The Effects of Materials Management Practices on Firm Performance in Ghana: Evidence from A Listed Company.

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Abstract

Background: Materials management practices has gained extensive prominence over the last few decades and continue to play a significant role in production and operations management.

Objectives: The objective of this scientific inquiry is to empirically examine the effect of materials management practices on firm performance by exploring employee views within the Ghanaian context, focusing on Fan Milk Limited, a consumer good listed manufacturing firm in Ghana.

Methods: A cross-sectional approach [research design] was espoused for the study, exploring quantitative research techniques for its analysis. The study was based on self-answering structured questionnaires completed by 240 respondents selected via stratified sampling. SPSS version 25.0 was utilised for data analysis. Statistical analyses include descriptive statistics, principal component analyses, exploratory factor analyses with varimax rotation, reliability and validity analyses, and multivariate regression analyses.

Results: The study found significant positive relationships between all eight materials management practices constructs and firm performance. Findings revealed further that Economic Order Quantity construct (β=0.901, p=0.000) contributed most to firm performance whilst Ergonomics (β=0.105, p=0.002) contributed least to firm performance.

Conclusion: Managerial recommendations via research findings established, should be taken critical for management of manufacturing firms when dealing with decisions influencing materials management and performance assessment by examining the possible feasibility of the eight materials management techniques exploited in this study as a relevant tool for initiating continuous performance improvement in Fan Milk Limited in particular and Ghana's manufacturing industry in general.

1. Introduction

Materials management (MM) encompasses all operations management activities from raw materials acquisition through the manufacturing processes to the delivery of the final products. It is a coordinating function, responsible for integrated approach towards the management of materials in an industrial undertaking. International Federation of Purchasing and Materials Management (IFPMM, 2014) defined MM as a total concept having its definite organization to plan and control all types of materials, its supply, and its flow from raw stage to finished stage so as to deliver the product to customer as per his requirements in time. Inventory control, material requirement planning and control (MRPC), purchasing, storage, just-in-time (JIT), ergonomics, standardisation, simplification, specification, value analysis, are some of the activities of MM.

Materials, which include stock of raw materials, work in progress (WIP), finished goods as well as other supplies and defined as industrial goods that will become part of another physical product are the vital spark of any manufacturing concern and as such no industry can operate without them (Kontuš, 2014).

Materials must be procured at the appropriate cost, in the right quality and quantity, at the right place and at the right time in order to co-ordinate and schedule the production activity in an integrative manner for an industrial undertaking. MM practices should be accorded topmost priority in view of the enormous investment made in them (Dimitrios, 2008).

The investment by firms in materials constitute a major component of the total assets of most businesses as in many cases, it exceeds fifty percent of the total cost of goods produced (Etale and Lingilar, 2016). Such huge investments necessitates substantial planning and control in order to curtail wastage and improve profitability. MM is a tool utilized to optimize performance in meeting customer service requirements and at the same time enhancing profitability. It is an important aspect of organisational undertakings and need to be accorded the due seriousness it deserves. MM however, is one of the most abandoned management practices in most businesses as some firms centre MM practices on haphazard procedures (Sander et al, 2010). Many firms tie up huge amount of liquid funds in materials for long periods in view of the relaxed MM practices or failure to control the materials prudently. Bad MM practices results directly into needless pressure on the cash flow of businesses. Insufficient materials could disrupt the smooth operations of a business, while surplus materials could also lead to unnecessary accumulation of scarce liquid funds in holding cost, which can translate into low profitability and a decline in overall performance. In addition, procuring materials too early, may result in funds being locked-up and undue interest incurred for the idle materials procured.

The central issue in MM is the ability to strike a trade-off (balance) between holding an appreciable level of materials in stock in order to satisfy materials requirement for production to avoid stock-out (under-stocking) and at the same time avoiding placing substantial amount of cash needlessly in materials (Kolias et al, 2011). Businesses must therefore maintain optimal stock levels at all times so as to avoid unnecessary carrying cost and stock out in the attempt to satisfy both manufacturing and sales needs. In order to hold and maintain an appropriate level of materials, businesses need to consistently embark on thorough and tried and tested MM practices.

Businesses employ numerous techniques vis-à-vis their MM. Evidence from extent literature (Lwiki *et al*. 2013) indicates that, the innumerable practices adopted by firms in managing their materials have substantial effect on firm performance in terms of annual turnover, profitability and overall market value. To the best of the author's knowledge, it appears the subject matter has not yet received the full attention it desires from researchers in Ghana. It is, therefore, in the attempt to fill this research gap that this scientific inquiry intends to empirically examine the effect of MM practices on firm performance in Ghana, focusing on Fan Milk Limited, a listed consumer good, manufacturing firm in Ghana. The remaining part of this paper is structured into the following sections: Section 2 presents the study's objectives. Section 3 reviews the theoretical and empirical literature related to the subject matter. Section 4 discusses the research methods. Section 5 is result and discussions. Section 6 is conclusion. Section 7

discusses the managerial implications of the study. Section 8 presents limitations and areas for future research.

2. Objective Of The Study

The objective of this scientific inquiry is to empirically examine the effect of MM practices on firm performance by exploring employee views within the Ghanaian context, focusing on Fan Milk Limited, a consumer good listed manufacturing firm in Ghana.

