

# The Effect of Internal Supply Chain Management Practices on the Operational Performance of Technical Universities in Ghana

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**Abstract**— This study sought to establish the effect of internal supply chain management practices on the operational performance of tertiary educational institutions in Ghana, particularly the Bolgatanga Technical University in the Upper East Region. The study employed descriptive and inferential research design methods. A survey was conducted using an interviewer-administered questionnaire containing five-point Likert scale test items. Survey data was collected from two hundred and three continuing students of the Bolgatanga Technical University. The data entry software Census and Survey Processing System (CSPro) was used for the data entry and subsequently exported into Statistical Package for Social Sciences (SPSS) for analysis. Data analysis and interpretation was based on descriptive and inferential statistics using multiple regression analysis. Exploratory factor analysis (EFA) was deployed as a construct validation tool. The study's findings revealed that educational internal supply chain practices such as academic training, classroom setting/environment, and non-academic activities (sports and recreation) were significant, whereas the source of admission information, examination, infrastructure, and alumnae activities were not. Since data was collected from continuing students of only the Bolgatanga technical university, it is suggested that a similar study be replicated to include more technical universities and to include all levels of students. The novelty of this research is that supply chain performance is generally assessed from a managerial perspective, but in this study,

the operational performance of technical universities is evaluated from a customer (student) perspective.

**Keywords:** *Internal supply chain management, supply chain practices, operational performance, supply chain management, technical university, tertiary education, Ghana.*

## 1. Introduction

The efficient and effective coordination of all supply-related operations of a business, from partners and suppliers to customers, is known as supply chain management. It is a widely used business concept that encompasses all stages of the manufacturing process, from raw materials acquisition through finished goods to delivery to final consumers [1]. In recent years, supply chain management strategies have become increasingly vital for the growth and sustainability of public organizations [38]. Competition is now between supply networks rather than companies as effective supply chain management (SCM) has emerged as a potentially significant method of achieving competitive advantage and enhancing organizational performance. Effective operational, investment and financing activities are required for supply chains to achieve optimum financial performance [49]. Operational performance is best described as the ability of several company units to cohesively work together to produce more output. It is the level at which all functional departments of a

company work together to achieve specified corporate objectives [4]. The concept of Internal Supply Chain Management (ISCM) must be viewed in terms of the value chain. It refers to a combination of systems and operations an organization uses to create its products and services for sale [26]. This can also be described as a chain of activities within a company that concludes with providing a product to the customer. This process involves multiple functions within companies such as sales, production and distribution. For institutions operating within the educational sector, ISCM should comprise all activities and processes within these tertiary educational institutions that result in the graduation of employable graduates [13]. This will include processes of student admissions, academic training, classroom setting/environment, examination and non-academic training activities like sports and recreation. A lot is expected of tertiary educational institutions because society demands an educational system that allows for stakeholder participation, transparency and accountability in accordance with good governance principles [14]. By connecting their internal activities with external stakeholders like suppliers and students, effective ISCM strategies can help technical universities increase their operational performance and competitive advantage [27]. Additionally, the adoption of ISCM practices has improved corporate organizations' operational performance, which has strengthened organizational competitiveness [19]. All the then 10 polytechnics in Ghana were converted by Act 922 (2016) into Technical Universities to provide technically oriented programmes to graduates for the Ghanaian employment market. This study will therefore contribute to a more in-depth analysis of the impact of ISCM practices on the operational

performance of technical universities in developing countries like Ghana.

### **Statement of the Problem**

The primary objectives of tertiary educational institutions are to generate employable graduates, undertake research and provide academic services to the general public [13]. Higher education not only trains individuals for adequate and relevant professional skills but also ensures active participation in their communities and cultures [47]. Many tertiary institutions struggle to attract the necessary number of students to operate efficiently. This situation is exacerbated by the inability of these institutions to produce graduates who are suitable for the industry [25]. According to [2], while higher education in Ghana contributes to the country's socioeconomic development through research generation and human capital development, there is a mismatch between the tertiary educational curricula and the country's national developmental needs.

