UNIVERSITY OF SOUTHERN QUEENSLAND

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The Role of Product Design, Manufacturing Systems and Environmental Uncertainty in the Nigerian Manufacturing Organizations.

A thesis submitted by

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Abstract

The concept of globalization and technological advancements has created many opportunities as well as threats in the manufacturing sector locally and globally. African countries manufacturing sectors performance are significantly low if compared with the manufacturing sectors of other countries, which is continually linked to multiple internal and external factors. Many research studies were conducted to identify the reasons behind Nigeria's insignificant manufacturing sector economic contribution but very few have adequately addressed the issue at both enterprise and government levels in terms of some specific manufacturing concepts and systems. Hence, this research attempts at identifying barriers to manufacturing performance over the past 25 years in Nigeria, in terms of three selected manufacturing concepts and systems measures - product design; manufacturing systems made up of manufacturing process, strategy and innovation; and environmental uncertainty. Further more, the thesis made a comparative study of Nigerian manufacturing sector with those of China, India and Malaysia, with a view to identifying barriers that are specific to Nigeria's manufacturing sector which hinder its growth and contribution towards the country's economic development.

To accomplish the thesis objectives, the research is focused on answering the central question – to what extent does product design, manufacturing systems and environmental uncertainty impact the performance of Nigerian manufacturing organizations. For this purpose, primary and secondary researches were conducted using mixed methodological approaches that are both quantitative and qualitative in nature. Three–step research process was applied and it is made up of questionnaire survey of 254 manufacturing establishments that employee 50 people and above and has been in existence for at least five years; secondary data analysis which also includes comparative study of Nigerian manufacturing sector with those of China, India and Malaysia; and focus group interview with 10 manufacturing experts.

The research results revealed that the performance of the Nigerian manufacturing sector is significantly low owing to uncertainty in the operating environment. Lack of funds, inadequate infrastructure, less government patronage, non-adaptability to technological advancements, ineffective manufacturing strategy and innovation were also identified as key factors impeding

the sector's growth. The results also revealed huge differences in the performance of the Nigerian manufacturing sector vis-à-vis China, India and Malaysia. The research then made sets of recommendations which include that the Nigerian government should encourage manufacturing investors, develop basic industries, improve infrastructure and implement favourable policies to create a better operating environment. Also it was recommended that manufacturing firms should encourage more research and development, innovations and strategy practices, skills acquisitions from other foreign firms, among other sets of recommendations. It was also suggested that Nigeria should learn more from the patterns of China, India and Malaysia manufacturing sectors with the hope of developing effective and productive manufacturing sector.

Key words: Product design, manufacturing process, innovation, strategy, environmental uncertainty, Africa, Nigeria, China, India and Malaysia

Thesis Contribution to Knowledge

The thesis is aimed at examining the performance of the Nigerian manufacturing sector in terms of Product Design, Manufacturing Systems – Manufacturing Process, Manufacturing Strategy and Manufacturing Innovation - and Environmental Uncertainty. The research is also focused on comparing the performance of Nigerian manufacturing sector with some developing countries such as China, India and Malaysia, in terms of the selected performance measures. The research was conducted with help of a mixed methodological approach which comprised of a secondary analysis of data, statistical survey with 254 manufacturing firms in Nigeria and a focus group interview with 10 experts. Below are the thesis major contributions to new knowledge.

1. The data analysis revealed that inadequate supply of raw materials and energy resources, lack of infrastructural facilities, financial resources, government patronage and skilled workforce, high level of corruption and low salaries and incentives are the major factors impeding the growth and development of Nigerian manufacturing sector. The findings of the statistical survey and the focus group interview had little contradictions with the secondary analysis and agreed that the above mentioned factors are the main limitations faced by the Nigerian manufacturing sector.

2. The research presented an in-depth analysis of the performance of Nigerian manufacturing sector in terms of the selected manufacturing concepts which are used as performance measures, these concepts are product design, manufacturing process, manufacturing strategy and manufacturing innovation. It was found that not much study on these concepts when grouped together has been done. The outcome of the study revealed that the current level of product design, manufacturing process and innovation are low in Nigeria mainly due to non-adaptability to advancements in technology.

3. The results also show that manufacturers in Nigeria need to focus on updating technology which will help them in coming up with innovative ideas in creating new product designs. Again they need to introduce modern tools and techniques within their manufacturing process to compete at the international level. The work also suggested the need for restructuring and reforming the current strategies to capture the attention of new consumers and successfully retain the loyalty of their existing consumers.