3. Related Literature Review

3.1. Theoretical Literature

In extant literature, theories employed in conveying clarity to the inquiry of the role of MM on functional performance exist. These include constraints theory and lean theory to create the imperative concerns vis-a-vis MM influence on firm performance.

3.1.2 Theory of Constraints (TOC)

Conceptualised by Dr. Eliyahu Moshe Goldratt, an Israeli physicist around 1980, the TOC is founded on the application in institutions of experimental science models such as cause-and-effect analysis to social sciences disciplines such as business management. TOC came into lime light when Dr. Eliyahu Goldratt publicized it via his popular 1984 novel, “The Goal” which offered chains of concepts engrossed on elucidating certain principles that oversee production and suggested a method of continuous improvement and decision-making for businesses to achieve their goals (Goldratt and Cox 1984). TOC is a system for detecting the most significant limiting factor (i.e. constraint known as a bottleneck) that impedes the process of achieving an organisational goal and then methodically refining that constraint until it is no longer a limiting factor. TOC states that constraints justify the performance of a system. A very imperative consequence to this is that wasting time optimizing non-limiting factors will not yield important benefits; only improvements to the limiting factors will further the goal. TOC offers a definite approach for detecting and eradicating limiting factors, known as the Five Focusing Steps (FFS). These FFS which are cyclical in nature are 1) Identify the constraints 2) Exploit the constraints 3) Subordinate and synchronize to the constraints 4) Evaluate the performance of the constraints and 5) Repeat the process. Therefore, once a constraint is resolved the next constraint should immediately be addressed.

TOC is criticized for many challenges associated with its implementation. The theory emphasis on sufficiently refining the constraint and the capabilities of these constraints to improve proficiency and this can be achieved by production entities deploying fitting inventory control practices. TOC is a methodology whose suggestion is connected to generation meant to achieve a reduction of the institutional materials.

3.1.3 Lean Theory

The "Lean" term was devised by John Krafcik in 1988 and defined by James Womack and Daniel Jones in 1996. Its production system is founded on efficiency (waste reduction), continuous and incremental improvement, value streams, touch time and standardized products. It is rooted in five principles namely 1) Exactly defining value by specific products, 2) mapping the value stream for each product, 3) creating value flow without interruption, 4) using a pull system, and 5) pursuing perfection (Womack and Jones, 1996). Womack and Jones (1996) describe the system as a production mechanism that induces more production using less manpower, minimal equipment, time, and space, while ensuring that customers are served with their exact product specification. Value-addition activities should only be centered on things customers are ready and willing to pay for and consider all other activities as waste. Firms that implement the lean philosophy, stand the chance of remaining competitive, improve their value delivering capabilities, reduce operational cost, and enhance profitability.

Critics of Lean insinuate that the system is highly unfavorable especially for company employees implementing the Lean system and that the system fails to take into introspection worker protection and welfare. The principle is concomitant with increased worker stress levels, in view of the pursuant for perfection.

Lean also over-emphasis on absolute waste reduction, which is likely to force top management to shut down certain segment of the firm that may not be profitable in the short run but are nevertheless essential to the firm's bequest.

3.2 MM Practices/Techniques

In any establishment, materials for operational activities are kept. When the number of materials in inventory is large and then enormous sums of money is required to generate such materials in inventory, it becomes the concern of the management to have a proper management control over its ordering, procurement, maintenance and consumption. The control can be for order quality and order frequency. It must be noted that, there are several MM practices but for the purposes of this study, the author limited the discussions to the MM practices being implemented by the case study firm.

3.2.1 Economic Order Quantity [EOQ]

The EOQ is a mathematical model for inventory control management developed by F.W. Haris in 1913. This inventory model is concerned with two main decisions: how much to order (purchase or produce) and when to order so as to minimize the total cost. For the foremost decision—there are two basic costs

to consider namely, inventory carrying/holding costs and the ordering/acquisition costs. As the quantity ordered is increased, the inventory carrying cost increases while the ordering cost decreases. The 'order quantity' means the quantity produced or procured during one production cycle. EOQ is computed by balancing the two costs. EOQ is that size of order which minimizes total costs of carrying/holding and cost of ordering/acquisition. *i.e.,* Minimum Total Cost occurs when Inventory Carrying Cost = Ordering Cost. Holding cost include the cost of financing the inventory along with the cost of physically maintaining the inventory.

Ordering cost include the cost associated with actually placing the order. These include a labor cost as well as a material and overhead cost. Organisation can therefore rely on the EOQ principles deploying the when to order (re-order level/point) and how much to order (EOQ) in an attempt to enhance their MM practices to reduce total inventory cost.

3.2.2 ABC Analysis [ABC]

ABC materials analysis is a method used to classify a business's materials into three categories – A, B and C, based on their value to the business. A items are the most important in terms of the value they bring a company, B items are more important than C items but less important than A items whilst C items are the least valuable. The objective of ABC inventory analysis is to help managers focus their time on their most valuable materials and adapt their MM policies accordingly. As there are many ways to define 'value', this classification can be based on many criteria, including annual sales revenue, average profit margin, annual sales volume or annual consumption value. ABC analysis is an important technique that follows the Pareto Principle with respect to a firm's MM. A- items represent 70–80% of the businesses annual consumption estimate and just 10–20% of total material items. B items represent 15–25% of annual consumption estimate and 30% of aggregate materials and C items characterize 5% of the annual application of estimate and half of total materials.