Existing literature shows that a significant amount of study has been conducted on supply chain management and operational performance ([1], [24], [37], [16], [13], [27], [19], [31]). The majority of these research, however, concentrated on generic supply chain operations across diverse business organizations. Indeed, relatively few studies have attempted to investigate how internal supply chain procedures affect operational performance, particularly from the perspective of technical universities. To comprehend and appreciate the impact that internal supply chain activities have on operational performance, more research must be conducted. Additionally, most studies have addressed the relationship between supply chain management and operational performance from a managerial

perspective. Motivated by the dearth and paucity of research investigating this issue from the perspective of the customer (student) and in the context of a developing country like Ghana, this study seeks to investigate the effect of internal supply chain management practices on the operational performance of technical universities in Ghana using the Bolgatanga Technical University as the study area.

## 2. Literature Review

### 2.1 Supply Chain Management

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain includes not only the manufacturer and suppliers but also transporters, warehouses, retailers and even customers themselves [11]. Internal supply chain components of an organisation such as manufacturers, intermediaries or service providers operate to receive and fill customer orders. [48] describe supply chain management as a systematic approach to managing flows of assets from sourcing raw materials, product manufacturing, to delivering to end customers. Supply chain management may also be described as the set of activities that connect all the stakeholders in chain type structure and each chain member adds value at every step of production [18]. An important goal of SCM has always been building new capabilities for participating companies that will enable them to have that competitive edge over their competitors [5]. In this context, [12] argued that a clear supply chain strategy aligned with the strategic goals of participating companies should drive business and technical capabilities even in the digital economy. SCM emphasizes the benefit of sharing information, risk and reward sharing, cooperation, all of which based on partnering relationships are still necessary to implement a company's omnichannel and

sustainability strategies [28]. SCM is needed for various reasons: improving operations, better outsourcing, increasing profits, enhancing customer satisfaction and generating quality outcomes [17]. [34] therefore indicates that if SCM principles and technologies can be employed to streamline and optimize the movement of goods and services in business, then they should also be applied in the education sector. Hence, tertiary institutions such as the Bolgatanga Technical University may improve its service delivery by effectively improving the ISCM practices within its operations.

### 2.2 Internal Supply Chain Management

Internal supply chain refers to the chain of activities within a company that concludes with excellence in providing a product or service to the customer [39]. This process involves multiple functions within companies such as production distribution and sales. It refers to the chain of activities within a company, specifically, purchasing, production, sales and distribution. [31] describes a firm's internal supply chain as the chain of value-creating activities or functions within an organization or company that aims at providing a product or service to customers, thus it deals with all processes that are internal to the firm. [42] argues that getting functional areas within the company working together in support of supply chain profitability is just as important as cooperation with external partners for gaining competitive success and satisfied customers. It is generally understood that several elements play a role in achieving long-term and sustainable economic growth. These features are made up of both internal and external supply chain management (SCM) components [3]. Furthermore, the success of a firm is significantly influenced by its internal supply chain management practices [35]. Based on the above literature, it is vital for institutions

operating within the education sector to recognize that internal supply chain management practices have an impact be it directly or indirectly on the final service offered and its ultimate delivery to the consumer.

### **2.3 Internal Supply Chain Management in Tertiary Institutions**

Education is a service whereby the outcome is intangible and consumed at the point of production. The focus has now shifted to customers as partners in the business where they are involved in the service delivery process. In public universities, supply chain activities are very dynamic. As education is one of the sectors with high potential to contribute towards the economic development of most countries, it is important to concentrate on the determinants that will improve the education sector's performance. Internal Supply chain management (ISCM) is one of the best strategies that can be used to improve higher education institutions' performance [6]. More and more organizations in both the public and private sectors are realizing the value ISCM plays in ensuring they can deliver on all aspects of their value chains. Indeed, the core value proposition of any tertiary institution is to attract students, add value to them through training and ensure they become productive members of society [17]. Improving the welfare of the final consumer or society should be one of the key objectives of a tertiary educational supply chain. Educational institutions must have some understanding of the partners in their supply chains, such as suppliers, customers, and society, to accomplish this purpose. To ensure the achievement of desired results, supply chain management performance depends on the seamless coordination of all supply chain players [17]. Internal supply chain management practices in tertiary institutions are unique because the output is usually the quality of education and research to enhance the

value experienced by society. In the tertiary education supply chain, the main supplier of inputs is usually the customers (students) who avail themselves physically, mentally, emotionally and through the information they provide [22].

