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Abstract

This study established the effects of product layout on stores operations. The objectives of the study included; to determine whether costs associated with product layout affects stores operations, to find out whether volume of output in production affects stores operations, to examine how flexibility of product layout affects stores operations. The study was significant to the management of the organization, other manufacturing and processing firms, policy makers and researchers for furthering the research in the future. The study was anchored under the following theories; Transaction Cost Theory, Resource Dependency Theory and Queuing Theory. The researcher reviewed literatures that are relevant to the topic of study, criticize them and identify the gaps to be filled. The study adopted descriptive research design. Primary data were collected using questionnaires and analyzed using SPSS software version 20. The model summary revealed that cost of operations, volume of output and flexibility of product layout explains 45.4% of changes in the dependent variable as indicated by the value of R^2 which implies that there are other factors not included in this model that influence and store operations. Regression results showed that cost of operations had a negative and statistically significant relationship with store operations while volume of output had positive and statistically significant relationship with store operations. Further, regression results showed that flexibility of product layout had positive and statistically significant relationship with store operations of dairy companies. From the study findings, the study concludes that store operations of dairy companies is significantly affected by cost of operations, volume of output and flexibility of product layout. This study recommends cost cutting by choosing better model to conduct store operations among dairy companies. This study recommends more increased volume operations. Continuity of supply of variable inputs should be put into consideration so as the volume of output budgeted to be produced in a day cannot be tampered. The study recommends development of queuing management system to reduce time wastage during store operations.

Key words: *product layout, stores operation, volume of output in production, product layout, dairy companies*

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1.1 Introduction

Stores layout is the design which a stores interior is set up to provide the best exposure possible and to create an attractive image for consumers (Jennifer, 2017). The objective of a stores layout is to allow equipment and workers to operate effectively that is, reduce material handling, simplify the manufacturing process, build in flexibility and keep employees safe. Layout design is fundamentally the plan of machines or workstations at creation floor to give smooth development of assets, for example, crude materials and laborers. A viable format configuration is significant for acceptable assembling of items or conveyance of administrations (Drira *et al.*, 2007). There are four essential sorts of designs, process format, item design, cross breed format, and fixed position design (Mikell, 2007). Process layout consists of functioning groupings of machines or activities that do similar work, it's applicable when the same operation must intermittently produce many different products or serve many customers; most common is job shop production. Product layout ensures continuous-flow, mass production, and batch processing arrangement. This product arrangement allows for continuity in production and use of specialized handling equipment since all products move in the same direction.

Hybrid layout also known as cellular layout or Group Technology (GT), some portions are arranged as process layout others product layout. They are used when components are made from raw materials and assembly operations in which components are assembled into finished products. Fixed- position layout is commonly used in the construction of large items such as airplanes, rather than moving the item from one work center to another tools and components are brought to one place for assembly, this thus minimizes the number of times that the product must be moved and often it is the only feasible solution.

Product layout deployed on a large scale requires more space than any type of layout since the tools and equipment cannot be shared easily between workers performing the same task on different product. This absence of excess underway region can resulting to increased costs for the gear since each repetitive station needs a full arrangement of hardware and devices to play out the work freely. Stores are one of the most important part in the logistics systems in a company; they contribute about 20% of the logistics costs (Koster Rene de, 2007). Also Baker (2009) mentioned in their paper the capital and operational costs of stores in USA is about 22% of logistics costs and its 25% in Europe.

Stores operations is a crucial factor that organizations need to put into consideration. If an organization can use the appropriate stores layout this can drive significant costs down as compared to employing workers. A company can also organize the workstations and this will reduce the risks of repetitive manual tasks, workstations should be designed according to the specific tasks and worker, thus increases ergonomic benefits and drives greater efficiency and productivity in the everyday work.

