

Management accounting systems design and company performance in Nigerian manufacturing companies: A contingency theory perspective

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Abstract

This study, aimed at providing information to help address the lingering problem of poor performance of the manufacturing sector in Nigeria, investigated the relationships between the Management accounting systems (MAS) design, company's context and company performance. Adopting the contingency theory framework, the study proposed three contingency variables; perceived environmental uncertainty, technology and decentralization as major influences on the relationship between MAS designs and company performance. The propositions were tested using empirical data collected through a questionnaire survey of chief accounting officers/ management accountants of one hundred and forty-four randomly selected Nigerian manufacturing companies from the Nigerian Stock Exchange listing. Statistical tools used in analysing the data are correlations and moderated regression analyses. The results provided support for the expectation that level of sophistication in MAS design has a positive relationship with performance and that contingency variables constitute significant moderating influences on the relationship in the companies sampled. It is suggested that adopting MAS designs tailored to the specific context of businesses will help improve performance of the Nigerian manufacturing companies.

Key words: MAS designs, manufacturing, company performance, contingency theory, technology, perceived environmental uncertainty, decentralization

1. Introduction

The primary focus of economic planning and management in Nigeria over the years has been the transformation of the economy through industrialisation, however, desired results are yet to be obtained. The Nigerian economy is far from being fully industrialized and the manufacturing sector is yet to take a prominent place in the scheme of things (Ayodele & Falokun, 2003). The country has not been able to shift its export base, from crude oil and agriculture to manufactures. Up to date, on the average, the manufacturing sector's contribution to gross domestic product (GDP) has been unimpressive ranging between 3 to 6 percent since the turn of the millennium. For instance, manufacturing contribution to GDP declined from about 6% in 2000 to 3.91% in 2006 and between 4.03% and 4.17% from 2007 to 2010 (National Bureau of Statistics 2011). The need to increase company level efficiency has been a dominant suggestion offered as the key to reversing this unimpressive performance. As Soderbom and Teal (2002) suggested, a key policy issue the Nigerian government should face is to understand and address the factors that will enable the efficiencies of companies and consequently their competitiveness to increase. Ayodele and Falokun (2003) also suggested the adoption of the combination of suitable management techniques with suitable technology and other resources in addressing the low productivity of the sector.

Management accounting has been suggested as one of such important management techniques that can help ensure efficiency in the use of companies' resources (IFAC, 1998). Traditionally, the main objective of the Management accounting systems (MAS) has been to provide information for costing products and for promoting efficiency in the use of labour and materials (Johnson & Kaplan, 1987). Such traditional MAS adopt practices and techniques such as standard costing and flexible budgeting for cost control, cost allocation and product cost measurements; incremental analysis for decision-making; measurement of profit, contribution and return on investments for performance monitoring; and the full integration of internal cost accumulation systems with the external financial reporting systems (Shillinglaw, 1989).

However, arguments have been advanced that the traditional MAS driven by the procedures and cycle of the organisation's financial reporting systems, produce information that is too late, too aggregated and too distorted to be relevant for managers' planning and control decisions (Johnson and Kaplan 1987). Critics have suggested that these traditional MAS have been unable to support the processes of change and adaptation to the realities of the global economy, in which industries have become less labour intensive, highly automated with greater product variety and higher overhead costs. They argued that the new manufacturing environment requires broad scope information including non-financial information, which are more timely, less aggregated and more reflective of organisation's strategy and goals (Johnson and Kaplan 1987; Kaplan and Norton 1992). The bid to address this shortcoming resulted in the emergence of new MA practices including activity-based costing (ABC) balanced scorecard (BSC) quality costing, target costing, lifecycle costing, (Cooper & Kaplan, 1988; Kaplan & Norton, 1992). These techniques have been offered as improvements to counter the distortions in product cost and performance information provided by the traditional MAS.