### **2.4 Operational Performance and Supply Chain Management**

Operational Performance is one of the key success factors for contemporary businesses operating in a challenging and competitive business environment. In reality, a business can continue to operate at a strong and favorable level while still experiencing great success by offering top-notch goods or services to customers at competitive prices [1]. Two distinct elements of supply chain management those corporate institutions must incorporate into their daily operations are end-user services and business efficiency [24]. Several conducted studies have established the link between Supply Chain management (SCM) and the operational performance of companies around the world. The research findings of [21] revealed that supply chain practices such as quality of information sharing, internal supply chain process, and lean practices had a significant influence on organizational performance. Another study by [1] revealed that a strong association exists between supply chain management and firms' operational performances. According to [37], while internal supply chain management practices do not directly affect operational performance, they do increase it indirectly. The findings of [16], which also revealed that SCM practices have a significant impact on a company's operational success, further enhance the already-existing association between internal supply chain management practices and operational performance. Additionally, [6] revealed that SCM practices have a favorable effect on university

performance, particularly in the areas of information exchange and innovation. Based on the literature reviewed above, it has been established that the SCM practices of corporate institutions have either a direct or indirect impact on operational performance. For the purpose of this study, the operational performance of technical universities is evaluated using a combination of seven ISCM practices: the Source of admission information, Academic training, Classroom environment, Examination, Infrastructure, Non-academic training, and Alumnae activities.

## 2.5 Theoretical Review

The current study is based on the Resource-Based View (RBV) theory. The RBV theory begins by supposing that firms are bundles of resources and capabilities. It describes an institution as a strategic entity or social structure that exists as a more or less efficient mechanism for creating and allocating economic value to society [7]. One of the most successful theoretical approaches in the field of strategic management, resource-based logic suggests that firms that behave as if their shareholders are their only residual claimant will not be able to attract the kinds of resources and capabilities needed to generate economic value [8]. RBV has been used in management studies to explain the resources firms have to create and maintain a sustained competitive advantage which directly improves the performance of higher education institutions [15]. As part of strategic management, experts have proposed the resource-based view theory (RBV), which is concerned with the strengths and weaknesses of institutions by identifying ways to avoid vulnerabilities in their operations [44]. [30] contend that the RBV theory can explain the

significance of new resources in technology, knowledge and connections, highlighting the role of SCM in continuously responding to changes in the business environment. Several studies have also investigated theory to explain the link between RBV and business operational performance ([20], [8],[32]). RBV has emerged as a relevant management theory in which businesses examine their resources and strive to enhance their performance [45]. Hence, drawing from the RBV theory, technical universities can gain a competitive advantage by attracting and efficiently utilizing resources, promoting academic programs offered, providing adequate infrastructure, and promoting extracurricular activities such as sports and recreation.

Based on the above review of literature this study hypothesized:

**H<sub>1</sub>:** Source of Admission information (SOA) has a positive effect on the Operational Performance (OP) of technical universities

**H<sub>2</sub>:** Academic Training (ACAT) has a positive effect on the Operational Performance (OP) of technical universities