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Effective adoption of product layout in an organization can help the organization adapt lean manufacturing. Lean manufacturing involves creating a culture of continuous improvement in the cost, quality and service delivery, developing employee empowerment and waste minimization. Womack (1990) suggested five key principles of lean thinking. First, specify what creates value as seen from the customer perspective, secondly, identify all steps across the value stream with the aim of elimination non-value adding activities, thirdly, make actions that create flow that is, link value adding activities effectively so as to deliver total value to the end customer, fourthly, only make what is pulled by customer demand just in time as opposed to producing stock in advance for customer requirements and lastly, strive for perfection by continuously removing the successive layers of waste that is activities that add cost but are not operationally necessary and do not add value.

1.2 Statement of the problem

Stores design is determined by how the company is structured, the type and material they offer too. Even in those cases a proposed design can be used, it is not always clear how the results can be validated (Rouwenhorst, 2000). A proficient stores design can lessen superfluous material taking care of, help to minimize expenses and keep up item move through the office. A wasteful design on your store can tremendously affect your business, this incorporates diminishing profitability, making stock control issues, mistakes in transportation and presenting dangers. With regards to spreading out your distribution center, it's essential to misuse the full space that is maintain a strategic distance from underutilization or overutilization of the space.

Product layout has been credited with helping to ensure that there is a smooth progression of creation, lower material dealing with costs since the machines are organized dependent on the arrangement of tasks and there is no backtracking, there is lesser work-in-progress since the creation procedure is consistent and continuous , there is ideal space use since the machines are in a successive way, there is likewise compelling usage of assets since there is least development of workers , reduced wastage , effective supervision and saving on time. On the other hand there are problems associated with product layout in stores operations, which include dreariness since laborers are occupied with dreary nature of work, total stoppage during breakdown since yield of one machine is the contribution of the following machine. Inflexibility is additionally another issue since activities are acted in a successive way making alterations inconceivable. High work costs is additionally another issue since laborers chip away at explicit machines consequently they need information to deal with different machines along these lines if there should be an occurrence of non-attendance of a specialist occupied with a specific machine, the whole work process might be influenced.

Research done earlier cast doubt on the effectiveness of product layout on stores operations. Some companies using product layout other than other types of layout experience positive performance outcomes while others do not. Product layout is expensive since machines in this type of layout are arranged on the sequence of operations and not according to the function they perform therefore it results to duplication of machines needed for different lines of production. This study established the effects of product layout on stores operations through a case study of dairy farms.

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1.3 Objectives of the study

i. To determine whether costs associated with product layout affects stores operations of dairy farms.
ii. To find out whether the volume of output in production affects stores operations of dairy farms.
iii. To examine how flexibility of product layout affects stores operations of dairy farms.

2.0 Literature Review

2.1 Theoretical literature

2.1.1 Transaction Cost Theory

To evaluate the influence of cost on stores operations, this study was based on the Transaction Cost Theory. This is one of the most influential theories. It tries to explain why companies exist and why companies expand or source out activities to the external environment. Transaction Cost Theory explains how firms can reduce costs of machines by using product layout in stores operations .TCT supposes that companies should try to minimize the production costs in the firm and the transaction costs within the markets. According to (Cease, 1937) each organization will extend as long as the organization's exercises can be performed less expensive inside the association as opposed to redistributing the exercises to outside suppliers in the market. Unit costs in product layout are relatively high due to the high volume of products that are produced within a short period of time therefore there could be operational costs which could be transferred to customers in form of high prices of commodities. There are transaction costs incurred each and every time a product or service is in transition from one stage to another (Williamson, 1993).

2.1.2 Resource Dependence Theory

This theory states that firms do not have all the resources they need therefore to some level they depend on the external environment for resources (Salanick, 1978) .this theory was developed to provide alternative perspectives to economic theories and to understand precisely the types of returns on investment that have played such a large role in recent marker failures (Pfeffer, 2003). Product layout can produce large amounts of output at a given period of time, it is therefore necessary for the organization to ensure there is constant supply of variable inputs thus enhancing technical efficiency that is maximum output is produced with a combination of inputs, and economic efficiency is achieved in that the production of the output is at the lowest possible cost.

