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Education sector structural digital transformations in comprehensive Universities of Ethiopia in post COVID-19 periods

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Abstract
Background: The COVID-19 virulent disease has resulted in provisional shutting down of higher education institutions around the globe. It has its pros and cons. In the educational years 2019 to 2021, the pandemic distorted the way of teaching and learning, accelerating renovation that taking place in the form of digital learning and teaching. Because of COVID-19, in Ethiopia, employ and incorporation of digital technologies in teaching has been adopted from March, 2020.
Methods: To analyze the impact of Information and communication technology in COVID-19 effected comprehensive universities of Ethiopia. Use of Information and communication technology is primarily based on the information quality.
Results: Because of COVID-19 especially traditional education practices are difficult to follow. So solution lies in the technology in form of digital learning through digital platform.

1. Introduction
As an external environmental threat COVID-19 have work as uncontrolled variable that impacted the substructure of the society that is the educational base. In Ethiopia at the advent of COVID-19 government announced the emergency situation in April, 2020. The shocks of these transformations were experienced in strategy making and substitutes of physical communication with digital contacts (Blankenberger B. & Williams A., 2020) [1].

Whereas Comprehensive universities faced challenges in continuation of teaching and learning with helps of classroom learning methods. Therefore Government set up a national task force to find the proactive solution. In addition of using mask, sanitizer and social distance Ministry also work on strategic alternative of digital platform in learning (Chala W.D., Srinivasan S., Maheshwaran M., 2020) [5].

Ethiopian Comprehensive universities in wake of difficult situation closed the universities as a interim solution and thousands of students return back to their home (Gettu T., 2020) [8]. According to an estimate at global level more than 1.672 billion learners are deprived from the education (Tiruneh D.T., 2020) [14].

The spillover effect of COVID-19 not limited to education sector but it goes beyond to effect the financial aspects of life leads to unemployment and loss of life (Geda A., 2020) [7]. Based on the above-mentioned situations, Ethiopian Comprehensive universities will tries to find the solution in Information and communication technology.

1.1 Literature Review
1.1.1 University education and educational oversight structure during COVID-19
To realize the profundity of the COVID-19 effect on the comprehensive universities there is a need of understand the ecosystem in which it exists. Education at university level functions under rules of demand and supply. For these market conditions present government system of a country plays a deceive role (Blankenberger, 2020; Kraft & Furlong, 2015) [2]. COVID-19 effected the comprehensive universities in many dimensions. Like, higher education institutions function under an information deficit environment because of lack of physical proximity. For better teaching and learning used inclusive three tier model in Ethiopian universities hampered during COVID-19 period. However, course contents, learning and knowledge outcomes of students, evaluation and grade measurement all is based on physical learning environment (Blankenberger, 2020; Winston, 1992) [2, 17].

This situation is making worse under pandemic by the fact that substantial requirements especially in comprehensive universities of Ethiopia where students learn by staying permanently inside the university hostels.

Walters, Yang & Roslander (2014) [16] demeanor a research intended at evaluating the challenges of give quality learning in universities of Africa and discover the likely clarifications to the current predicament. But at hand pandemic is ahead of their study.

Secondly, universities are generally viewed as a provider of research environment, initiator of embedded step to step knowledge and supplier of social equity (Hazelkorn & Gibson, 2019; Marginson, 2018) [10]. Thirdly, comprehensive universities maneuver as providing knowledgeable and skilled workforce to the market beyond the award of degrees (Birnbaum, 2001).

1.1.2 Response of Ethiopia Government during post-COVID-19

The supervision arrangements of universities in altered atmosphere of post-COVID-19 are come up with new approaches of digital learning. The three tire structure of higher education superstructures on accrediting bodies, federal regulatory entities and state. As a functional unit, both organizational integrity and active learning are vital for ensuring quality and regularity in the university (Blankenberger, 2020; Hazelkorn & Gibson, 2019) [2, 10]. the employ and incorporation of digital communication higher education of Ethiopia. Even though an infrastructural deficit, this was tracked by an expansion of digital technology applications in higher education (Yigezu M., 2021) [18].

Unpredicted situations make complicated the standards and educational offerings of higher educational institutes in providing standard education (Blankenberger, 2017) [3]. In this context in Ethiopia, process to digitalize the education system is comprehended with the "Digital Technology for Education Sector Transformation" (D-TEST) plan. The D-TEST plan is the flagship plan that takes account four mechanism of ESDP-VI with two supplementary mechanisms: digital identity card for learner, educator, and hold up workforce; and a nationwide instructive cloud for expansion of educational infrastructure and services (Yigezu M., 2021) [18]. By 2020/21 academic year ministry have plan to digital identification card to more than 4.8 million learners (Mengistie T.A., 2020) [13].