Some researchers have however, called for caution in actively pursuing these "new" concepts (Zimmerman, 2003). While some suggested that benefits from traditional MA techniques might indeed be higher than those derived from the newer techniques (Chenhall and Langfield-Smith, 1988) others have argued that the techniques described as new MAS were not really "new" but a "reinventing the wheel" (Jones & Dugdale, 2000, p. 1). Empirical evidence was provided in Lea (1998) indicating that the traditional design of MAS when used properly can perform as well as an ABC system. Askarany (2004) also provided empirical

evidence suggesting that there are no statistically significant differences between the level of satisfaction of adopters and non-adopters of ABC, implying that as with the traditional costing techniques, the more recently developed sophisticated MA practices were not providing benefits universally.

The apparent conflict in the findings and opinions of the proponents and critics of the different MAS designs has stimulated research devoted to examining the functioning of the systems within organisations. Such research has adopted both traditional and emergent theoretical perspectives to offer differing insights into aspects of MA in trying to explain the sources of the discrepancies in the findings (Hoque, 2006).

The traditional perspective views MAS as systems that seek to enhance the economic performance arising from their use by economically ensuring effective and efficient use of resources. One major stream of MAS research within this traditional perspective, in trying to resolve the conflicting views has focused on organisational level of analysis, suggesting that the efficiency of the aspects of MAS is contingent on certain characteristics of the organisation and its environments (Waterhouse & Tiessen, 1978). Such studies largely motivated by early contingency formulations in organisational theory have adopted the contingency theory as basis for their analysis. The contingency theorists, driven by efficiency considerations, have examined the implication of a number of contingent factors, including: the environment, organisational structure and technology (Emmanuel, Otley & Merchant, 1990), strategy and culture (Chenhall, 2006 on MAS designs and their effectiveness. The contingency theory has constituted a dominant paradigm in studies of MAS with a large stand of research providing evidence supporting its propositions (Dent, 1990; Fisher, 1995).

However, there is a paucity of research focused on examining the functioning of MAS in manufacturing companies in Nigeria (Adelegan, 2001) in a bid to provide information for enhancing these companies' performance. The objectives of this study therefore, are to investigate: (1) the relationship between MAS designs adopted by these companies and company performance and (2) the moderating influence of three specific contingency variables on the relationship.

The rest of the paper proceeds as follows; section 2 presents the theoretical framework and hypotheses, section 3 details the methodology, section 4 the results and section five concludes the paper.

2. Theoretical Framework and Hypotheses Development

Management accounting has been suggested as one of those important management techniques, which distinctly adds value, by continuously probing whether resources are used effectively by people and organisations, in creating value for customers and shareholders, or other stakeholders IFAC (1998). Management accounting systems (MAS) are the information systems relied upon to provide information to managers for making decisions that will lead to effective performance. These systems traditionally apply a variety of techniques, including the standard costing of products, absorption costing and budgeting to provide timely and accurate information to managers, which will assist them in controlling costs, measuring and improving productivity and thus ensure the achievement of the business goals (Amey & Egginton, 1973). These accounting systems according to Gordon & Miller (1976), "may be custom-designed to improve poorly functioning organisations, by providing information most relevant to the key organisational problems and opportunities" (p. 68). Based on views expressed in other studies Adelegan (2001) also noted that information produced by the MAS and the way it is used, can support or hinder change in organizations.

Some researchers have challenged the usefulness of traditional design of MAS and linked the poor performance of manufacturing initiatives, using newer and more advanced

technologies, to their continued reliance on the traditional design of MAS that failed to provide appropriate goals, performance measures, or reward systems (Kaplan, 1983; Johnson & Kaplan, 1987). Lawrence and Ratcliffe (1990) also argued that traditional MAS is no longer relevant in the new competitive environment and provided empirical evidence suggesting dissatisfaction among both management accountants and managers, with the MA techniques in use in the manufacturing companies.

These arguments which appear to suggest that improving performance will necessitate the adopting appropriate design of MAS by companies are in line with the contingency theory. The theory, in providing explanation of the functioning of MAS in their organisational context, views the systems as decision facilitating mechanisms, which should be tailored to an organisation's structural, environmental and strategic situations to bring about good organisational performance (Gordon & Narayanan, 1984).