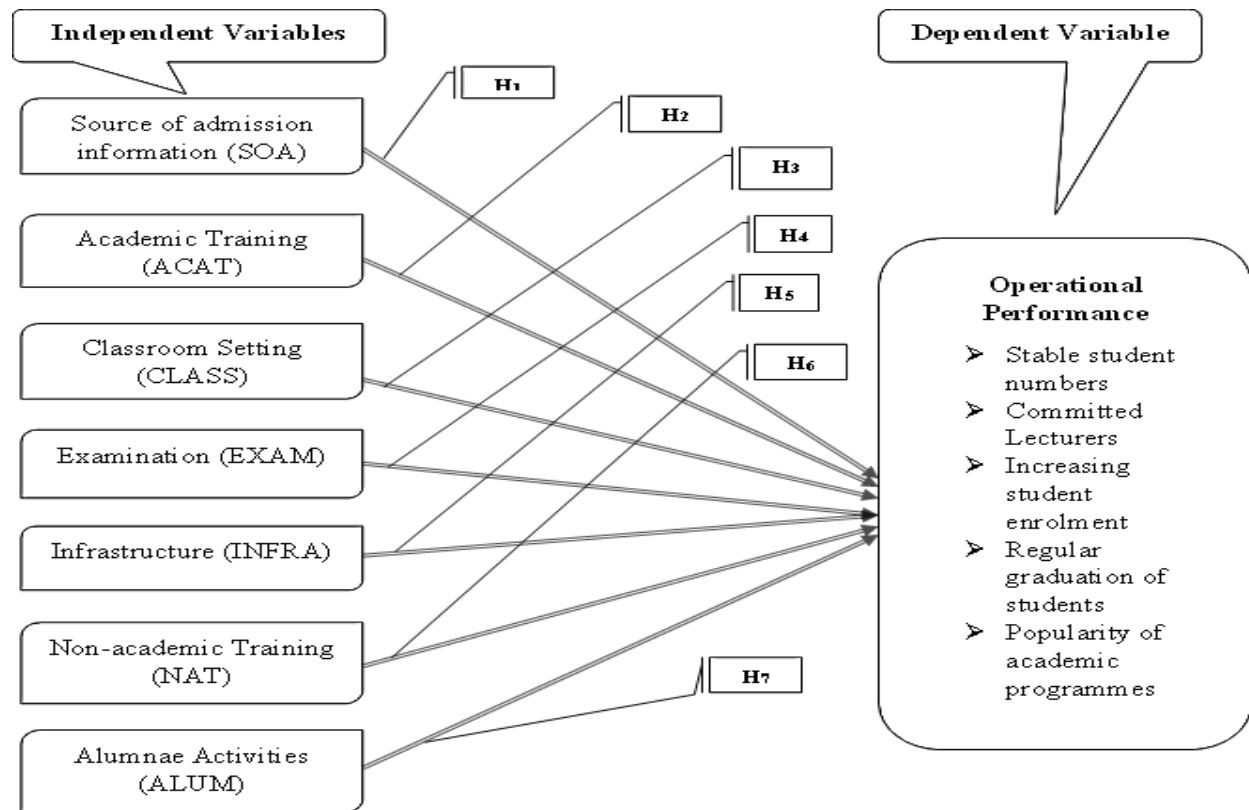
**H<sub>3</sub>:** Classroom Setting (CLASS) has a positive effect on the Operational Performance (OP) of technical universities

**H<sub>4</sub>:** Examination (EXAM) has a positive effect on the Operational Performance (OP) of tertiary institutions

**H<sub>5</sub>:** Infrastructure (INFRA) has a positive effect on the Operational Performance (OP) of technical universities

**H<sub>6</sub>:** Non-academic Training (NAT) has a positive effect on the Operational Performance (OP) of technical universities

**H<sub>7</sub>:** Alumnae Activities (ALUM) has a positive effect on the Operational Performance (OP) of technical universities



**Figure 1: Research Framework**

### 3. Methodology

A descriptive research design was adopted for this study. The population of the study was 750 continuing students consisting of level 200 and level 300 students of the Bolgatanga Technical University. Using simple random sampling, a sample size of 261 students were selected using Yamane's (1967) formula for sample size determination with a 0.05 margin of error. Of the 261 questionnaires that were sent out to respondents, 203 copies (approximately 78% return rate) were successfully retrieved and were deemed useful for analysis. The data entry software Census and Survey Processing System (CSPRO) version 7.7 was used for the data entry and subsequently exported into Statistical Package for Social Sciences (SPSS) version 23 for analysis. Exploratory Factor Analysis (EFA) was applied as a construct validation tool to determine the validity of the research instrument and the reliability

was measured by calculating Cronbach's Alpha Reliability Coefficient. Multiple regression was done with the aid of SPSS version 23 to determine the effect of internal supply chain management practices on the operational performance of technical universities in Ghana with particular reference to the Bolgatanga Technical University.

#### 3.1 Measurement Model

The study employed Exploratory Factor Analysis (EFA) and Multiple Regression analysis to examine the effect of ISCM practices on the operational performance of technical universities.