3.2.3 Materials Requirement Planning and Control [MRPC]

MRPC is a scientific technique of ascertaining in advance the requirements of raw materials, ancillary parts and components, spares etc. as directed by the production programme. It is a subsystem in the overall planning activity. The MRPC is performed based on the sales forecast and production plans.

This involves estimating the individual requirements of parts, preparing materials budget, forecasting the levels of inventories, scheduling the orders and monitoring the performance in relation to production and sales. The factors, which influence material planning are classified as macro (price trends, business cycles, government import policy etc.) and micro (plant capacity utilization, rejection rates, lead times, inventory levels, working capital, delegation of powers and communication) systems.

3.2.4 Strategic Supplier Partnership [SSP]

SSP plays an important role in optimizing the costs and improving the quality of materials being provided to the firm. Partnering with suppliers to develop deep, mutually rewarding relationships over the long-term is often cited as a means by which to lessen that risk and develop true supply chain excellence. The Institute for Supply Management (ISM) defines supplier partnership as a commitment over an extended time to work together to the mutual benefit of both parties, sharing relevant information and the risks and rewards of the relationship. These relationships require a clear understanding of expectations, open communication and information exchange, mutual trust and a common direction for the future. It is highly imperative for the manufacturer to involve the supplier at the initial stages of the product design process so as to reduce the probability of defect and the risk of obsolescence (Lwiki *et al.*, 2013).

3.2.5 Just-in-Time [JIT]

The just-in-time (JIT) MM system is a Japanese philosophy that aligns materials orders from suppliers directly to the producers as and when needed. JIT provides an efficient production in an organization and delivery of only the necessary materials in the right quantity, at the right time and place while using the minimum facilities.

Businesses deploy this method to enhance efficiency and reduce waste by procuring goods only as they need them for the manufacturing activity, which decreases inventory costs. According to Harrison and Hoek, (2011), JIT is viewed as a “Production methodology which aims to improve overall productivity through elimination of waste and which leads to improved quality”. Manufactures therefore need to predict demand accurately. For the JIT system to be successful, it is highly dependent on steady production, high-quality workmanship, glitch-free plant machinery, and dependable suppliers. JIT production method reduces materials costs in view of the fact that producers need not incur storage costs. Producers need not worry about unwanted materials whenever orders are cancelled. The central motive of JIT is to have at the right time, the appropriate quantity of materials, open to satisfy either the firm’s production needs or the end user requirements. The less an organisation incur on materials acquisition, storage and final delivery to the firm’s customers, the limited obsolete quality it has to markdown. Lastly, this all climaxes into saving and substantial sums of money fot the organisation.

3.2.6 Stores Management [SM]

Store is an essential element of MM since it is a place that keeps the materials in a manner by which they are well accounted for, are preserved safe, and are accessible at the times of need. Storage is an important part of the economic cycle and store management is an expert operation, which can contribute

substantially to the overall efficiency and effectiveness of the materials function. The most vital purpose served by the stores is to offer incessant service to the manufacturing sections. Characteristically a store has a few processes and a space for storage. The main processes of store are (i) to receive the incoming materials (receiving), (ii) to keep the materials as long as they are required for use (keeping in custody), and (iii) to move them out of store for use (issuing). The ancillary process of store is the inventory control.

In a production setting, this process of receiving, keeping in custody, and issuing forms a cyclic process which runs on a continuous basis.

3.2.7 Computerized Materials Management [CMM]

A **CMM system** is the integration of sub-functions involved in the management of materials into a single interconnected system. It is software installed on the computer systems that aids a firm to track the material levels by executing the automatic counting of materials, recording withdrawals and revising the materials balance. It is very difficult for any firm to maintain a large stock of materials, and therefore, many businesses have adopted the JIT system in terms of minimum and maximum limit for the materials. There is an inbuilt system for placing orders in computer systems that automatically generates a payment order to the supplier when the minimum level of the material stock or the reorder point is reached. The benefits of a CMM system can be derived, when the business integrates its materials control system with the other systems such as accounting and sales that aids in better control of material levels. Thus, a CMM system has made a life of both the producer and the retailer easy, who can manage their materials electronically without wasting much time on the manual tracking system. Also, all the documents, such as purchase order, Invoice, account statement gets automatically generated with a use of computerized inventory control system. But however, over reliance on the technology may be problematic in the situations of power outbreak and lost internet connectivity, as it may bring a system to a halt.

3.2.8 Ergonomics/Human Engineering [E]

Ergonomics or human engineering is a comparatively new branch of science which evolved around 1949 but depend on inquiries carried out in several other older, traditional scientific fields, such as engineering, physiology and psychology.

ILO defines human engineering as, ‘The application of human biological sciences along with engineering sciences to achieve optimum mutual adjustment of men and his work, the benefits being measured in terms of human efficiency and well-being.’ Human engineering is concerned with man-machine system. Thus another definition which highlights the man-machine system is: ‘The design of human tasks, man-machine system, and effective accomplishment of the job, including displays for presenting information to human sensors, controls for human operations and complex man-machine systems.’ Human

engineering focuses on human beings and their interaction with materials, equipment facilities and environments used in the work.