Based on the above review of literatures, this study prepared a core objective is to analyze the impact of adoption of digital technology on the transformation of comprehensive universities at the wake of COVID-19 in the country.

1.1.3 Objective of the study

The main objective of the Information and communication technology is to analyze the impact of COVID-19 on comprehensive universities of Ethiopia.

2. Methodology of study

The over-arching methodological frame selected for this study is qualitative and quantitative methodologies qualitative and quantitative very important in this research. And also charts. That is, the study employed mixed methodology research that measures the collection and analysis of data using numbers and words. Descriptive and inferential psychoanalysis has been used to measure the impact of COVID-19 to bring the positivism in the research.

2.1 Study area

The research area was selected as the Bule Hora University, Ethiopia. Bule Hora University was established in 2012 G.C. It is situated in West Guji Zone, Oromia Regional State, which is the south part of Ethiopia. From capital city Addis Ababa it has a distance 467 km. it is the youngest comprehensive universities in Ethiopia. The foundation stone of the Bule University (BHU) was laid on 28 November 2008.

2.2 Method of Data Collection

Structured questionnaire was framed to gather the responses. The drafted questionnaire in English is pre-tested in excluding the study area. Some amendment had made after the pre-test. The form was prepared by staff of college of Informatics, Bule Hora University. Digital technology was given to the data collectors and the link was sent to all the students by using the social Medias like WhatsApp Telegram, and Email. For data collector necessary instructions was provided along with questionnaire, techniques of assessing subjects, overcome across difficulties in completing the questionnaire etc. Student's satisfaction on quality of teaching learning quality management was assessed. The Likert scale was used as a questionnaire for data collection.

2.3 Target population

The target populations of this study are both administrative and academic stuff serving in BHU. These target population is the source for the sample respondents to be selected to give data for the study. Since the employees' performances can be known by the Clients especially the academic staff members and the administrative staff, will be population of the study.

Table 1: Responsibilities of the Informants

Responsibilities	Number	Percentage (%)
Finance head	2	0.68
Research and tech. transfer head	2	0.68
Human Resource management head	2	0.68
Coordinator	22	7.43
Accountant	34	11.49
Lecturers	62	20.95
Casher	38	12.84
Department head	16	5.41
Guards	26	8.78
Store keeper	5	1.69
Secretary	20	6.76
Sanitary	26	8.78
Divers	14	4.73
Liberian	18	8.08
Total	296	100

Source: SPSS (2021) output

2.4 Research Design

This study mainly used descriptive-case study design with mixed research approach. Mixed Research Design incorporated the both qualitative and quantitative research approach.

2.5 Sampling Technique and Sampling Size

The sampling techniques applied are both probability and non-probability techniques. From the probability, simple random sampling was employed to opt for informants for the study. From the probability sampling, stratified sampling technique which is based on social strata was employed to collect quantitative data from the informants. From the non-

probability sampling purposive sampling techniques was used select informants who provide qualitative data analyzed in this study. These sampling techniques were used to substantiate both the qualitative and quantitative data obtained from respondents in order to expose the actual Post COVID-19 practices that impact employees' performance. From eight colleges currently operating in Bule Hora University two colleges namely engineering and informatics colleges were randomly selected using simple random sampling. There are 456 teaching staff and 1254 administrations employees with a total of 1710 employees currently in the two colleges (BHU report, 2020). Accordingly, the sample size of the informants taken to provide information to present study is intended by incorporation of Taro Yamane (Yamane, 1973) formula having 95% confidence level.

$$n = \frac{1710}{1+1710(0.05)^2}$$

$n = 325$ informants participated in providing data for this study.

2.6 Data Collection Method
The data collection methods used in this study is individual interview and questioners. The qualitative data were collected through interview from management officials. Interview was also used to collect data from the academic staffs who are the clients for the management officials. The quantitative data were collected from the employees who are actually large in number as compared to the management officials from whom data will be gathered through interview.

2.7 Data Analysis and Processing
The method of data analysis employed was both quantitative and qualitative. As a process, the analysis began with the quantitative data presenting in table and substantiated with the qualitative data obtained through interview. The quantitative data collected were analyzed using suggestion test, mean, standard deviation, correlation and suggestion analysis. The collected data was compiled, classify, edited and coded to have the required quality, accuracy and completeness. It was entered into the Window 10 computer software by using Excel Micro soft office and statistical tools like statistical package for social sciences (SPSS) version 24.0 for data analysis**.** The collected data was analyzed using both descriptive and inferential statistics.

2.7.1. Descriptive statistics
In this study from Descriptive Statistics like Mean, Frequency, percentages were used to analyze the collected quantitative and was presented by tables, graphics and pie charts based on the nature of research questions. Descriptive statistics was used in the analysis by generating graphs, charts and tables with respect to the basic research questions.