Contingency theory perspective

The contingency theory perspective adopted in the study of MAS took its roots from the contingency theory of organizations which in its simplest form, contends that what constitutes effective management is situational, depending upon the unique characteristics of each circumstance (Woodward, 1980). According to Emmanuel *et al.* (1990), the contingency theory of organisation has generated considerable interest among accounting researchers. Its use in the study of the complex relationship between strategic priorities, organisational design and MAS and their impact on organisational performance has continued to attract the attention of these researchers (Gerdin & Greeve, 2004; Jermias & Gani, 2004). The theory as applied to management accounting (MA) has been described as "a major development of the behavioural MA research" which seeks to define specific aspects of an accounting system's design that are appropriate for different sets of circumstances (Drury, 1992, p. 800). The theory is based on the premise that "there is no universally appropriate accounting system applying equally to all organisations in all circumstances" (Emmanuel *et al.*, 1990, p. 57), implying that as the specific circumstances of an organisation alters, so should the MAS adapt, if they are to remain effective. The suggestion of MA contingency-based studies is thus that the systems facilitate decision-making in organisations and should be designed to fit the organisational and environmental context in which they are used (Gordon & Narayanan, 1984).

Accounting researchers have drawn on the theory, to investigate the influences on the design of MAS. The argument is that, since MAS are a most important information processing mechanism in organisations, they constitute an important aspect of organisational design therefore, contextual factors, which influence organisational structure and management systems in a systematic way, should also influence them (Macintosh, 1981). Contingency studies of MA have offered a variety of suggestions on what specific contingencies should result in particular MAS designs many deriving from theoretical speculations based on the results of work in organisational theory. These studies have attempted to relate the design of MAS to several contextual variables, which have been broadly classified in Jones (1985) into environmental influences and internal variables. Environmental influences are described as those, which occur largely independently of action taken by the organisation, while internal variables are those in respect of which the organisation can exercise more discretion.

Internal variables examined in studies of MAS have included: organisational size, (Bruns & Waterhouse, 1975; Merchant, 1981); technology (Khandwalla, 1977; Macintosh, 1981; Merchant, 1984); strategy (Chenhall, 2006; Govindarajan & Fisher, 1990; Govindarajan & Gupta, 1985; Jermias & Gani, 2004; Simons, 1987); structure (Flamholtz, 1983; Gerdin, 2005; Gordon & Miller, 1976; Gosselin, 1997). The external variables focused have been various conceptualizations of external environment (Ajibolade, Arowomole &

Ojikutu, 2010; Bruns & Waterhouse, 1975; Chenhall & Morris, 1986; Flamholtz, 1983; Gerdin, 2005; Gordon & Narayanan, 1984; Gul, 1991; Gul & Chia, 1994; Haldma & Laats, 2002; Khandwalla, 1972; Merchant, 1984; Macintosh, 1981; Waterhouse & Tiessen, 1978) and national culture (Henri, 2006).

The importance of the influence of the external environment is widely accepted in literature and researchers have found considerable evidence supporting the proposition that the task environment has a major impact on both the organisational structure and information systems. Unpredictability in factors in the external environment such as: technological sophistication and complexity in the industry in which a company operates have been proposed to affect the technology of operations. Technology of operations has also been noted to affect the extent to which a company tends towards decentralisation and sophistication in control systems has been linked to these factors (Khandwalla, 1977). Evidence of such relationship from prior studies informed the focus of this study on three important related variables in the context of individual organisation: the external environment, technology and decentralisation. Such prior studies have reported a link between some combinations of these variables, some control system variables and performance. For instance, Inegbenebor (1995) examined the effect of the contingent variables of size and structure on the performance of manufacturing enterprises in Nigeria. The study, although not an MAS study, examined the use of sophisticated control systems including MAS components (standard costing, budgeting and responsibility accounting) as part of the elements of structure. The study found that in the use of sophisticated control system effective companies had a significant and higher mean score than non-effective companies, thus pointing to evidence of a link between performance, decentralisation, size and the use of sophisticated MAS. The study did not specifically involve a test of the effect of the variables on MAS.

