

Application of statistics in the business industry: The perspective of small scale business enterprises in Ghana

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Abstract

The business sector is a crucial component of modern society. It is a planned and clever channel for making money. It covered everyone's efforts in achieving a common economic objective. This study seeks to explore how statistics are used to deliver high-quality goods and challenges small enterprises encounter in using statistics in their daily operations. In the fields of product design, reliability assurance, manufacturing quality improvement, additional manufacturing applications, and product field service, statistics are unquestionably and highly useful. The sample would be chosen using a scientific sampling method. A total of 240 respondents, including 50 small business owners and 190 employees, was interviewed using a well-structured questionnaire. The study's findings show that respondents do not believe that statistics help in the process of producing good products at minimum cost. Findings show that respondents have difficulty of understanding and applying statistical methods. The study recommends that small-scale business operators be extensively sensitized and educated on the significance of statistical application ramifications for their business outcomes.

Keywords: Business industry, strategy, statistics.

1.0 Introduction

In recent years, the global economy has faced unprecedented challenges, with the COVID-19 pandemic and geopolitical conflicts significantly disrupting business operations worldwide (Dorr et al., 2021). These crises have led to decreased business activities and plummeting sales, especially among small-scale enterprises, creating severe liquidity challenges for these businesses (Cowling et al., 2012; Iyer et al., 2014; Lee et al., 2015; McGuinness & Hogan, 2016). The economic downturn has been further exacerbated by the collapse of the interbank market, leaving small businesses vulnerable to liquidity shortages (Cowling et al., 2020). Small businesses in emerging markets like Ghana are particularly affected due to their limited financial reserves and reliance on internally generated funds (Akpan et al., 2020). The situation is complicated by the devaluation of the Ghanaian cedi against the dollar and market volatility, resulting in significant challenges for these enterprises. Moreover, internal issues exacerbate the problem. Many small business owners lack awareness of the benefits of statistics in effective decision-making (Mutalimov et al., 2021). As a result, they neglect systematic record-keeping of crucial business data, hindering their ability to gauge performance indicators accurately. Despite these challenges, the strategic application of statistics can empower small businesses, enabling them to adapt, survive, and thrive in competitive markets. Statistics offer transformative insights, facilitating the re-engineering of growth strategies and operational efficiencies. Through meticulous data analysis, small-scale entrepreneurs can optimize their profits and losses, track business development, and ensure survival in the face of adversity.

This study aims to bridge this gap by evaluating the utilization of statistics by small enterprises to provide high-quality goods and services. Additionally, it seeks to ascertain the challenges small enterprises encounter in using statistics in their daily operations, as well as the factors influencing

the non-application of statistical methods in small enterprises. This study aims to shed light on the transformative potential of statistics for small businesses in Ghana, offering insights that can empower these enterprises to thrive in challenging economic climates and contribute meaningfully to the nation's economic development.

Methodology

Study area

Sagnarigu Municipal District is one of the sixteen districts in Ghana's Northern Region (Gyebi, 2013; Duodu, 2015). It was formerly a part of the then-larger Tamale Municipal District, which was formed in 1988 from the former West Dagomba District Council, until a small northern portion of the district was split off to create Sagnarigu District on June 24, 2012. As a result, the remaining portion has been retained as Tamale Metropolitan District (to which it was elevated to metropolitan district assembly status in August 2004). On the other hand, it was promoted to municipal district assembly level on March 15, 2018, becoming Sagnarigu Municipal District. The municipality is located in the northwest part of the Northern Region and has Sagnarigu as its capital city (which is also the capital city of the Northern Region). The population of the municipality, according to the 2021 population and housing census, stands at 341,711, with 170,199 males and 171,512 females. The district has a household population of 146,291 with a total of 23,447 households. The average household size in the district is 6.3 people per household. Children constitute the largest proportion of the household composition, accounting for 43.3 percent. Spouses form about 9.9 percent. Extended (heads, spouse(s), children, and the head's relatives) households constitute 50.5 percent of the total number of households in the district. Sagnarigu serves as the municipality's capital and is situated in the Northern Region's northwest (which is also the capital city of the Northern Region). The 2021 population and housing census puts the municipality's population at

341,711, with 170,199 men and 171,512 women. There are 23,447 households in the district, with 146,291 people living in them. In the district, there are 6.3 individuals per family on average. With 43.3 percent of the total home population, children make up the largest portion. About 9.9% of people are married couples. Extended households, which include the head, spouse(s), children, and the head's relatives, make up 50.5 percent of all the households in the district.