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2.1.3 Queuing Theory

According to Shafeek (2014) stated that utilization of this theory in manufacturing processes can help to foster better productivity depending on the decisions made while in the waiting line. Important performance of queuing model will be determined as a guide to increase efficiency of each workstations and suggestion to increase performance of each workstation. According to the book Quantitative Analysis for Management (1999), states that assembling plants must decide the ideal number of mechanics to have on the job each move to fix machines that breakdown. There are costs that a firm experiences while there is a queue in the firm, such as service costs. As service improves in speed, the costs spend while waiting on the queue will also reduce, in a manufacturing scenario there will be loss of productivity due to workers awaiting repairs for their tools or machines.

Queuing theory has various characteristics, they include; arrival characteristics, which states that the service system has three characteristics such as the size of calling population which can either be finite or infinite, patterns of arrival at the system which is analyzed by a probability distribution known as the Poisson distribution and lastly the behavior of the arrivals which can be bulk whereby a customer refuses to enter a line because it's too long to suit its needs or renege where customers who enter a queue become impatient and they leave. The second characteristic is waiting in line, whereby most systems prefer using the First-In First –Out (FIFO) rule, in a manufacturing set-up the organization will organize the stock in this system thus ensuring that the stock that entered first leaves first. Lastly there is the service quality characteristic; the organization should consider the configuration of the service system and the pattern of the service times. The pattern of the service times can either be single-channel system, where there is only one server, multiple –channel system where there are many servers to take care of the customers or it can be either a single-phase system where the customer receive service at one point before leaving the organization or multiphase system where the customer receives services at various points in the organization before leaving. If the organization adopts queuing theory it ensures that stores operations are conducted in a sequential manner that adjustments in course of production can be made, thus enhancing flexibility of stores operations in the organization.

