

Adoption of Advanced Manufacturing Technology In Selected Manufacturing Firms In Nigeria

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ABSTRACT: *The study examines the effect of advanced manufacturing technology adoption in selected manufacturing firms in Nigeria. Using a survey research design, primary data were collected using a structured five point likert scale questionnaire. Result from SPSS 16.0 output reveals that although AMT adoption has led to labour cost savings, it has not significantly improved the profitability of the firm. We therefore recommend that more investment be made on the training and development of skilled personnel to ensure efficiency in the installation, repairs and functioning of advanced technology.*

KEYWORDS: *Advance manufacturing technology, labour, machine, adopted etc*

I. INTRODUCTION

Advanced Manufacturing Technology (AMT) is the latest system of production by manufacturing companies all over the world. It represents variety of modern computer-based technologies committed to the improvement of manufacturing operations and enhancement of business organizations competitiveness in the market. Due to global competition, the adoption of Advanced Manufacturing Technology is becoming necessary for business operators all over the world. Advanced Manufacturing Technology can be described as programmed machines that can produce a variety of products without time lost, damages and high-quality products at any given time. Advanced Manufacturing Technology (AMT) is a group of integrated hardware-based and software-based technologies, which if properly implemented, monitored and evaluated, will lead to improving the efficiency and effectiveness of the adopting firm in manufacturing a product or providing a service (Baldwin, Sabourin & Rafiquzzaman, 1996). AMT is also defined as computer controlled or micro-electronics-based equipment used in the design, manufacture or handling of a product. AMT is a modern method of production incorporating highly automated and sophisticated computerized design and operational systems. AMT is the use of innovative technology to improve products or processes. AMT is a family of activities that depend on the use and coordination of information, automation, computation, software, sensing, and networking's and or make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences (<https://enm.wikipedia.org>).

Advanced Manufacturing is not limited to emerging technologies; rather, it is composed of efficient, productive, highly integrated, highly controlled processes across a spectrum of globally competitive. For advanced manufacturing to accelerate and thrive in Nigeria, it will require the active participation of communities, educators, workers and businesses, as well as Federal, State and Local government (www.naseni.org). The objective of this paper is to examine the adoption of Advanced Manufacturing Technology in Nigeria using some selected Manufacturing companies in Edo State as a case study.

II. STATEMENT OF THE RESEARCH PROBLEM

Advanced Manufacturing Technology is mainly computer-based systems, which provide adopting firms with the potential to improve manufacturing operations greatly. It is generally expected that the resultant improvement in operational performance will enhance the firm's ability to reap the underlying marketing, strategic and business benefits for which the systems were adopted. It is a family of technologies that include computer-aided design and engineering systems, materials resource planning systems, automated materials handling systems, robotic, computer-controlled machines, flexible manufacturing system, electronic data interchange and computer-integrated manufacturing system (Gunawardana, 2006). Nonetheless, there is limited previous researches which address the issue of adoption of Advanced Manufacturing Technology. The limited prior research concerning adoption of Advanced Manufacturing Technology, together with the growing importance of AMT in business organizations and the need to replicate previous studies done in developed nations in Nigeria provided the primary motivation for this study. Previous studies (Bronwich & Bhimani, 1994, Tchijor, 1992, Tani, 1992, Gunawardana,

2006, Libby & Waterhouse, 1996, Iloque & Hopper, 1997) have recommended the need for future research on adoption of Advanced Manufacturing Technology. With the industrialization of many countries and increased in the world population, the need to have a comprehensive knowledge of the AMT provide the impetus and focus for this study as insufficient attention has not be given to study the adoption of Advanced Manufacturing Technology in many countries. This view is supported by Astebro (1992) who noted that academic researchers have tended to focus on the traditional manufacturing processes. To fill this knowledge gap, answers will be provided to the following research questions:

- (i) What is the relationship between labour costs saving and the adoption of Advanced Manufacturing Technology
- (ii) What is the relationship between increased profitability and the adoption of Advanced Manufacturing Technology
- (iii) What is the relationship between lack of technical skills and the adoption of Advanced Manufacturing Technology

III. RESEARCH OBJECTIVES

The broad objective of the study is to examine the adoption of Advanced Manufacturing Technology. However, the specific objectives are to:

- (i) investigate the relationship between labour costs saving and the adoption of Advanced Manufacturing Technology,
- (ii) examine the relationship between increased profitability and the adoption of Advanced Manufacturing Technology,
- (iii) determine the relationship between lack of technical skills and the adoption of Advanced Manufacturing Technology

Hypothesis of the Study

- H₀₁: There is no significant relationship between labour costs saving and adoption of Advanced Manufacturing Technology
- H₀₂: There is no significant relationship between increased profitability and the adoption of Advanced Manufacturing Technology
- H₀₃: There is no significant relationship between lack of technical skills and the adoption of Advanced Manufacturing Technology

The Scope of Study : This study measures the adoption of Advanced Manufacturing Technology in Nigeria using manufacturing companies as a case study. The study will cover selected manufacturing companies in Edo State. The sample of this study is limited to five selected manufacturing companies in Edo State.