3.3. *Empirical Literature*

In extant literature, several studies have been conducted on the nexuses between MM practices and performance. Khan (2020) evaluated the mediating aspects of business strategies in affecting the aspects of inventory capability and firm performance of the Bangladeshi readymade garment industry using a survey of 385 senior managers. The study results revealed that business strategies mediate the consequence of inventory materials capability and performance of the firm. Shin, Ennis, and Spurlin (2015) assessed the relationship between firm performance and inventory management using data from the US manufacturing industry and the findings indicated that a lower ratio of inventory to sales generated a higher profit. Koumanakos (2008) also examined the impact of MM on performance within the manufacturing sub-sectors of food, textile, and chemicals from the period 2000 - 2002 in Greece utilizing traditional inventory measurement criterion such as inventory level, lead time and demand and found out that firms that maintained high inventory levels generated lower rate of return.

Atnafu & Balda (2018) examined the impact of inventory management practices on firms' competitiveness and organizational performance of micro and small enterprises operating in the manufacturing sub-sector in Ethiopia and found that higher levels of inventory management practice can lead to an enhanced competitive advantage and improved performance. Also, competitive advantage can have a direct, positive impact on performance. A study conducted by Lwiki *et al. in* 2013 on the impact of inventory management practices on financial performance of sugar manufacturing firms in Kenya from 2002 – 2007 revealed a direct relationship between inventory management and performance. In another Kenyan study, Nyabwanga and Ojera (2012) explored the nexus between inventory management practices and business performance of small scale enterprises (SSEs) in Kisii Municipality in Kenya. The study finding showed a positive and significant relationship between effective inventory management practices and performance. The study further, indicated that inventory budgeting had the largest effect on performance, followed by shelf-space management, Inventory level management had the least effect on performance. Empirical evidences in Ghana also follow similar trend just like their African counterparts. Kasim, Zubieru and Antwi (2015) analysed the inventory management practices of 300 small and medium enterprises (SMEs) in the northern region of Ghana and also observed a positive and significant correlation between inventory management practices and SMEs performance. Similar to this results, Prempeh (2016) also found a positive and significant correlation between efficient inventory management practices and profitability of four listed manufacturing firms in Ghana.

4. Methods

4.1 Study design and population

The research design adopted for this empirical inquiry is cross-sectional design utilizing quantitative research techniques for its analysis. The study population comprised all the 623 employees of the case study firm i.e. Fan Milk Limited (FML).

4.2 *Data collection technique and Research instruments*

The study employed the use of structured questionnaires which were administered to the respondents. The questionnaires were designed and structured into three parts. Part 1 gathered socio-demographic information/data [sex, age, educational level and work experience] from the respondents. Part 2 was structured [closed-end] survey questionnaire on MM practices constructs and their respective items [Independent variables]. Part 3 was on performance constructs and their respective items [Dependent variables]. There were eight (8) MM practices constructs used as explanatory variables and one (1) performance construct used as dependent variable. Each construct was made up of four (4) items resulting in a total of thirty six (36) questions. All the 36 questions utilised to assess the impact of MM practices on firm performance from the view point of firm employees were captured on a five-point Likert scale as follows: Strongly Disagree (SD)= 1; Disagree (D)=2; Undecided (U)=3 Agree (A)=4; Strongly Agree (SA)=5 (**Appendix 1).**

Survey questionnaires were pretested (pilot tested) using ten employees to ensure the questionnaires were understood and to ensure high internal consistency. Stratified sampling (segregated staff into senior management and ordinary employees) was used to select a sample size of 244 respondents, using Yamane (1967) formula as follows: $n = N/(1 + Ne^2) = 623/[1+623(0.05^2)]=244$. n=Sample size = 244, N = Population size = 623, e = Level of precision = 5%.

A final figure of 240 were deemed usable after the author had remove those questionnaires that had logic errors or missing values, giving a 98.36 per cent response rate. The sample size of 240 respondents comprised all 10 senior management staff and 230 ordinary staff of FML. The author strictly adhered to confidentiality and anonymity principles. The author with the aid of three research assistants, who were trained to understand the questionnaires administered the resultant questionnaires following purification of the scales to the respondents from 15th June 2020 to 30th July 2020, during working hours utilizing on the spot data collection technique. The trained research assistants had a good grasp of the commonly spoken local Ghanaian languages (i.e. Twi, Ga and Ewe) and could effectively communicate with the respondents. On the average, it took between 15 - 20 minutes for a questionnaire to be administered. Clearance was sort from FML managers before conducting the study.

4.3 Reliability and Validity of Measurement Scale

Reliability of study questionnaires as defined by Standard for Educational and Psychological Testing is the extent to which scores on a test are essentially invariant over time. It ensures enhanced clarity of the questions as well as confirm research stability. The study recorded Cronbach's alphas above 0.7 and it's considered satisfactory (Hair et al, 2016). The value of Cronbach's alpha in this study of MM practices effect on firm performance are as follows: EOQ=0.92, ABC=0.86, MRPC=0.89, SSP=0.93, JIT=0.87, SM=0.80, CMM=0.80, E=0.94 with overall Cronbach's alpha on MM practices of 0.88 and firm performance 0.89. Meanwhile, the questionnaires were developed through borrow/adjust from specialists and in extant literature as a way of content validating how well the chosen items on the questionnaires scale measures the 8 constructs in this study.