Research Design

The study was a cross-sectional survey since it involved data collection from respondents at one point in time.

Sampling Technique

Systematic sampling was employed to choose participants for this study. Systematic sampling makes sure that each unit has an equal chance of being selected for the sample. In systematic sampling, each k th unit is chosen, starting with the unit that corresponds to the random number r

(also known as the random start), which is chosen at random from 1 to k, where k is an integer such that $k = N/n$.

Sample size

A total of 240 respondents, including 50 small business owners and 190 employees, were interviewed using a well-structured questionnaire.

Sample Size Determination

The sample size was determined on the small scale business operators within Sagnarigu Municipal District. To determine the sample size for large populations, we use the Cochran approximation which is stated as below:

$$n = \frac{n_o}{1 + \frac{n_o}{N}}$$

$$n_o = \frac{Z_{\alpha/2}^2 PQ}{d^2}$$

n= sample size

N=Population Size

p = proportion of businessmen

q = proportion of businesswomen

Z= the value that specifies the level of confidence usually is 95%, for surveys in which case z is set to 1.96

d= the degree of accuracy = 0.05

Substituting the above figures into the mentioned formula:

$$n_o = \frac{(1.96)^2(0.7)(0.3)}{(0.05)^2} = 323$$

$$n = \frac{323}{1 + \frac{323}{940}} = 240$$

Study Population

The study population was business men and women in the Sagnarigu district. The study unit composed of men and woman of age 20 – 49 years who have established small scale business in the Sagnarigu district for at least one year.

Source of Data

The research study used a primary data collection approach. Structured closed-ended and open-ended questionnaires were utilized to gather primary data in line with the research objectives. This type of data collecting entails researchers making sure that the questions are written for respondents in a way that is simple to grasp and elicits complete and pertinent information (Kumar, 2011). Survey participants were given quantitative questionnaires to complete in order to gather the study's main data.

Data analysis method

The Statistical Package for Social Sciences (SPSS) version 23 and Microsoft Excel (2016) were employed as statistical tools. Data collected from respondents was cleaned and validated by cross-referencing it with hard copy questionnaires before being entered into Microsoft Excel 2016 and imported into SPSS statistical software. SPSS statistical software was used to analyze the data. The data analysis specifically employed in analyzing this research uses both descriptive and inferential statistics. The study adopted the use of frequency distribution and central tendency measurement techniques (mean and standard deviations) in analyzing the quantitative data obtained in the survey.

A 5-point ranking system using the Relative Importance Index (RII) was utilized to ascertain challenges of using statistics in the business industry. The RII five-point scale, ranging from 1(Strongly Disagree) to 5 (Strongly Agree) was adopted for each factor as follows;

$$RII = \frac{\sum W}{A * N}$$

W = the weight given to each factor by the respondent and ranges from 1 to 5

A = the highest weight5

N= the total number of respondents.

Artificial Neural Networks

Computer architectures that are designed after the brain are known as artificial neural networks (ANNs). It is composed of several "neurons" (or "nodes") arranged in layers (Maind et al., 2014).

The connections that have been built between the various processing units and the pertinent features inside the neural network architecture are what drive the global behavior of these neurons.

Weighting is applied to every link connecting the neurons in successive levels. The intensity of the link between the i^{th} neuron in a layer and a j^{th} neuron in the subsequent layer of the network is represented by the weight w_{ij} . One "input" layer, one or more "hidden" layers, and one "output" layer make up the framework of a neural network.

The weighted links that are made between the input layer and the first hidden layer in an ANN allow for the transformation of data from the neurons in the input layer to the neurons in the first

hidden layer. In this instance, the layer's data is handled mathematically.