4. The results of the research revealed that there is huge gap between the performance of Nigerian manufacturing sector and those of China, India and Malaysia, specifically in terms of the selected performance measures, which was also found missing in the literature. The results revealed that social and economic stability in China, India and Malaysia play an important role in the performance of the manufacturing sectors of these countries which helps them in contributing towards the economic development. China focuses on manufacturing products with innovative and advanced features, with shorter lifecycles and at low prices which has enabled the country to hold a major share in the global manufacturing industry. Adapting to new techniques and modern technology and favourable regulatory reforms were the main factors for improvement in the Indian manufacturing sector. The Malaysian government had allocated high capital and resources to promote the heavy industries which resulted in the economic stability of the country.

5. The study suggested that the Nigerian government should focus on developing the basic infrastructural facilities, encourage foreign investors and implement favourable policies to provide a suitable environment for improving the performance of the Nigerian manufacturing sector. The results also suggested that Nigerian manufacturers should focus on adapting to new technology, improving the skills of the workforce and invest on research and development to become competent in domestic and international market.

6. The mixed methodology selected for conducting this research was rewarding and in summary, the research provided an in depth knowledge about the selected measures and its importance in the success of the manufacturing industry. The research helped in understanding the performance of the manufacturing sectors of Nigeria as well as that of developing countries like China, India and Malaysia. The research also helped in providing the necessary suggestions and recommendation in improving the performance of the Nigerian manufacturing sector. The proposed measures require sufficient financial resources that the sector currently lacks, which calls for further research in identifying different methods of improving the manufacturing sector with the available finances.

Associated Publications

1. Mustapha U. M., Ku H. and Goh S (2010); Literature review of past and present performance of the Nigerian manufacturing sector. *Proceedings of the IMechE, Part B: Journal of Engineering Manufacture.* DOI 10.1243/09544054JEM1818. Online ISSN 2041-2975.

2. Mustapha U. M., Ku H. and Goh S (2009); *Research Design for Investigation of Nigeria Manufacturing Management.* Rough Sets and Knowledge Technology, 4th International Conference, RSKT 2009, Gold Coast, Australia, July 14-16, 2009. Proceedings. Lecture Notes in Computer Science 5589 Springer 2009, ISBN 978-3-642-02961-5.

3. Mustapha U. M., Ku H. and Goh S (2010). The Importance of Product Design in Nigerian Manufacturing Sector. *Competition and Challenge: The journal of global political economy.* Paper under review.

4. Mustapha U. M., Ku H. and Goh S (2010). Are African manufacturing enterprises competitive in terms of manufacturing process? *International Journal of Production Research.* Paper under review.

5. Mustapha U. M., Ku H. and Goh S. (2010). Impacts of Manufacturing Strategy and Innovation in Nigerian Manufacturing Success. Paper has been sent to Proceedings of the Institution of Mechanical Engineers, Part B, *Journal of Engineering Manufacture*. Paper under review.

6. Mustapha U. M., Ku H. and Goh S (2010). Environmental Factors Affecting Nigerian Manufacturing Organizations. *Journal of Engineering and Technology Management.* Paper under review.

7. Mustapha U. M., Ku H. and Goh S (2010). Decline of Manufacturing in Africa: China and India responsible? Or who else. *International Journal of Advanced Manufacturing Technology.* Paper under review.

Certification of Thesis

I certify that the ideas, designs and experimental work, results, analyses and conclusions set out in this thesis are entirely my own effort, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted for assessment in any other course or institution, except where specifically stated.

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ENDORSEMENT

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Acronyms and Abbreviations

ADB	African Development Bank
BPR	Business Process Reengineering
CAD	Computer Aided Design
CAM	Computer-Aided Manufacturing
CBN	Central Bank Nigeria
CEO	Chief Executive Officer
CIM	Computer Integrated Manufacturing
CNC	Computer Numerical Control
CP	Capital Productivity
CPG	Consumer Packaged Goods
EIA	Energy Information Administration
FDI	Foreign Direct Investment
FICCI	Federation of Indian Chambers of Commerce and Industry
FMCG	Fast Moving Consumer Goods
FMS	Flexible Manufacturing Systems
FOF	Factory Of the Future
GDP	Growth Domestic Product
IMF	International Monetary Fund
ISIC	International Standard Industrial Classification
ISO	International Organization for Standardization
JIT	Just-In-Time
MAN	Nigerian Manufacturers Association of Nigerian
MRP	Materials Requirements Planning
NFPEs	Non-Financial Public Enterprises
NGR	Nigeria
NPC	Nigerian Population Commission
OPEC	Organisation of Petroleum Exporting Countries
R&D	Research and Development
SAP	Structural Adjustment Programme

SMEs	Small and Medium Enterprises
TQC	Total Quality Control
TQM	Total Quality Management
UNCTAD	United Nations Conference on Trade and Development.
UNIDO	United Nations Industrial Development Organization (UNIDO),
USA	United States of America
WPR	Wage Productivity Ratio