4.4 Data processing and analysis

The author coded and entered collected data in SPSS version 25.0 for analysis. Bartlett's test of sphericity (p=0.000) and the Kaiser-Meyer-Olkin (KMO= 0.89) were performed to examine the factorability of the data and sampling adequacy (KMO) and the results were very significant which indorsed the dataset suitability for factor analysis (FA). Principal Component Analysis [PCA] with varimax rotation was utilized as a means of reducing the dataset which permitted exploratory factor analysis (EFA) to be performed on thirty six items and the results is depicted in Table 1. All construct with a more than 1.00 eigenvalue as well as items with a more than 0.5 factor loadings and items with less than 0.5 cross-loadings relevant to the other constructs were used for the analysis (Hair et al., 2016). Cronbach's α were computed to test the reliability of the items in each construct, and values of 0.7 and above were obtained and deemed acceptable (Hair et al, 2016). Thereafter, a multiple linear regression was performed to ascertain the impact of constructs and their predictive power as explanatory variables on firm performance.

5. Results And Discussion

5.1 Socio-demographic characteristics of Respondents

240 respondents participated in the survey. More than half (170) constituting 71% were males and the remaining 70 (29%) were females. Majority, 105, representing 44% were in the age range of 31 - 40 years. Next, 75, constituting 31% were in age range 41 – 50. Next, 40, constituting 17% were in the age range 51 – 60. The lowest 20, constituting 8%, were in age range 20-30. Majority of the respondents 95 (40%) were diploma holders. 80 of the respondents, representing 33% were first degree holder whilst 35, constituting 15% held post graduate degrees. The remaining 30 (13%) were holders of basic level certificates (JHS and SHS). Majority of the respondents 105 (44%) had worked between 5 to 10 years.

65 of the respondents constituting 27% had worked experience between 11 and 20 years. 50 of the respondents constituting 21% had worked experience below 5 years, whilst 20 (8%) had worked for more

than 20 years. The heterogeneity in the profile of the respondents did not account for any variations in the results and as such the author considers the study findings to be reliable (Table 2).

Table 2: Socio-demographic data of the sample respondents

Variable	Number	Percentage
Sex		
Male	170	70.83
Female	70	29.17
Total	240	100
Age		
20 - 30	20	8.33
31 - 40	105	43.75
41 - 50	75	31.25
51 - 60	40	16.67
Total	240	100
Education		
Basic school certificate	**30**	12.50
Diploma	95	39.58
First Degree	80	33.33
Post graduate	35	14.58
Total	240	100
Work Experience		
< 5 years	50	20.83
5 - 10 years	105	43.75
11 - 20 years	65	27.08
Above 20 years	20	8.33
Total	240	100

Source: Field Data compiled by Author (2020)

5.2 MM Practices Constructs and Firm performance

Thirty two items were captured onto eight MM practices constructs and four items were captured on one performance constructs to assess the MM practices - performance connexion at FML. The author performed EFA in order to bring out appropriate constructs as good explanatory estimators of performance. The author initially extracted eleven constructs having eigenvalue greater than 1; and all eleven factors together accounted for 70.4 per cent of the performance total variance. As recommended by Hair et al 2016 this extracted structure was not used in view of the fact that some of the items had low-factor loadings and some items had higher cross-loadings. To obtain acceptable structures which are significant statistically, all items having a higher than 0.5 cross loadings and constructs with a less than 0.5 loadings were removed. Constructs such as buffer stock and EOQ were merge to form a construct named 'EOQ', demand forecasting and MRPC constructs were also merged and named 'MRPC' and finally lot-for-lot and JIT were merge as one construct named 'JIT' based upon the strong correlation and EFA was repeated. Now, eight factors have been formed for MM practices, which accounted for 70.4 per cent of the total variance in TQM and deemed higher than the recommended level of 60 per cent by Hair et al, 2016.

All factor loadings in this FA exhibited statistically significant values of higher than 0.7, which was higher than the recommendation value indorsed by Hair et al., 2016.

MM practices constructs having lower (below 0.5) cross loadings between them depicts satisfactory unidimensionality (Hair et al., 2016).

Table1: Material Mgt. Practices Constructs and their corresponding items of descriptive statistics							
Factors/Dimensions	**Items**	**Mean**	**SD**	**Loadings**	**Eigenvalues**	**% of Variance Extracted**	**Cronbach's Alpha**
EOQ (1)	1A	4.45	0.76	0.97	15.6	18.9	0.92
	1B	4.06	0.90	0.86			
	1C	4.17	0.66	0.98			
	1D	4.30	0.68	0.95			
ABC Analysis (2)	2A	4.54	0.67	0.88	5.50	14.5	0.86
	2B	4.30	0.73	0.80			
	2C	3.75	0.71	0.96			
	2D	3.51	0.59	0.97			
MRPC (3)	2A	3.45	0.78	0.87	3.05	9.50	0.89
	3B	3.36	0.89	0.89			
	3C	3.55	0.86	0.91			
	3D	3.22	0.82	0.94			
Strategic Supplier Partnership (4)	4A	3.78	0.66	0.88	2.85	7.20	0.93
	4B	3.88	0.74	0.78			
	4C	3.88	0.68	0.81			
	4D	4.03	0.57	0.90			
Just-In-Time (5)	5A	3.48	0.74	0.83	1.95	6.50	0.87
	5B	3.64	0.55	0.95			
	5C	3.87	0.77	0.84			
	5D	3.95	1.01	0.98			
Stores Mgt. (6)	6A	4.55	0.86	0.76	1.75	5.50	0.80
	6B	3.98	0.73	0.95			
	6C	3.97	0.77	0.82			
	6D	4.15	0.83	0.91			
Computerized Materials Mgt. (7)	7A	3.98	0.65	0.88	1.65	4.9	0.8