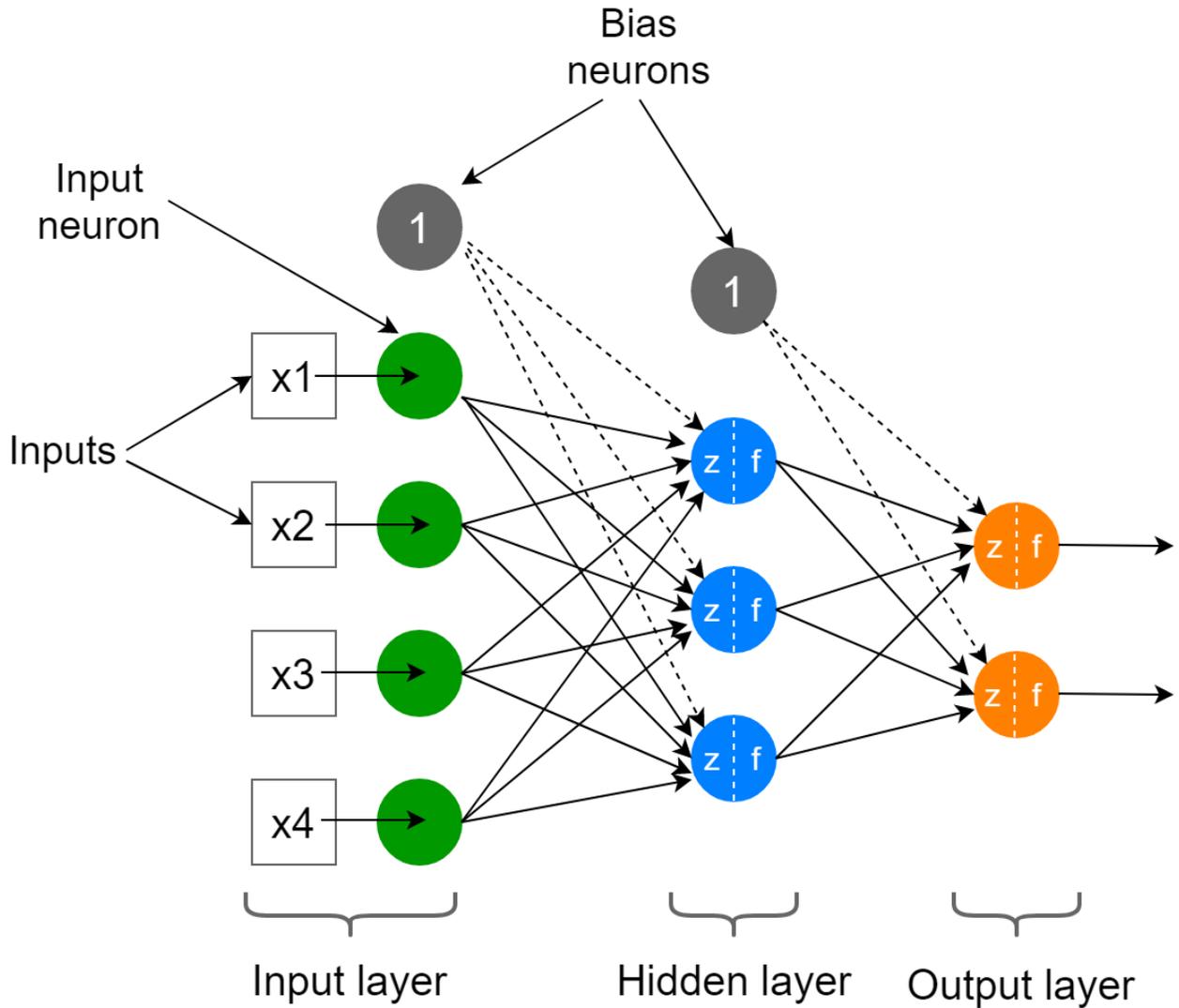


Figure 1: The general structure of Artificial Neural Network with one Hidden Layers

Results

Demographic Characteristics of Respondents

Table 1 presents the socio-demographic characteristics of the 240 respondents employed in this current study. Table 1 shows that the majority of respondents (40.0%) are between the ages of 26 and 32, with only a few (3.7%) between the ages of 19 and 25. The majority (72.9%) of the respondents are males, whereas their female counterparts constitute 27.1%. More than half (79.2%) of the respondents are employees, with a few (20.8%) of them being employers. Most (60.4%) of the respondents operate their businesses within 4-6 days weekly. A large number of respondents (64.6%) have their businesses situated in Sanarigu Kukuo, while few (3.8%) have theirs in Kpalsi. The majority (61.3%) of the respondents have been running their businesses for 6–8 years. A good number (87.5%) of the respondents keep records of their goods and services.

Table 1: Socio-demographic Characteristics of Respondents.