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2.2 Conceptual framework

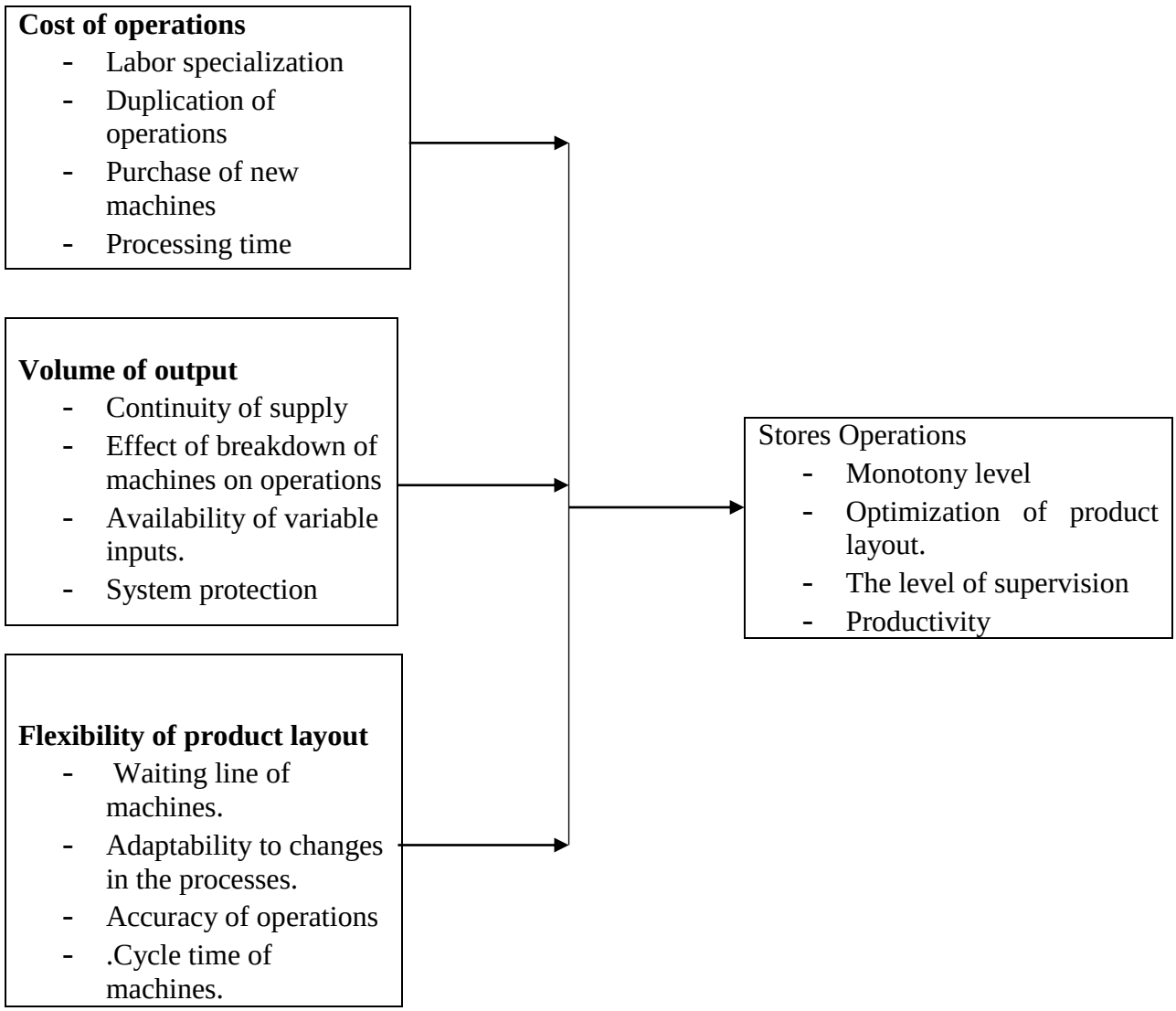

Figure 1: conceptual framework

3.0 Research Methodology

This study utilized a descriptive research design. The study population of this study was 81 dairy farms in Illinois. The researcher used semi-structured questionnaires which contains close-ended questions. Data gathered was analyzed using the MS- Excel 2010 as it helped to develop frequencies and percentages. Multiple regression predicted the linkage between product layout and stores operations.

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4.0 Presentation and Discussion of Results

4.1 Introduction

4.2 Descriptive results

Descriptive results items in the study. Tabulation is conducted and presentation done in form of frequencies.

4.2.1 Cost of operations and store operations of dairy farms

The study determined whether costs associated with product layout affects stores operations of dairy farms. Participants answered items on cost of operations as shown in table 1.

Table 1: Cost of operations and store operations of dairy farms

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
Labor specialization affects the level of supervision in the stores	43.8%	30.1%	4.1%	15.1%	6.8%	2.1	1.3
Duplication of operations has effects on the level of monotony in the stores operations	43.8%	28.8%	8.2%	8.2%	11.0%	2.1	1.4
Purchase of new machines affects the level of productivity	43.8%	27.4%	11.0%	8.2%	9.6%	2.1	1.3
The processing time of machines affects the level of productivity	34.2%	34.2%	11.0%	12.3%	8.2%	2.3	1.3
Average						2.2	1.3

Table 1 indicated that majority 73.9% agreed that labor specialization affects the level of supervision in the stores. Outcome also showed that majority of the respondents 72.6% of the respondents agreed that duplication of operations has effects on the level of monotony in the stores operations. The results also showed that majority of the respondents 72.2% of the respondents agreed that purchase of new machines affects the level of productivity. Finally, majority 68.4% of the respondents agreed that the processing time of machines affects the level of productivity. Mean response was 2.2 implying that respondents were agreeing to the statements in the questionnaire.

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4.2.2 Volume of output and store operations of dairy farms

The study determined whether the volume of output in production affects stores operations of dairy farms. Employees answered items on volume of output as shown in table 2.