IV. RESEARCH DESIGN

The research design that was adopted for this study is the exploratory research design. The exploratory design advocated by Petty (1991) relies on observing phenomena in their natural setting and deriving theories that fit the analysis of the data. It is employed when the researcher is concerned with surveying responses from a sample of the population without any control on the elements of the sample and as such it is used extensively to collect information on numerous subjects of research (Nachmias & Nachmias, 2009).

Population and sample of the study :The population for this study includes management staff of the selected manufacturing companies in Edo State. In this study, the management staff of five manufacturing companies in Edo State formed the case-study. These are, Guinness Plc, Coca-cola company, Seven-up Bottling Company, IK Pure Water Company and Muoka Foam Company. All of these manufacturing companies are located in Edo State. The choice of sample is prompted by convenience and proximity.

Sources of Data: Primary data were used for the purpose of this research. Basically, primary data sources are those collected or sourced directly by the researcher in the course of the research. Sixty (60) questionnaires were distributed to respondents to elicit the necessary primary data.

Research Instrument : This research work employed the use of close ended questions (Structured questionnaire) in eliciting the required data needed to test the formulated hypothesis.

The five point Likert Scale was utilized in developing the questionnaire. The research instrument comprised of few demographic questions and other secondary questions to elicit information on adoption of Advanced Manufacturing Technology. Validity and reliability tests were carried out on the questionnaire, of the sixty (60) questionnaires administered; fifty (50) valid questionnaires were retrieved.

V. DATA ANALYSIS METHOD

In this study, the Spearman Rank Order Correlation technique was adopted as the data analysis method. The Pearson Product Moment Correlation coefficients can only take on values from -1 to +1. The sign at the front indicates whether there is a positive correlation (as one variable increases, so too does the other) or a negative correlation (as one variable increases, the other decreases). The size of the absolute value (ignoring the sign) provides an indication of the strength of the relationship. A perfect correlation of 1 or -1 indicates that the value of one variable can be determined exactly by knowing the value on the other variable. On the other hand, a correlation of 0 indicates no relationship between the two variables. The Statistical Package For Social Science (SPSS) 16.0 will be used in carrying out the analysis.

Description of variables

Labour costs saving: This is the reduction of wages and salaries expenses due to the use of AMT.

Increased profitability: This show the level of success in adopting AMT

Lack of technical skill: This represents the ability of the manufacturing firm to adopt AMT.

Data Presentation and Analyses: On the bases of gender, 48 % of respondents are female and 52 % are male. On the age distribution of respondents, 10%, 30%, 44%, 12% and 2% are less than 20 years, 20-30 years, 31- 40 years, 41-5- years and over 50 years.

For Years of work experience, 3% has worked for less than 3 years, 40%, for 3-6 years, 44% for 7-10% and 10% for over 10 years.

Highest academic qualification 2%, 24%, 64%, 10% has SSCE, OND/NCE, BSC/HND and Masters as their highest academic qualification.

50% of respondents were from the production department, 10% administrative staff, 8% marketing and distribution staff, and 30% research and development staff.

Labour cost savings		SA	A	UD	D	SD	Total responses
6	AMT adoption has reduced labour cost in Nigerian manufacturing firms	7	24	11	7	1	
7	The cost of purchasing and maintaining AMT is lesser than the cost of labour	0	5	7	29	9	
8	AMT adoption has significantly replace labour in Nigeria manufacturing firms	4	29	6	11	0	
9	The cost of purchase and maintenance of Advanced technology is less than total labour cost	1	2	8	22	17	