Demographic Characteristics	Frequency (n=240)	Percentage (%)
Age		
19-25 years	9	3.7
26-32 years	96	40.0
33-39 years	75	31.3
40 and above	60	25.0
Total	240	100
Gender		
Male	175	72.9
Female	65	27.1
Total	240	100
Position		

Employer	50	20.8
Employee	190	79.2
Total	240	100
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Days of operation		
1-3 days	10	4.2
4- 6 days	145	60.4
All days in a week	85	35.4
Total	240	100
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Community		
<u>Kpalsi</u>	9	3.8
Sanarigu Kuku	155	64.6
Choggu	76	31.7
Total	240	100
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Years in business		
1-3 years	10	4.2
6- 8years	147	61.3
9 years and above	64	26.7
Total	240	100
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Records keeping		
Yes	210	87.5
No	30	12.5
Total	240	100
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Source: Field Data (2023).

Table 2: Use of statistics by industry players to provide high-quality goods and services

	Yes (%)	No (%)
Statistics helps in the process of producing good product at minimum cost	20.0	80.0
Statistical quality control procedures ensure that the production process produces the desired product	30.0	70.0
Statistics plays a key role in manufacturing processes to ensure less defective products	25.0	75.0
Statistics is the only area that can assist to produce any product at standard quality	40.0	60.0

Source: Fieldwork, 2023

According to Table 2, a good number (80%) of the respondents expressed an opposing view that statistics do not help in the process of producing a good product at minimum cost, as opposed to a few (20%) who thought otherwise. More than half (70%) of the participants refuse to accept that statistical quality control procedures ensure that the production process produces the desired product, as opposed to a few (30%) who indicated otherwise. The majority (75%) of the participants opposed the idea that statistics play a key role in manufacturing processes to ensure fewer defective products. Finally, the majority (60%) refuse to accept the statement that statistics is the only area that can assist in producing any product of standard quality.

Table 3: Ranking of the criticalities of challenges of using statistics in the business industry

Challenges	SD	D	N	A	SA	W	RII	RANK
Businesses face the challenge of scaling data analysis	0	0	89	78	73	944	0.79	2 nd
Data Analysis skills challenges	15	40	54	100	31	812	0.68	4 th
Statistical methods are difficult to understand and apply	0	41	20	79	100	958	0.80	1 st
There are errors in manual data entry	70	89	30	16	35	577	0.48	5 th
Statistics does not have an impact on business results	8	60	32	50	90	874	0.73	3 rd

Source: Field Survey, 2023

The information examines the challenges of using statistics in the business industry. The specific challenges in order of RII ranking include: statistical methods are difficult to understand and apply (RII = 0.80); businesses face the challenge of scaling data analysis (RII = 0.79); statistics does not have an impact on business results (RII = 0.73); data analysis skills challenges (RII = 0.68); and errors in manual data entry (RII = 0.48). This implies that the difficulty of understanding and applying statistical methods is one of the major challenges of using statistics in the business industry.

Table 4: Artificial Neural Network (ANN) analysis of factors influencing non-application of statistical methods in small enterprises

Independent Variable Importance		
	Importance	Normalized Importance
Inadequate knowledge	.202	92.2%
lack of expert	.408	99.3%
Financial constraint	.517	100%
Type of product	.219	95.2%

No effect .155 70.8%

Results from table 4 and the diagram below show the factors influencing non-application of statistical methods in small enterprises in the order of importance. Lack of financial resources to hire statistics expertise emerged the most critical factor contributing to why small enterprise operators do not make use of statistics in their transactions(good and services). This is followed by lack of employee with data-driven interest (expert) and then the nature of the product / service.