	7B	3.50	0.46	0.79			
	7C	3.77	0.61	0.86			
	7D	3.99	0.55	0.89			
Ergonomic/Human Engineering (8)	8A	3.58	0.76	0.93	1.55	3.40	0.94
	8B	3.52	0.78	0.84			
	8C	4.25	0.81	0.73			
	8D	3.54	0.88	0.96			
TOTAL						**70.4**	**0.78**
Source: Field Data compiled and analysed using SPSS 25.0 by Author (2020)							

The first factor corresponds to EOQ which produced the most variation accountability, having an eigenvalue of 15.6, representing 18.9% of the total variance. The second factor was named ABC, accounted for an eigenvalue of 5.5, representing 14.5% of the total variance. The third factor was named MRPC, which accounted for a 3.05 eigenvalue, representing 9.5% of the total variance. The fourth factor was named SSP, which accounted for a 2.85 eigenvalue, representing 7.20% of the total variance. The fifth factor was named JIT, which accounted for a 1.95 eigenvalue, representing 6.5% of the total variance. The sixth factor was named SM, which accounted for a 1.75 eigenvalue, representing 5.50% of the total variance. The seventh factor, was named CMM, which accounted for a 1.65 eigenvalue, representing 4.90% of the total variance. The final factor was named E, which accounted for a 1.55 eigenvalue, representing 3.40% of the total variance. Computed Cronbach's α for reliability test for the constructs were all above 0.7 it is deemed greater than the value recommended by Hair et al 2016. As such the MM practices instrument is deemed to have the required reliability and stability.

5.3 Predictors of MM Practices Constructs on Firm Performance

Multivariate linear regressions was undertaken to determine the expounding potency of the eight extracted MM practices constructs used as prognostic variables on firm performance used as dependent variables with a $p<0.05$ established as a statistical criterion.

The regression model generated adjusted R^2 of 0.67 meaning the regression model explained 67% of the variations in the MM practices constructs on firm performance. This indicates that all the eight variables were good explanatory variables of firm performance and their t-values indicated that these constructs are strong predictors of firm performance. Table 3 shows that, EOQ having β of 0.901 is statistically, a

significant predictor of firm performance with p-values of 0.000 is less than the statistically standardised 5% significant level. Furthermore, ABC, MRPC, SSP, JIT, SM, CMM and E are significantly good MM practices predictors of firm performance. Analysis from the results in Table 3, shows that the most important predictor of the firm performance was EOQ having β of 0.901 and statistically significant at p=0.000≤0.05, followed by ABC with β of 0.406 and statistically significant at p=0.001≤0.05. MRPC was the third best predictor of firm performance, having β of 0.255 and statistically significant at p=0.010 ≤0.05. SSP with β of 0.189 and statistically significant at p=0.002 ≤0.05 was the fourth best predictor of firm performance. JIT was the fifth best predictor of firm performance with β of 0.175 and statistically significant at p=0.010≤0.05. SM was the sixth best predictor of firm performance with β of 0.155 and significant statistically at p=0.001<0.05. CMM was the seventh best predictor of firm performance with β of 0.145 and significant statistically at p=0.003<0.05. E was the last predictor of firm performance with β of 0.105 and significant statistically at p=0.002<0.05.

Table 3: A multiple linear regression of Material Mgt. Practices dimensions on Firm performance

Predictors	**B**	**SE**	**β**	**t-value**	**Sig**
Constant/Intercept	1.505	1.205	7.204	5.978	0.355
Economic Order Quantity	0.351	0.188	0.901	4.793	0.000
ABC Analysis	0.190	0.101	0.406	4.018	0.001
Material Requirement Planning & Control	0.325	0.088	0.255	2.898	0.010
Strategic Supplier Partnership	0.166	0.078	0.189	2.423	0.002
Just-In-Time	0.322	0.074	0.175	2.365	0.010
Stores Management	0.188	0.060	0.155	2.583	0.001
Computerized Materials Management	0.255	0.055	0.145	2.636	0.003
Ergonomics (Human Engineering)	0.251	0.055	0.105	1.909	0.002
Firm Performance	*R^2=0.69 Adjusted R^2=0.67; F-value=30.51; p=0.000, p≤ 0.05*				

Source: Author's Compilation and processing of Field Data (2020) using SPSS 25.0.

The author ensured that the standardised multivariate linear regression model satisfy all the assumptions necessary under multiple linear regression analysis which are the linearity of the phenomenon measured,

constant variance of the stochastic disturbance term (homoscedasticity), independence of the error term and normality of the error term distribution. The Standardized regression model is as follows:

FP = β_0 + (0.901 × EOQ) + (0.406 × ABC) + (0.255 × MRPC) + (0.189 × SSPM) + (0.175 × JIT) + (0.155 x SM) + (0.145 × CMM) + (0.105 × E) + ℓ. Where β_0 and ℓ represent the intercept (constant) and stochastic disturbance term, respectively.