Increased profitability		SA	A	UD	D	SD	Total responses
10	The level of profitability has been satisfactory in recent times	7	21	5	14	3	50
11	The adoption of AMT has improved the profitability of firms in Nigeria	13	29	4	3	1	50
12	The profitability of manufacturing firms significantly depends on the use of AMT	13	22	11	4	0	50
Lack of technical skills		SA	A	UD	D	SD	
13	There is lack of requisite skills for Advance manufacturing technology in Nigerian Manufacturing firms.	5	17	10	16	2	50
14	The repairs of automated system of manufacturing is readily available in Nigerian firms	6	20	7	17	0	50
15	Manufacturing technology are continually upgraded to reflect current realities	6	24	12	7	1	50
Advanced Manufacturing Technology		SA	A	UD	D	SD	
16	Automated production system has been very effective in Nigerian manufacturing companies	7	28	10	5	0	50
17	Advance technology has highly been incorporated in the production system of Nigeria Manufacturing firms.	10	29	3	9	0	50
18	The challenges of Advance technology in Nigerian manufacturing companies has limited its use and effectiveness	10	22	1	11	6	50

Presentation of Results and Discussion of Findings : The discussion of the result is based on the Pearson Product Moment correlation. The result is presented and discussed below;

Correlations

		Reduction in labour cost	The level of profitability	Lack of requisite skills	Adoption of advanced manufacturing technology
Reduction in labour cost	Pearson Correlation	1	.058	-.052	.521**
	Sig. (2-tailed)		.690	.720	.000
	N	50	50	50	50
The level of profitability	Pearson Correlation	.058	1	-.393**	-.351*
	Sig. (2-tailed)	.690		.005	.012
	N	50	50	50	50
Lack of requisite skills	Pearson Correlation	-.052	-.393**	1	-.235
	Sig. (2-tailed)	.720	.005		.100
	N	50	50	50	50
Adoption of advanced manufacturing technology	Pearson Correlation	.521**	-.351*	-.235	1
	Sig. (2-tailed)	.000	.012	.100	
	N	50	50	50	50

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Source: SPSS 16.0 Output

Hypotheses Testing

HO1: Labour costs saving and the adoption of Advanced Manufacturing Technology: The result reveals that labour cost savings has a weak positive but significant relationship (0.521) with the adoption of advanced manufacturing technology in selected Nigerian manufacturing firms. Given the statistically significant criterion ($.000 < 0.05$), we accept the null hypothesis (H_1) that there is no significant relationship between Labour cost savings and advanced manufacturing technology adoption in selected manufacturing company.

HO2: Profitability and the adoption of Advanced Manufacturing Technology: The results show that Profit ability has a weak (-0.351) negative insignificant relationship on the adoption of advanced manufacturing technology in selected Nigerian manufacturing firms. Given the statistically significant criterion ($0.012 < 0.05$), we accept the null hypothesis (H_2) that there is no significant relationship between profitability and adoption of advanced manufacturing technology in selected Nigerian manufacturing firms.

HO3: Lack of technical skills and the adoption of Advanced Manufacturing Technology: The results show that the lack of technical skills has a weak (-0.235) negative insignificant relationship on the adoption of advanced manufacturing technology in selected Nigerian manufacturing firms. Given the statistically insignificant criterion ($0.100 > 0.05$), we reject the null hypothesis (H_3) that there is no significant relationship between the lack of technical skills and the adoption of advanced manufacturing technology in selected Nigerian manufacturing firms.

Summary of Findings : The findings from the study show that the adoption of advanced manufacturing technology has resulted in labour cost reduction but has not resulted in overall cost reduction in selected Nigerian manufacturing firms. The adoption of advanced manufacturing technology has not significantly influenced the level of profitability in selected manufacturing firms in Nigeria. The lack of technological skill has a significant influence on the success of advanced manufacturing technology in selected manufacturing firms in Nigeria.

VI. CONCLUSION AND RECOMMENDATION

The study examines the effect of advanced manufacturing technology adoption in selected manufacturing firms in Nigeria. Using a survey research design, primary data were collected using a structured five point likert scale questionnaire. Result from SPSS 16.0 output reveals that although AMT adoption has led to labour cost savings, it has not significantly improved the profitability of the firm. This study should be viewed in the light of its

limitations. First the smallness of sample size increases the risk of sampling error thereby limiting its generalization. Our study has implication for management actions.

The use of advanced manufacturing technology should be an aftermath of a benefit cost analyses. Although, the adoption of advanced technology has not significantly improved the profitability of selected manufacturing firms, Investment in the training and development of technological personnel should be improved so as to maximize the gains of advanced technologies.

Further studies is recommended to improve the geographical coverage and increase the sample size.

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