This study therefore proposed that while sophistication in the design of MAS may affect performance independently, appropriate combination of level of sophistication with the level of perceived environmental uncertainty, technological complexity and decentralisation will result in higher organisational performance. This expectation resulted in four hypotheses; the first of these being formulated to find out the extent to which level of sophistication in MAS design is associated with companies' performance stated in the null form as follows:

H₀₁: There is no significant relationship between level of sophistication in MAS designs and company performance.

MAS Design

The MAS consists of several subsystems two of which have been the subject of the recent criticisms of MAS: the product costing systems and the budgetary/performance measurement systems. In the literature four attributes of the designs of these subsystems have been identified as having some theoretical link with variables related to the organisation's task environment. These attributes are the level of detail provided (scope), frequency of reporting (timeliness), aggregation and integration (Chenhall & Morris, 1986). The literature has suggested that based on the organisation's task environment, some managers are likely to benefit from broad scope, aggregated and frequently reported information while, others in some context will benefit from information with less of these characteristics. Other studies have suggested that level of detail, aggregation and integration are closely related and have summarised these characteristics into two dimensions: level of detail and frequency of reporting (Gerdin, 2005; Pizzini, 2006). This study adopts this latter viewpoint and conceptualises MAS designs in terms of their level of detail and frequency of reporting. The design of MAS employed is therefore identified by the extent of two characteristics in the systems. The more sophisticated the design, the more detailed the information provided and

the more frequently the system generates the information. The designs of MAS components in terms of the levels of these characteristics have been associated with company performance (Inegbenebor, 1995; Ajibolade et al. 2010).

Company (Organisational) Performance

Organisational performance is the net result of the combined efforts of all individuals and groups in an organization (Khandwalla, 1977). Organisations referred to in this study are the manufacturing companies. The definition of company performance is problematic because it varies, depending on the viewpoint from which it is being assessed. For example, from society's viewpoint, performance may be assessed in terms of efficiency of production of products or services needed by the society. From the owners' viewpoint, profitability and growth rate in earnings may be the criteria, while employees may assess performance from how well employees are being treated. Customers may look at product quality, prompt delivery and competitive pricing. Since management must take into account the various expectations of these groups in setting its goals, management's criteria for assessing company performance may be assumed to adequately reflect the concerns of others groups such as: society, employees, suppliers and customers (Khandwalla, 1977).

Dess and Robinson (1984) suggested that two popular measures of economic aspects of company performance from management's viewpoint are the return on assets and growth in sales. They however noted that, obtaining accurate data in terms of these measures may prove difficult especially in multi-industry companies and privately-held companies as owners, who are the sole gatekeepers to such information on individual companies, are very sensitive about releasing any performance-related data. Dess and Robinson therefore suggested that subjective measures might be used where accurate objective measures are unavailable. In line with other MAS contingency studies that have used a variety of subjective measures of performance, this study employed subjective measures of sales growth and return on investments as a measure of companies' performance. The performance variables represent dimensions in terms of which the companies' performance is evaluated by the key decision makers within and outside the organisation, that is, profitability and rate of growth in sales.

External environment

The environment has been described as the "totality of physical and social variables taken directly into consideration in decision making behaviour of individuals in the organisation and consists of both internal and external environments" (Duncan, 1972, p. 314). The external environment, which has been reported as a major variable in contingency-based research (Chenhall, 2003; 2006) has been defined to include such aspects as competitors' actions, market demand, products and process innovations, legal and political constraints (Chenhall & Morris, 1986). Unpredictability in these variables making up the external environment has been argued to affect the extent to which managers would require the MAS information.