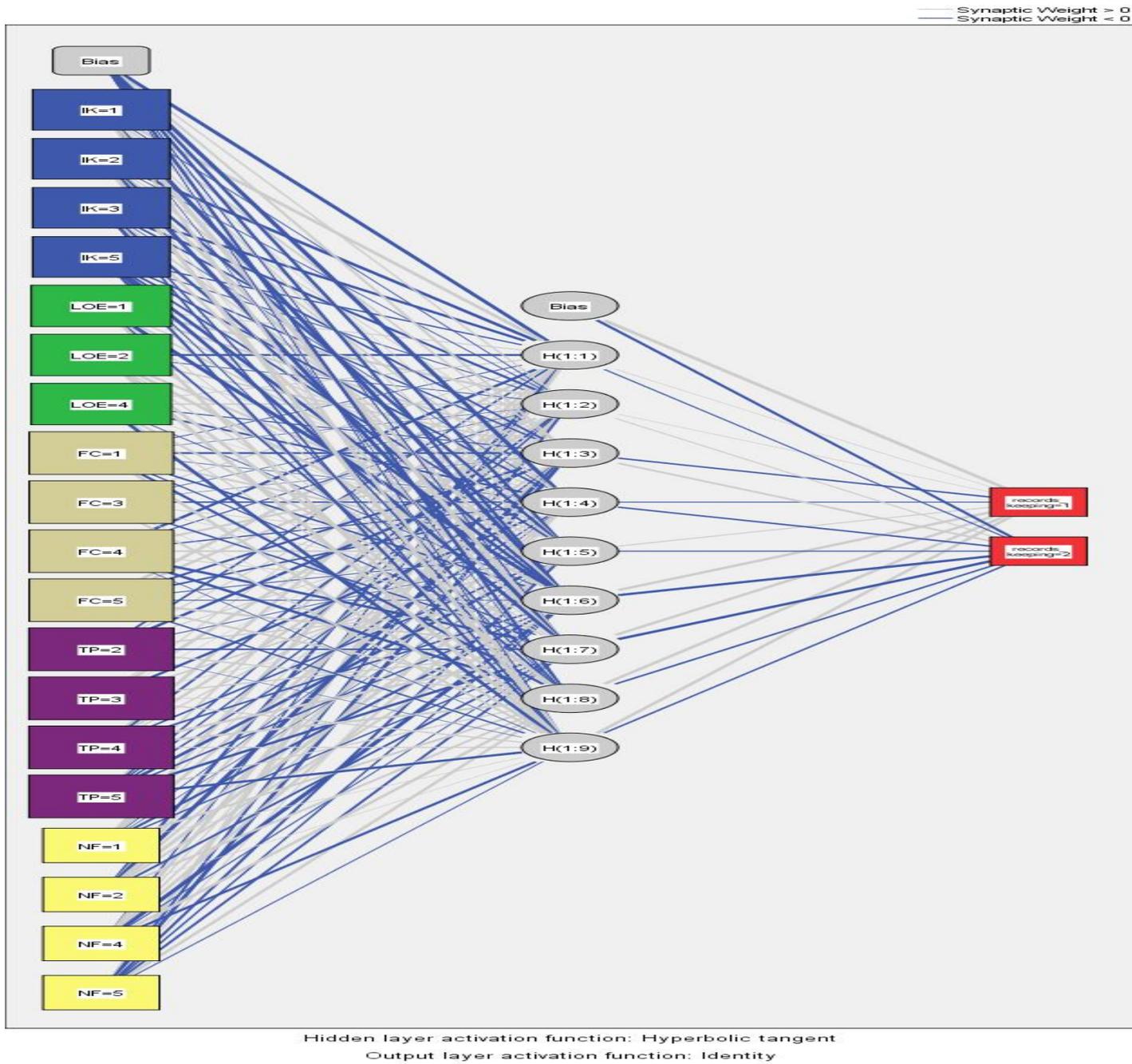


Figure 2: The Structure of Artificial Neural Network with one Hidden Layers

Conclusion

The study combined both descriptive analysis and artificial neural networks to evaluate how statistics are utilized by industry players to provide high-quality goods and services and how frequently small-scale business owners employ basic statistics in the day-to-day operation of their

businesses. A large proportion of the respondents have been in small-scale businesses for 6–8 years and keep records of their goods and services. From the study, the respondents do not believe that statistics help in the process of producing good products at minimum cost, that statistical quality control procedures ensure that the production process produces the desired product, that statistics play a key role in manufacturing processes to ensure less defective products, or that statistics is the only area that can assist in producing any product at standard quality. The difficulty of understanding and applying statistical methods is what the respondents perceive to be a challenge should they apply it to their operations. The major factor contributing to why small enterprise operators do not make use of statistics in their transactions (goods and services) is a lack of financial resources to hire statistics experts.

Recommendation

Based on the results and conclusions thereof, the study recommends the following:

1. The study recommends that small-scale business operators be extensively sensitized and educated on the significance of statistical application ramifications for their business outcomes.
2. The study also recommends further studies on specific aspects of the business industry that need apt application of statistics for increased productivity.

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