Table 2: Volume of output and store operations of dairy farms

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
There is continuity of supply of variable inputs affecting the level of productivity and volume of output	39.7%	30.1%	13.7%	8.2%	8.2%	2.2	1.3
Breakdown of machines affects the volume of output of production hindering effective productivity	37.0%	26.0%	13.7%	15.1%	8.2%	2.3	1.3
The availability of variable inputs affects the volume of output and productivity	37.0%	31.5%	11.0%	11.0%	9.6%	2.2	1.3
The systems protection affects the volume of output thus interfering with the productivity	39.7%	23.3%	15.1%	9.6%	12.3%	2.3	1.4
Average						2.3	1.3

Table 2 indicated that majority 69.8% agreed that there is continuity of supply of variable inputs affecting the level of productivity and volume of output. Outcome also indicated that majority of the participants 63.0% of the respondents agreed that breakdown of machines affects the volume of output of production hindering effective productivity. The results also showed that majority of the participants 68.5% of the respondents agreed that the availability of variable inputs affects the volume of output and productivity. Finally, majority 63.0% of the respondents agreed that the systems protection affects the volume of output thus interfering with the productivity. Mean response was 2.3 implying that respondents were agreeing to items in the questionnaire.

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4.2.3 Flexibility of product layout and store operations of dairy farms

The study examined how flexibility of product layout affects stores operations of dairy farms. Result findings were presented in table 3.

Table 3: Flexibility of product layout and store operations of dairy farms

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
Product layout affects the waiting line of machines thus affecting flexibility	34.2%	31.5%	9.6%	12.3%	12.3%	2.4	1.4
Product layout interferes with adaptability to changes in the processes involved in the stores thus hindering flexibility	39.7%	28.8%	13.7%	9.6%	8.2%	2.2	1.3
Product layout affects accuracy of stores operations in the organization hindering flexibility	30.1%	35.6%	15.1%	8.2%	11.0%	2.3	1.3
The cycle time of machines hinders the flexibility of product layout	41.1%	23.3%	13.7%	12.3%	9.6%	2.3	1.4
Average						2.3	1.3

Table 3 revealed that majority 65.7% agreed that product layout affects the waiting line of machines thus affecting flexibility. Outcome of study also indicated that majority of participants 68.5% of the respondents agreed product layout interferes with adaptability to changes in the processes involved in the stores thus hindering flexibility. The results also showed that majority of the respondents 65.7% of the respondents agreed that product layout affects accuracy of stores operations in the organization hindering flexibility. Finally, majority 64.4% of the respondents agreed that the cycle time of machines hinders the flexibility of product layout. Mean response was 2.3 an implying that respondents were agreeing to items in the questionnaire.

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4.3 Correlation analysis

It was noted that cost of operations and store operations negatively and statistically significant correlate (r=-.477, p = .000). Volume of output and store operations are positively and significantly associated (r = .495, p = .000). Flexibility of product layout had a positive and significant association with store operations (r = .521, p = .000).

Table 4: Correlation matrix of variables

Variable		Stores Operations	Cost of operations	Volume of output	Flexibility of product layout
Stores Operations	Pearson Correlation	1	-.477**	.495**	.521**
	Sig. (2-tailed)		0.000	0.000	0.000
Cost of operations	Pearson Correlation	-.477**	1	-0.221	-.399**
	Sig. (2-tailed)	0.000		0.060	0.000
Volume of output	Pearson Correlation	.495**	-0.221	1	.344**
	Sig. (2-tailed)	0.000	0.060		0.003
Flexibility of product layout	Pearson Correlation	.521**	-.399**	.344**	1
	Sig. (2-tailed)	0.000	0.000	0.003	

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

4.4 Regression Analysis

Store operations were regressed against cost of operations, volume of output and flexibility of product layout. The regression analysis was undertaken at 5% significance level. The study obtained the model summary statistics as shown in table 5.

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.673	.454	.430	.48712

R square in table 5 was .454 implying that 45.4 percent of store operations are caused by changes in cost of operations, volume of output and flexibility of product layout. Other variables not included in the model justify for 54.6 percent of the variations in store operations of dairy farms. Table 6 shows the ANOVA outcome.