Unpredictability has been studied using various concepts including turbulence, hostility, diversity, complexity and restrictiveness, complexity and dynamism, controllability and uncertainty. However the concept of uncertainty appears to be the most widely used conceptualization in contingency studies. Uncertainty presents the organisation with difficulty in planning the future as events cannot be identified or the impact of events on operations is unknown. It presents managers with difficulty in setting prices, setting targets in budgeting and measuring performance of the managers and units. Uncertainty will therefore necessitate detailed reporting of broad scope information, both financial and non-financial, detailed costing information obtained by applying more accurate costing procedures to ensure

competitive pricing of an organisation's product and ultimately its profits (Chenhall & Morris, 1986; Gul & Chia 1994; Reid & Smith, 2000). Researchers have suggested that environmental uncertainty should be conceptualized as a perceptual phenomenon referred to as perceived environmental uncertainty (PEU) and measured as the extent of individual manager's perceived inability to predict the organisation's external environment accurately (Gul & Chia, 1994; Milliken 1987). This provides the basis for the second hypothesis of this study that the higher the environmental uncertainty the more sophisticated MAS information would an organization require for making decisions that would enhance performance. That is, environmental uncertainty is expected to moderate the influence of MAS design on performance. This hypothesis is stated in its null form as follows:

H₀₂: Perceived environmental uncertainty (PEU) has no significant moderating influence on the relationship between MAS designs and companies' performance.

Technology

Technology refers to "how organisations' work processes operate (the way tasks transform input into output) and includes: hardware (such as machine and tools), materials, people, software and knowledge" (Chenhall, 2006, p. 96). Technology has been defined in contingency studies in terms of different characteristics such as, complexity, task uncertainty and interdependence. This study views technology as varying in terms of its level of complexity and adopts the description of complexity used in Khandwalla (1977) {as adapted from Woodward, 1965}. Complex technologies are described as technologies that are extremely capital intensive and automated as in the case of chemicals and oil refinery or technologies that involve techniques that are rapidly developing as in aerospace, pharmaceuticals, electronics and nuclear power (Khandwalla, 1977). Companies that employ such capital intensive, automated processes are likely to employ mass production and process technologies. These will involve highly analysable processes and few exceptions, with more readily available knowledge of processes and measure of output, highly suited to standardised administrative (financial) controls as that provided by the MAS (Chenhall, 2006). Companies that use such technologies are suggested to use more sophisticated management control and information systems (Khandwalla, 1977). It is therefore hypothesised that the more the complexity of technologies (capital-intensive production processes and higher level of automation) the greater the need for more sophisticated MAS to enhance performance i.e complexity of technology exerts a moderating influence on the relationship between MAS design and performance. The hypothesis is stated in the null form as follows:

H₀₃: Technological complexity has no significant moderating influence on the relationship between MAS designs and companies' performance.

Decentralisation (Structural component)

Organisational structure is about the formal specification of different roles for organisational members, or tasks for groups, to ensure that the activities of the organisation are carried out (Chenhall, 2006). The way an organisation is structured affects the way decisions are made, the performance standards to be set and the way the performance is measured. An aspect of structure that is most commonly examined in MAS research is the extent to which an organisation is decentralised. Decentralisation, which refers to the level of autonomy delegated to the managers and the MAS designs together have been recognised as constituting a significant part of the control package in an organisation (Otley, 1980). Decentralisation might take the form of divisionalisation and/or departmentalisation, which will usually be accompanied with a greater need to control and integrate the work of all divisions/departments that make up the organisation. Under these conditions, the MAS may

have to become more sensitive and sophisticated since the progress of divisions must be monitored at the top of the organisation (Gordon & Miller, 1976). More decentralised organisations have been associated with more administrative oriented control which involves increased use of more sophisticated budgeting and performance measurement systems (Inegbenebor, 1995; Merchant, 1981). Based on these arguments, this study proposes that the demand for information especially for the purpose of measuring and controlling performance created by increased decentralisation in companies will be associated with a more sophisticated MAS design for effective performance. The following hypothesis was therefore formulated for testing:

H₀₄: Level of decentralisation has no significant moderating influence on the relationship between MAS designs and companies' performance.

3. Research Method

A cross sectional survey was used to address the problems of this study. The use of the survey design allowed the issues to be addressed in their organisational setting rather than in a contrived laboratory setting. Accounting researchers have called for increased examination of MAS in their organisational setting (Hayes, 1983; Hopwood, 1983; Otley, 1980) and Dillman (cited in Van der stede *et al.*, 2005, p. 56) has suggested that "properly constructed and administered surveys could constitute important sources of high quality data".