5.4 Discussion

This current study sought to empirically explore MM practices and its effect on performance at the case study firm. Information obtained from respondents indicated that out of the numerous MM practices available, FML implemented the EOQ, ABC, MRPC, SSP, JIT, SM, CMM and E systems. With respect to EOQ, information obtained revealed that, FML has a formal well-laid down inventory control model vis-a-vis the exact quantity of inventory to order during re-order periods, clear policy on order frequencies, buffer level monitoring mechanisms to check stock-out as well as maintaining optimal inventory levels at all times as a risk mitigation measure to avoid overstocking and understocking. This is evident as EOQ recorded a positive and significant β of 0.901, the highest predictor of firm performance as depicted in regression results in table 3. This result is consistent with the study of Ross et al (2008) who observed that, EOQ model is a tactic of ascertaining the optimal inventory level that takes into account the inventory carrying costs, stock-out costs and total costs which are useful in the determination of the correct inventory levels to hold.

With respect to ABC Analysis, which is a technique for prioritizing the management of inventory. Inventories are categorized into three classes - A, B, and C. Information obtained from respondents revealed that, FML's management efforts and oversights are expended on managing A-items. C items get the least attention and B items are in-between. A-items are those of both high-value and high-demand and C items are low-value and low-demand. This practice ensures proper and proficient resource utilization culminating in enhanced profitability and improved firm performance. This is why FML recorded a β of 0.406 making ABC the second best predictor of firm performance.

Information obtained from respondents indicated that FML routinely performs its MRPC function, which involves estimating the individual requirements of parts, preparing materials budget, forecasting the levels of inventories, scheduling the orders and monitoring the performance in relation to production and sales and this has contributed to its improved profitability and firm performance. This is reflected in the firm recording a β of 0.255 making MRPC the third best estimator of firm performance.

It is also apparent that, FML is managing its partnership with its selected supplier's pretty well as information gathered from respondents indicated that FML since its inception has placed great emphasis on establishing excellent long term relationship with its supplier's and this has yielded enormous mutual rewards for both partners. This is reflected in the positive and significant impact of SSP on firm performance recording a β of 0.189 making it the fourth best estimator of firm performance.

Information gathered from respondents showed that FML's JIT practices where it only procures raw materials as and when needed to feed the production schedules devoid of maintaining unnecessary inventory has resulted in improved profitability and enhanced firm performance. This is reflected in the firm recording a β of 0.175 making JIT the fifth best predictor of firm performance.

Again information obtained from respondents indicated that FML practices proper store management systems, having modern state of the art warehousing and refrigerator facilities coupled with tight security and insured stock-in-trade and premises against fire and other allied perils. There is appropriate inventory coding for easy access and tracking purposes all enhancing firm performance. The SM issues is reflected in the firm recording a β of 0.155, making SM the sixth best predictor of firm performance.

Information obtained from respondents indicated that, FML's operations is automated and is assisted by computer applications which is integrated with other business application packages like accounting and sales resulting in improved operational functionability culminating in improved firm performance. This is reflected in the firm recording a β of 0.145 making CMM the seventh best predictor of firm performance. The last estimator of firm performance at FML is ergonomics. Information received from respondents indicated that FML places much emphasis on man-machine arrangements in an attempt to create a very conducive working environment for its employee to get the best out of its human capital to aid boost firm performance. This is reflected in the firm recording a β of 0.105 making CMM the eight predictor of firm performance.

6. Conclusion

This study found a positive and significant relationships/correlation between all eight MM practices and firm performance at FML. This notwithstanding, some MM practices such as EOQ, ABC, MRPC SSP and JIT, contributed more to firm performance than others such as SM CMM and E. As such, there is the need for more work to be done to ensure an improvement in those MM practices that contributed less to firm performance. Management of FML should also channel more resources, to those MM practices that contributed more to firm performance to ensure sustained and continuous improvement.

7. Managerial Implications

This study recommends the following:

- Management of manufacturing firms in general and FML in particular should conventionalise MM practices surveys, using the eight MM constructs utilized in this study i.e. EOQ, ABC, MRPC, SSP, JIT, SM, CMM and E to track firm performance on a routine basis, as this would aid in a decline in production cost, culminating in enhanced profits and improvement in overall firm performance.
- Management of FML in particular and manufacturing firms in general should put in more effort to ensure an improvement in those MM practices that contributed less to firm performance and also channel more resources, to those MM practices that contributed more to firm performance to ensure sustained and continuous improvement in firm performance.
- Management of manufacturing companies requires technical and analytical acumen to systematically access MM practices alternatives as the success of every MM policy very much depend on i.e. the flow of vital information from top management level to every member of the organisation and the receiving of feedbacks by top management.

8. Limitations And Future Research

The research gathered information from survey participants on MM practices and firm performance, and it is highly likely that, some participants may provide information that might portray good image of the very institution in which they work (an occurrence that is referred to as 'desirability' in scientific inquiries lexicon) rather than what actually pertains on the ground. This may affect the quality of the research findings and jeopardise the entire research exercise. Future studies in this area should consider broadening the database by including more manufacturing firms to have a feel of the bigger picture in Ghana.