##### 3.1.1 Exploratory Factor Analysis

Exploratory factor analysis (EFA) is a statistical technique used to reduce data to a smaller set of summary variables and to explore the underlying theoretical structure of the phenomena. EFA is one of

a family of multivariate statistical methods that attempts to identify the smallest number of hypothetical constructs that can parsimoniously explain the covariation observed among a set of measured variables [46]. The EFA was employed to test the accuracy of the scale and increase the explanatory power of the research scale or model [41].

### 3.1.2 Regression Analysis

Regression models are used to describe relationships between variables by fitting a line to the observed data. Regression allows you to estimate how the dependent variable changes as the independent variable(s) change. Multiple linear regression is used to estimate the relationship between two or more independent variables and one dependent variable [10]. Multiple regressions also allow determining the overall fit of the model and the relative contribution of each of the predictors to the total variance explained.

#### Assumptions of multiple linear regression

Multiple linear regression makes all of the same assumptions as simple linear regression:

- i. Homogeneity of variance (homoscedasticity): the size of the error in our prediction doesn't change significantly across the values of the independent variable.
- ii. Independence of observations: the observations in the dataset were collected using statistically valid methods and there are no hidden relationships among variables.
- iii. In multiple linear regression, it is possible that some of the independent variables are correlated with one another, so it is important to check these before developing the regression model. If two independent variables are too highly correlated ( $r_2 > \sim 0.6$ ), then only one of them should be used in the regression model.

The equation for the regression model for this study is described below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \epsilon$$

Y is the dependent variable, i.e., Operational performance,  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\beta_4$ ,  $\beta_5$ ,  $\beta_6$ , and  $\beta_7$  are the coefficients or multipliers that describe the size of the effect the independent variables have on the dependent variable. Also,  $X_1$ ,  $X_2$ ,  $X_3$ ,  $X_4$ ,  $X_5$ ,  $X_6$  and  $X_7$  represent the independent variables, i.e., Source of admission information, Academic training, Classroom setting, Examination, Infrastructure, Non-academic training and Alumnae activities respectively.  $\epsilon$  is the error term.

## 4. Results and Discussions

The study targeted continuing students of the Bolgatanga Technical University in the Upper East Region of Ghana. A total of 261 students were targeted for this study for which 203 questionnaires were successfully completed representing a retrieval (response) rate of approximately 78%.

### 4.1 Biographic Data of Respondents

The demographic information of respondents to the questionnaire on the effect of internal supply chain management practices on the operational performance of technical universities is presented in Table 1 below.

**Table 1: Biographic Data of Respondents**

Biographic Factors	Frequency	Percent (%)
<b>Age of Respondents</b>		
20-25 years	136	67.0
26-30 years	48	23.6
31-35 years	8	3.9
36-40 years	10	4.9
Above 40 years	1	0.5
<b>TOTAL</b>	<b>203</b>	<b>100.0</b>

<b>Level of Education</b>		
HND	203	100
B. Tech	0	0.0
DBS	0	0.0
<b>TOTAL</b>	<b>203</b>	<b>100.0</b>
<b>Student Level</b>		
Level 200	122	60.1
Level 300	81	39.9
<b>TOTAL</b>	<b>203</b>	<b>100.0</b>

**Source: Field Survey, 2022**

In terms of the age of respondents, 67% of respondents were more than 20 years of age while 23.6% were within the age range of 31-35 years. This implies that most of the respondents were fairly experienced and knowledgeable about the operations of the technical university. Also, all 203 respondents at the time of the study were pursuing various Higher National Diploma (HND) programmes at the university. Additionally, 60.1% of the respondents were level 200 students while 39.9% were students at level 300.

#### **4.2 Effect of Internal Supply Chain Management on Operational Performance**

To effectively investigate the relationship between internal supply chain practices and operational performance, the reliability and validity of the research instrument were measured and the results of the goodness of fit are presented below:

**Table 2: Measures of Goodness Fit**

<b>Cronbach's Alpha Reliability Coefficient</b>		<b>0.856</b>
Bartlett's Test of Sphericity	Chi-Square	2985.199
	Degree of freedom	861
	p-value	0.000
<b>Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy</b>		<b>0.759</b>

**Source: Field Survey, 2022**

To check the internal consistency of construct items a well-known test Cronbach Alpha was used in this research. The questionnaire consisted of 42 items and the value for Cronbach's Alpha for the survey as depicted in Table 2 below was  $\alpha = 0.856$ . An Alpha coefficient value of 0.856 implies that should the instrument be replicated in a similar research environment the result is almost 86% likely to be the same. The reliability coefficient of 0.856 is acceptable and indicates satisfactory internal consistency reliability [9].