The survey consisted of the selection of a sample of two hundred manufacturing companies obtained from the Nigerian stock exchange listing through a combination of stratified and random sampling methods. The ten manufacturing sub-sectors identified on the stock exchange listing made up the strata from which the sample of companies was randomly drawn.

A questionnaire was used to collect data on each of the variables. Multi-item measures for each variable, adapted from earlier studies (Gerdin 2005, Khandwallah, 1977; Pizzini, 2006) were used. The Cronbach alpha coefficient was obtained for each of the multi-item measures in the study. A satisfactory internal reliability for the variables was achieved as reflected by the large Cronbach alpha coefficients reported in Table 1. Two hundred copies of the questionnaire were served on the chief accounting officers or management accountants in the sampled companies. One hundred and fifty-five (155) responses were received, representing a response rate of 77.5%. Eleven copies of the questionnaire were however, excluded from the analysis because these had incomplete data on the variables under study, resulting in a total of one hundred and forty four (144) usable responses. This gave an effective response rate of 72%. The data were subjected to correlation and moderated regression analyses to test the study's propositions.

Table 1: Instrument Reliability Statistics

Variable	Number of Items	Cronbach's Alpha
Technology (TECH)	3	.717
Perceived environmental uncertainty (PEU)	11	.813
Decentralisation (DEC)	10	.883
Product costing system design (MAS 1)	13	.908
Budgetary/performance measurement system design (MAS 2)	20	.916
MAS design (MAS 1 + MAS 2)	33	.929

Company performance	2	.953
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4. RESULTS

Correlation Analysis

Test of H₀₁: This hypothesis was formulated to determine whether higher sophistication in MAS designs adopted by the companies is associated with higher performance. The results as shown in the correlation matrix in Table 2 revealed a significant positive and strong correlation ($r = 0.626$) between company performance and MAS designs. Furthermore, when MAS were decomposed into individual components, the budgetary/performance measurement systems showed stronger relationship with performance, with correlation coefficient ($r = 0.718$). These results, which suggest that a systematic relationship exists between MAS design and performance, provided support for the expectation in the study that level of sophistication in MAS design may be used to influence the performance of manufacturing companies. It however contrasts findings in Govindarajan (1984) that no direct connection exists between MAS subsystems and performance until the mediating effect of uncertainty was considered.

The correlation results also revealed that the other variables in the study were each significantly positively correlated (at 0.01 level of significance) to MAS designs measured in terms of their level of sophistication. PEU and technology both had stronger correlations with MAS designs with correlation coefficients of 0.620 and 0.508 respectively. Decentralisation also showed a statistically significant but weaker correlation with MAS design with a correlation coefficient of 0.297. These results appear consistent with earlier empirical evidence and theoretical suggestion. For instance, Khandwalla (1972) concluded that the sophistication of an accounting information system was linked to the intensity of competition faced by the manufacturing companies studied. Gordon and Narayanan (1984) also found a strong relationship between environmental uncertainty and control systems designs. The study found that both structure and control systems were dependent upon the state of the environment. Otley (1980) also observed that the major factor underlying control systems designs appears to be environmental unpredictability in its various guises. However the results showed some inconsistencies with existing literature, for instance it contradicts Chenhall and Morris' (1986) evidence of no significant direct effect of decentralisation on broad scope MAS information. Gerdin (2005) reported a negative relationship between decentralisation and increased sophistication in MAS designs. A significantly high proportion of traditional MAS (less sophisticated MAS) focusing more on financial measures were noted among highly decentralised structures (lateral units) facing reciprocal interdependence.

However, uncovering the existence of these statistically significant positive relationships between MAS design and performance, and between MAS design and the organizational factors supports a need to consider the moderating influence of the organizational factors to determine whether the influence of MAS on performance may be further enhanced under certain conditions facing the organisation. Hypotheses 2 – 4 were tested to achieve this.