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Table 6: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.591	3	4.530	19.093	.000
Residual	16.373	69	.237		
Total	29.964	72			

The model with p value 0.05<0.000 implies that the model is satisfactory in predicting how cost of operations, volume of output and flexibility of product layout influence store operations of dairy farms. The F value derived indicates that the data used was linear and therefore can be used for regression analysis.

The analyst utilized t-test to decide the centrality of every individual variable utilized right now an indicator of store activities of dairy ranches. The p-esteem under sig. section was utilized as a marker of the hugeness of the connection between the ward and the autonomous factors. At 95% certainty level, a p-estimation of under 0.05 was deciphered as a proportion of measurable noteworthiness. Thusly, a p-value above 0.05 demonstrates a factually unimportant connection between the ward and the free factors. The model is shown appeared in table 7.

Table 7: Regressions of coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.866	.436		4.286	.000
Cost of operations	-.203	.069	-.287	-2.945	.004
Volume of output	.299	.086	.331	3.473	.001
Flexibility of product layout	.258	.089	.293	2.897	.005

From the above results, it is evident that cost of operations had a negative and statistically significant relationship with store operations of dairy farms (r =.-203, p = .004), volume of output had positive and statistically significant relationship with store operations of dairy farms (r =.299, p = .001). Further, flexibility of product layout had positive and statistically significant relationship with store operations of dairy farms (r =.258, p = .005). The following regression equation was estimated:

$Y = 1.866 - 0.203X_1 + 0.299X_2 + 0.258X_3$

Where,

Y = Stores Operations

X_1= Cost of operations

X_2 = Volume of output

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X_3 = Flexibility of product layout

On the estimated regression model above, the constant = 1.866 shows store operations of dairy farms if (cost of operations, volume of output and flexibility of product layout) were put at zero. A unit increase in cost of operations would lead to a decrease in store operations of dairy farms by -0.203. A unit increase in volume of output would lead to an increase in store operations of dairy farms by 0.299 units. Further, a unit increase in flexibility of product layout would lead to an increase in store operations of dairy farms by .258.

5.0 Conclusion

From the study findings, the study concludes that store operations of dairy farms is significantly affected by cost of operations, volume of output and flexibility of product layout. The study found that cost of operations had a negative and statistically significant relationship with store operations at of dairy farms. The study therefore concludes that a unit increase in cost of operations would lead to a unit decrease in store operations of dairy farms.

The study found that volume of output had positive and statistically significant relationship with store operations of dairy farms and therefore it is concluded that a unit in increase in volume of output leads to a unit increase in store operations of dairy farms.

It was also concluded that flexibility of product layout had positive and statistically significant relationship with store operations of dairy farms implying that a unit in increase in flexibility of product layout leads to a unit increase in in store operations of dairy farms.

Finally, the study concludes that the independent variables selected for this study that include cost of operations, volume of output and flexibility of product layout influences store operations of dairy farms. It is therefore partially sufficient to conclude that these variables significantly influence store operations of dairy farms as shown by the p value in ANOVA summary. The fact that the predictor variables explain 45.4% of changes in store operations at of dairy farms implies that there are other factors influencing in store operations of dairy farms that were not included in the model.

6.0 Recommendations

The study established that cost of operations had a negative and statistically significant relationship with store operations of dairy farms. This study recommends cost cutting by choosing better model to conduct store operations of dairy farms. Adoption of transaction cost theory by the organization to help the organization minimize unnecessary costs thus high cost of production will not be passed to customers in terms of high prices.

The study found that volume of output has positive and statistically significant relationship with store operations of dairy farms. This study recommends more increased volume operations. Continuity of supply of variable inputs should be put into consideration so as the volume of output budgeted to be produced in a day cannot be tampered. The organization therefore needs to hire a large number of maintenance workforces so as to cater for any breakdowns of the machines so that production process can continue.

Finally, flexibility of product layout had positive and statistically significant relationship with store operations of dairy farms. The adoption of queuing by the organization will help to reduce cycle time and the waiting line of the machines thus enhancing a continuous flow of activities in the stores. The study recommends development of queuing management system to reduce time wastage during store operations.

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