Declarations

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Appendix

Appendix 1: Material Mgt. Practices Constructs and their corresponding items/variables Definitions	
Factors/Dimensions	**Definitions**
1. Inventory Model - Economic Order Quantity	This is concerned with two main decisions: how much to order (purchase or produce) and when to order so as to minimize the total cost via the minimization of holding and ordering cost.
	1A = The Company has a formal well-laid down inventory model with respect to the exact quantity of inventory to order during re-order periods. ***[Re-order quantity]***
	1B = The Company has a formal well-laid down inventory model with respect to periodic orders i.e. when to order ***[Re-order periods/level]***.
	1C = The Company has a formal well-laid down inventory model with respect to Buffer level mechanisms for regular monitoring to avoid complete stock-out ***[Minimum Level, Safety Stock, Lead time etc.]***
	1D = The Company maintains optimal/appropriate inventory levels at all times as a risk mitigation measure to avoid overstocking ***[Maximum stock level]*** and understocking ***[Minimum stock level]***.
2. Inventory Mgt. Practice	ABC analysis is a well-established categorization technique based on the Pareto Principle for determining which items should get priority in the management of a company's inventory. Inventories are categorized into three classes - A (70-80% of firm annual consumption), B (15-25%), and C (5%). Most management efforts and oversights are expended on managing A items. C items get the least attention and B items are in-between.
[ABC Analysis]	2A = Materials classified as 'A' receives tight control which emanate from high company authority [top level Mgt.]
	2B = Materials classified as 'B' receives moderate control which emanate from middle level Mgt. [departmental heads]
	2C = Materials classified as 'C' receives the least control which emanate from grass root level of authority.
	2D = The Company's overall inventory management philosophy is to prioritize high-valued inventory to maximize its utilisation
3. Material Requirement Planning & Control	This function is based on the sales forecast and the production plans of a company. This involves estimating the individual requirements of parts, preparing materials budget, forecasting the levels of inventories, scheduling the orders and monitoring the performance in relation to production and sales.
	3A = The Company undertakes periodic materials budgeting
	3B = The Company performs periodic inventory level forecasting
	3C = The Company undertakes proper order scheduling for its production activities
	3D = The Company undertake tight/strict performance monitoring in relation to production cost and sales revenue

4. Strategic Supplier Partnership	Assessing the effectiveness and long-term cooperation with fewer dependable suppliers to improve quality. The extent to which purchasing policy emphasizes the need to procure high quality inputs at the least cost possible
	4A = The Company maintain excellent relationships with its suppliers
	4B = The Company provides certification to its suppliers and routine audit takes place to maintain the quality of product standards
	4C = The Company maintains detailed information about its suppliers and their respective performances.
	4D = The Company suppliers regularly takes feedback so as to maintain quality standards.
5. Just-In-Time	The JIT technique is a Japanese philosophy, rationality associated with assembling which comprises having the right things in the right quality and quantity in the correct place and at the opportune time.
	5A = Transportation reliability exist
	5B = Process flexibility and improvement exist [The Company operates an efficient mechanism for alerting suppliers of reorders]
	5C = There is a program to find wasted time and costs in all internal processes [Intolerance for waste and non-value added activities]
	5D = Availability of accurate data to assist in accurate inventory level forecasting
6. Stores Management	This involves physical control of materials, preservation of stores, minimization of obsolescence and damage through timely disposal and efficient handling, maintenance of stores records, proper codification and stocking.
	6A = The Company has modern state of the art warehousing, storage and preservation facilities
	6B = There is proper inventory coding for easy identification, stock-taking and monitoring
	6C = The Company has insured its premises and stock-in-trade against fire and other allied perils
	6D = There is tight security to avoid pilfering/embezzlement/theft
7. Computerized Materials Mgt.	This is the extent by which the firm's daily operations are automated and are assisted by computer applications such as business application software [the extent to which the firm utilizes inventory control software and its integration with the firm's general ledger software], intranet, extranet, internet.
	7A = All purchasing orders are transmitted electronically
	7B = All materials flowing in and out of stock/warehouse are monitored and tracked electronically by the use of advanced information systems
	7C = The Company's materials control systems is integrated with the firm's mother business application software (General Ledger) for proper accounting

	and auditing purposes
	7D = There is strong Inter-departmental coordination based on electronic links.
8. Ergonomics [Human Engineering]	The human factors or human engineering is concerned with man-machine system. Ergonomics is “the design of human tasks, man-machine system, and effective accomplishment of the job, including displays for presenting information to human sensors, controls for human operations and complex man-machine systems.”
	8A = The Company has highly skilled, flexible and multifunctional workforce
	8B = Reliability of machinery and equipment exist for effective and efficient operations
	8C = Worker tasks, duties, functions and roles are well outlined and communicated to all to understand
	8D = Man-Machine arrangement/systems is conducive for optimal performance
Firm Performance	Performance parameters based on employee views are categorised into three: financial, operational and customer service. Financial performance is assessed by eliciting respondent views on firm profitability & market share. Operational performance consists of internal processes, innovation and learning that results in cost efficiencies. Customer satisfaction represents respondent’s views as to whether the firm's customers are satisfied with its production and operation activities or otherwise.
	FM1 = Financial Performance: Profitability & Market share - [Sales revenue. Market share. Return on investment. Return on sale]
	FM2 = Operational Performance: Cost efficiency - [Material acquisition costs/ordering cost. Cost of carrying inventory. Non-quality costs. Warehousing costs. Manufacturing unit costs. Logistics costs. Transportation costs.]
	FM3 = Output level - Operational Performance [Delivery of inputs on-time. Material inventories. Quality inputs. Inspection of incoming materials/components/products. Set-up time. Lead-time. Inventory levels. Rate of defect products. Level of utilization at plant. Product/service quality. Rate of new product development. Level of absenteeism. Employee’s productivity.]
	FM4 = Customer satisfaction - [Response to customer standards. Customer evaluation to firm performance. Continuity to use firm’s product. Recommendation of firm’s product to others]
Source: Author's Constructs based on extant Literature	