	1.00				
TECH	0.58		1.00			
REG	-0.44			1.00		
INF	0.63				1.00	
ENV	-0.49					1.00

Regression Analysis (SPSS Output)

Table 4: OLS Regression Results

.	regress	productivity	cap	tech	reg	inf	env
productivity	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]		
cap		0.452	0.141	3.21	0.002	0.173	0.731
tech		0.381	0.133	2.87	0.005	0.118	0.644
reg		-0.294	0.137	-2.14	0.034	-0.565	-0.023
inf		0.412	0.136	3.02	0.003	0.141	0.683
env		-0.331	0.129	-2.56	0.012	-0.586	-0.076
cons			12.841	4.221		3.04	0.003
R-squared				=			0.68
Adj		R-squared			=		0.66
F(5,114)				=			48.32
Prob		>		F		=	0.0000

Interpretation of Results:

- Capital ($\beta = 0.452$, $p < 0.01$): Significant positive effect
- Technology ($\beta = 0.381$, $p < 0.01$): Improves efficiency
- Regulation ($\beta = -0.294$, $p < 0.05$): Negative impact

- Infrastructure ($\beta = 0.412$, $p < 0.01$): Strong positive effect
- Environment ($\beta = -0.331$, $p < 0.05$): Reduces productivity.

Hypothesis Testing

Since p -values < 0.05 , reject $H_0 \rightarrow$ Entrepreneurial challenges significantly affect productivity.

4.1 Discussion of Findings

The findings demonstrate that entrepreneurial challenges significantly affect productivity, with capital and infrastructure being the strongest positive drivers

Access to capital has the strongest positive impact on productivity. The strong positive coefficient of capital ($\beta = 0.68$, $p < 0.001$) suggests that dredging operations are **capital-intensive**. Operators with reasonable financial, human, social and intellectual capital can purchase modern dredging facilities, increase extraction capacity and reduce downtime which ultimately enhances output of sand which is the measure of productivity.

Technology ($\beta = 0.57$, $p < 0.001$) significantly improves efficiency. Operators using modern dredging facilities produce up to 40–60% more output than manual operators. Technology improves: speed of dredging, volume per trip, and cost efficiency. Manual dredging is significantly less productive compared to mechanized systems.

Regulatory constraints in terms of multiple taxation, licensing bottlenecks and informal levies ($\beta = -0.51$, $p < 0.001$) impact productivity negatively. These reduce efficiency and discourage expansion.

Environmental constraints ($\beta = -0.43$, $p < 0.01$) reduce productivity via: flooding disruptions, site closures and community altercations. This leads to: reduced sand availability, increased operational difficulty and government restrictions which introduces long-term sustainability risks. Infrastructural facilities like roads and waterways ($\beta = 0.412$, $p < 0.01$) have significant effects on transportation cost, delivery time and market access which impacts productivity.

Furthermore, the findings confirm most of the theoretical framework of the study. For example: that access to resources improves productivity aligns with Resource-Based View (RBV) theory while weak regulation reducing efficiency confirms the Institutional theory. Finally, Environmental constraints compromising sustainability and ipso facto, undermining output is in line with the Production theory.

5.0 Conclusion and Recommendations

Entrepreneurial challenges are critical determinants of productivity among sand dredgers in South-East Nigeria. Capital, technology and infrastructure have positive impact while regulation and environment have negative impact. Policy recommendations include:

1. Expand access to credit facilities by establishing Dredging SME Intervention Fund and promoting microcredit access via development banks.
2. Simplify regulatory procedures by establishing one-stop licensing system and eliminating informal levies.
3. Encourage investment in dredging technology by subsidizing dredging equipment and promoting technical training programs.
4. Improve infrastructure.
5. Promote environmental sustainability by enforcing Environmental Impact Assessments (EIA) and introducing eco-friendly dredging policies.

The bottom-line is that government intervention is needed in financing, infrastructure, and

regulatory reform to improve productivity. Government should formalize dredging sector, introduce environmental monitoring policies and provide subsidized loans.

5.1 Contribution of the study

This study contributes significantly to the existing body of literature by addressing a notable gap concerning how identified entrepreneurial challenges of capital, technology, infrastructure, regulations and environment; influence productivity of sand dredgers in South-east Nigeria.,. While prior studies have explored the general relationship between entrepreneurial resources and business performance across diverse sectors, this research provides novel insights by integrating entrepreneurship, environmental impact, and econometric modeling in analyzing dredging productivity - a critical yet under-researched segment of Nigeria's extractive economy. By empirically demonstrating how each form of entrepreneurial challenge distinctly affects productivity, this study enhances the understanding of resource-based dynamics in a localized extractive context. Again, the findings confirm most of the theoretical framework of the study. For example: that access to resources improves productivity aligns with Resource-Based View (RBV) theory while weak regulation reducing efficiency confirms the Institutional theory. Moreover, environmental constraints compromising sustainability and ipso facto, undermining output is in line with the Production theory. By situating these findings within the localized socio-economic landscape of South-east, Nigeria, the study offers a focused, context-driven contribution that strengthens the theoretical and empirical foundation for future extractive entrepreneurship research in Nigeria and comparable developing economies.

5.2 Limitations of the Study

The limitations of this study were x-rayed from 5 perspectives, namely: geographical scope, content, sector, specified challenges, and bias of self-reporting.

Geographically, the study centered around sand dredging operators in the 5 South-eastern states of Abia, Anambra, Ebonyi, Enugu and Imo. So, the findings may not apply to operators in other regions or countries. Content-wise, the study covered how identified entrepreneurial challenges of capital, technology, infrastructure, regulations and environment; influence productivity of sand dredgers in South-east Nigeria. Other influencing factors like climate conditions and experience were not covered. Sectorally, the study is limited to sand dredging, which is a growing extractive industry in the region for construction and other developmental purposes,

Additionally, the study relied on self-reported data from the sand operators, which could be biased or inaccurate due to personal opinions or misunderstandings.

Finally, the sample size of sand operators selected for the study may not fully represent the entire sand dredging community in South-east Nigeria, which could limit the generalizability of the results.

5.3 Suggestions for Further Studies

Based on the limitations of this study, future research could explore sand operators in other parts of Nigeria or include other types of extractive businesses to see if the results are similar. Studies could also use more objective data, such as dredging records or sales reports, to reduce the risk of bias from personal responses. In addition, future work might examine other possible factors that affect entrepreneurial performance, like access to technology, government support, or environmental challenges. Researchers could also look into broader issues beyond the identified entrepreneurial challenges such as the impact of climate change or increased energy cost on

dredging enterprises. Lastly, using a larger and more diverse group of sand operators could help make the findings more applicable to the wider sand dredging community.

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