To check content validity, factor analysis was employed to identify fewer expressions that explain the structure of the research scale. Assessment from Bartlett's Test also revealed a Chi-Square value of 2985.199, a degree of freedom of 861 and a p-value of  $0.000 < \alpha - \text{value of } 0.05$  which is highly significant at the 5% level of significance. Also, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value of 0.759 can be said to be acceptable and high enough to signal that the manifest variables have so much in common to warrant the basis for the application of EFA to the empirical data [40]. This information is presented in Table 2 below.



This study was conducted to determine if various internal supply chain management practices can influence the operational performance of technical universities. It was hypothesized that Source of Admission information (SOA), Academic Training (ACAT), Classroom setting (CLASS), Examination (EXAM), Infrastructure (INFRA), Non-academic Training (NAT) and Alumnae activities (ALUM) will have a positive effect on Operational Performance. To test this hypothesis, multiple regression analysis was

used. The results from Tables 3 and 4 below indicate that 31.8% of the variance in the operational performance of tertiary institutions can be accounted for by the seven predictors, collectively,  $F(7,195) = 12.967$ ,  $p\text{-value} < 0.05$ . As a result, there is evidence that at least one of the independent variables influences the dependent variable and the proposed model is a significant predictor of the operational performance of technical universities

**Table 3: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.564 <sup>a</sup>	.318	.293	.62010

**a. Predictors: (Constant), ALUM, ACAT, SOA, INFRA, CLASS, NAT, EXAM**

Source: Field Survey Results, 2022.

**Table 4: Analysis of Variance (ANOVA)**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	34.904	7	4.986	12.967	.000 <sup>b</sup>
Residual	74.983	195	.385		
Total	109.887	202			

**a. Dependent Variable: OP**

**b. Predictors: (Constant), ALUM, ACAT, SOA, INFRA, CLASS, NAT, EXAM**

Source: Field Survey Results, 2022

The beta coefficients explain the influence of the independent variables on the dependent variables. Examining the unique individual contributions of the predictors as presented in Table 5 below indicate that Academic training ( $\beta = 0.216$ ,  $t = 3.084$ ,  $p = 0.002$ ),

Classroom setting ( $\beta = 0.288$ ,  $t = 4.024$ ,  $p = 0.000$ ) and Non-academic training activities ( $\beta = 0.115$ ,  $t = 2.165$ ,  $p = 0.002$ ) positively predict the Operational performance of technical universities.



examine the effect of internal supply chain management practices on the operational performance of technical universities. The results of this study offer new indications regarding internal supply chain management practices that favour the financial and economic sustainable performance of technical universities in Ghana. The findings of the study highlighted that better coordination and improvement of internal supply chain practices such as academic training, classroom setting and non-academic training significantly influence the operational performance of technical universities.

The study's findings should provide managers of technical universities with enough knowledge to successfully coordinate and enhance their internal operations. For instance, given the limited funding available to operate technical universities, internal supply chain operations such as academic training, classroom setting and non-academic training activities like sports and recreation should be prioritized or given special attention because they have a significant impact on operational performance. Furthermore, the study's findings will assist organizations in the higher education sector to appreciate the value of internal supply chain management methods in increasing student enrolment rates and producing employable graduates that match the demands of the industry.

### 5.1 Limitations of the Study

The study could not capture responses of students from all academic levels at BTU but rather sampled only level 200 and 300 students. Furthermore, only students from one of Ghana's ten technical universities took part in the study. Additionally, the model could only partially explain the variability in operational performance, indicating that several additional factors may have an impact on the operational performance of

technical universities. Therefore, it is advised that a comparative study be conducted with the participation of students at all academic levels in other technical universities in Ghana.

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B.T.J (Bolgatanga Technical University) generated the idea for the article, analyzed part of the data and wrote the abstract. O.A (Bolgatanga Technical University) was responsible for reviewing and synthesizing the literature and putting the final pieces of this article together.

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