Table 2: CORRELATION MATRIX OF THE VARIABLES IN THE STUDY

	PERF	MAS	MAS 1	MAS 2	TECH	DEC	PEU
(PERF)	1	.626**	.333**	.718**	.491**	.432**	.511**
(MAS)		1	.846**	.931**	.512**	.297**	.620**

(MAS 1)			1	.595**	.277**	.125	.492**
(MAS 2)				1	.586**	.363**	.597**
(TECH)					1	.500**	.549**
(DEC)						1	.415**
(PEU)							1

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

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

Tests of Hypotheses of Moderating influence of PEU, TECH and DEC (H₀₂, H₀₃, H₀₄)

Having established that a relationship exists between MAS and performance. The moderation regression analysis was used in examining these hypotheses. The process involved the running of two regression models for each of the hypotheses: model one involved the main effects of MAS and each of PEU, TECH, DEC and model two involved the inclusion of an interaction term. The statistical significance of the model that includes the interaction term; and the change in R² were used to provide evidence of moderation effects and to suggest whether or not the null hypotheses two to four (H₀₂ - H₀₄) should be rejected. Results of these regression analyses are as shown in Tables 3 - 5.

Test of H₀₂: The test of H₀₂ provided evidence suggesting that PEU has a significant moderating effect on the relationship between MAS and performance as presented in Table 3. The model which included the interaction term explained 95.6% variation in performance. The beta coefficient of the interaction term also showed statistical significance at p < 0.05. Furthermore, the change in R² explained by the interaction term did not only achieve statistical significance but also explained a substantial variation in performance ($\Delta R^2 = 0.542$ at p < 0.05). This evidence indicates a strong support for the moderating effect of PEU on the relationship between MAS design and performance. The expectation of significant moderation effect of PEU was therefore supported. This implies that the impact of MAS designs on performance will vary with the level of PEU facing the companies. Thus, companies facing higher level of PEU are likely to exhibit higher business performance if supported by more sophisticated MAS designs. The evidence is in conformity with earlier evidence of strong moderating influence of PEU (Gordon & Narayanan, 1984; Govindarajan, 1984; Gul & Chia, 1994).

Test of H₀₃: The results as shown in Table 4 provided evidence of a modest support for the proposition that technology moderates the relationship between performance and MAS designs. The model including the interaction term was statistically significant, however only minimal change in R² was observed ($\Delta R^2 = 0.012$ at p < 0.05). This evidence differs slightly from expectations and from results in extant literature (Abernethy & Lillis, 1995). Perhaps the general low level of the use of very complex technologies made the moderation effect of technological complexity on MAS design less visible in these Nigerian manufacturing companies, or perhaps as Reid and Smith (2000) noted, going down from large company application to small company application, might limit the scope and emphasis of the contingency theory with a lesser influence of technological uncertainty at the small company level.

Test of H₀₄: Results of these regression analyses as shown in Table 5 indicated that the beta coefficient for the interaction term did not show significance (p = 0.061) and the change in R² was minimal and non-statistically significant ($\Delta R^2 = 0.011$ at p > 0.05) suggesting no moderation effect of decentralisation and MAS on performance. The model that

included this interaction term however, achieved statistical significance. The results may be interpreted as lack of support for the proposition that higher level of sophistication in MAS designs under conditions of higher decentralisation, would result in higher performance. However the positive relationship observed in the correlation analysis and the statistical significance of the model may capable of contradictory interpretations. Perhaps, the lack of statistical significance of the beta coefficient of the interaction term and the R^2 change was as a result of the fact that small companies for whom decentralisation has been noted to have negative effect on performance were included in the sample together with the large companies. Size has been found to affect the likelihood of decentralisation having positive effect on performance (Inegbenebor, 1995).

Table 3: Moderated Regression Analysis Results for H_{02}

Model	Dep.	Indep.	Mod. Var.	b_0	b_1	b_2	b_3	R^2	R^2 Adj.	P-value
1	Perf	MAS	PEU	3.068	.702	.273	-	.416	.408	.000
2	Perf	MAS	PEU, MAS*PE	2.12	.661	.283	.265	.958	.957	.000
P-value					.000	.000	.000			
$R^2 \Delta$.542		.000

Notes: MAS*PEU – Interaction term representing the moderating effect of perceived environmental uncertainty on the relationship between MAS and companies' performance.

Table 4: Moderated Regression Analysis Results for H_{03}

Model	Dep	Indep.	Mod. Var	b_0	b_1	b_2	b_3	R^2	R^2 Adj.	P-value
1	Perf	MAS	Tech	3.070	.733	.137	-	.407	.398	.000
2	Perf	MAS	Tech, MAS*Tec	3.052	.777	.140	.041	.419	.396	.000
p-value					.001	.605	.047			
$R^2 \Delta$.012		.000

Notes: MAS*Tec – Interaction term representing the moderating effect of technology on the relationship between MAS and companies' performance.

Table 5: Moderated Regression Analysis Results for H_{04}

Model	Dep.Var	Indep.	Mod.	b_0	b_1	b_2	b_3	R^2	R^2	p-
1	Perf	MAS	Dec	3.068	.763	.356	-	.458	.450	.000
2	Perf	MAS	Dec, MAS*De	-2.036	1.224	.952	-.185	.469	.458	.029
p-value					.000	.007	.061			
$R^2 \Delta$.011		.568

MAS*Dec – Interaction term representing the moderating effect of decentralisation on the relationship between MAS and companies' performance.

Conclusion

Sophisticated MAS designs have been advocated by researchers as alternatives to the traditional MAS design in attempts to find ways of improving companies' productivity and competitiveness in the global market. These sophisticated MAS are designed to produce more broad scope information (financial and non-financial) at greater frequencies and details. This study has provided findings in support of the proposition that more sophisticated MAS designs will enhance the performance of the manufacturing companies in Nigeria, if level of sophistication is tailored to the level of environmental uncertainty facing the companies and technological complexity of their production process. The study found evidence of a strong moderation influence of the perception of environmental uncertainty and a modest moderation influence of technology on the relationship between MAS and performance. The implication of this is that companies facing high environmental uncertainty and complex technological production processes will likely reap great benefits from using more sophisticated MAS. Such MAS will help produce more information for appropriately measuring performance, more detailed product cost information for proper pricing of products and would help highlight areas for cost control purposes for increased profitability. The study found no conclusive evidence regarding the relationship between MAS design and level of decentralisation. Decentralisation although found to be positively correlated with sophistication in MAS designs, was not found to moderate the relationship between MAS design and performance. Further research may be needed to reconcile this seemingly contradictory finding.

This study of organisational functioning of MAS in Nigeria, has yielded results that are compatible with research findings in the developed countries. The results, which were largely in conformity with predicted directions provided general support for a significant role for more sophisticated MAS designs in manufacturing companies in Nigeria. A major implication of these findings for the management of these companies and the designers of their accounting information systems is that there is the need to develop product costing systems and performance monitoring systems that will provide managers with appropriate level of details and at frequencies appropriate to the level of environment uncertainty as perceived by the managers. The role of technology must also be considered in designing such systems. The use of such custom designed MAS is expected to lead to more efficient use of the limited resources at companies' disposal and ultimately to enhanced performance.

Designing systems for improving organisational performance requires some level of knowledge and skills on the part of accounting professionals. The professional accounting bodies are challenged to initiate and support management accounting research into what takes place in practice in comparison with the education and training being given to practitioners. Regular reviews of management accounting education curricula in educational and training institutions should be encouraged to incorporate new findings and developments. The dissemination of findings to practitioners should also be encouraged through the continuing education programmes of the accounting professional bodies and joint sponsorship of publication of findings with manufacturing associations. This should help reduce the disconnection between research findings and industry as noted in NBS (2011). Finally, it is the responsibility of the management accounting professionals to remain relevant in adding value to the companies for which they work and to their profession by keeping abreast of research findings in their area of responsibility.

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