2.7.2. Inferential Statistics
To investigate the relationship and the effect of independent variables on dependent variable, both correlation (Pearson Correlation Coefficient), and regression (Multiple Linear Regression Analysis) was employed. The Multiple linear regression of econometric model can be written as follow:

$$Y= \beta o + \beta i (X_i) +u_i ----------------------------------- \text{(Equation)}$$

Where, Y = dependent variables, β_0 = intercept, β_i= estimated coefficient of explanatory variable, whereas X_i = explanatory variables, u = error term
• For this study, Y (Education sector transformation) = β_0 + β_1 (DIGITAL TECHNOLOGY) +β_2 (Cs) + β_3 (PA)+ ui.
Where, Digital Technology = Digital technology performance
Cs = Education sector development programme
PA = Information and communication technology

2.8 Validity and Reliability
Cronbach's alpha reliability test was calculated after the pilot test was conducted. All items were carefully input in to SPSS version 24 and the average result found were greater than 0.70 for all likert scale thematic questionnaire items which shows the items are internally consistent and the details are presented in Table three below.

Table 2: Cronbach Alpha Value

S. No	Item Category	Cronbach Alpha Value
1	Digital technology	0.821
2	Education sector development programmer	0.823
3	Information and communication technology	0.703
4	Education sector transformation	0.745

Source: SPSS (2021) out put

2.9 The Descriptive Analysis
2.9.1 Descriptive Analysis of Post COVID educational practiceson Education sector transformation
The study sought to know the extent to which various Post COVID educational digital practices put impact on Education sector transformation in comprehensive universities in Ethiopia.

2.10 The Relationship between POST COVID-19 digital practices adopted at comprehensive universities of Ethiopia and Education sector transformation.
Under this heading it is sought to examine POST COVID-19 digital practices and education sector transformation. Accordingly, to examine the relationships between POST COVID-19 digital practices adopted at comprehensive universities of Ethiopia and Education sector transformation, Pearson product moment correlation analysis was employed. In order to apply Pearson product moment correlation test first normality of the data related to digital technology practices, education sector development programme practices, Information and communication technology practices and education sector transformation were tested.

Table 3: Test of Skewness/Normality

Variables	N	Mean	SD	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Digital technology	296	1.42	.28	.049	.142
Education sector development programme	296	1.53	.35	.101	.142
Information and communication technology	296	1.54	.36	.391	.142
Education sector transformation	296	2.11	.52	.614	.141
Valid N (listwise)	296				

Source: SPSS (2021) data output

As it is shown on the above table 3, for all variables the skewness values are between -1 to +1. This revealed that all the data are normally distributed. Therefore, assumption to use Pearson product moment correlation is satisfied.

2.11 Inferential statistics
2.11.1 Correlation Analysis
2.11.2 Pearson correlation analysis

Accordingly, Pearson's Product Moment Correlation Coefficient and linear regression are used to examine the relationship of those variables under study (cooper, 2010). Pearson product moment correlation is applied to test how much POST COVID-19 digital practices and Education sector transformation in comprehensive universities is correlated.

Table 4: Pearson Correlation between Post COVID-19 and Education sector transformations

Correlations		Digital technology.	Education sector development programme	Information and communication technology.	Education sector transformation
Digital technology. Average	Pearson Correlation	1	.699**	.587**	.589**
	Sig. (2-tailed)		.000	.000	.001
	N	296	296	296	296
Education sector development programme. Average	Pearson Correlation	.699**	1	.662**	.623*
	Sig. (2-tailed)	.000		.000	.041
	N	296	296	296	296
Peducation sector transformation average	Pearson Correlation	.587**	.662**	1	.523*
	Sig. (2-tailed)	.000	.000		.021
	N	296	296	296	296
Education sector transformation average	Pearson Correlation	.589**	.623*	.523*	1
	Sig. (2-tailed)	.001	.041	.021	
	N	296	296	296	296
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Source: SPSS (2021) data output

Pearson correlation for the Education sector transformation with Digital technology practices (r=.589, Sig. (2tailed) is 0.001 which is <0.05), Education sector development programme (r=0.623, Sig (2-tailed) is 0.041 which is <0.05), and Information and communication technology (r=.0.523, Sig. (2tailed) is 0.021 which is <0.05) show a positive correlation and the results indicates that all the variables are statistically significant at (p<.05). According to Cohen (1988) correlation value between 0.6-07 is substantial.

Thus, the analysis indicated that Education sector development programme is the most correlated variable with the dependant variable education sector transformation (r = .623, p <0.05). This affirmed that boosting effectiveness of digital technology, employing Information and communication technology and developing education sector development programme positively correlated with education sector transformation.

2.11.3 Assumptions of simple linear regression analysis
2.11.3.1 Sample size
A sample must represent well the characteristics of the population. Most researchers tend to use Tabachnick and Fidel, (2007) formula for calculating sample size requirements for multiple regressions that is N > 50 + 8m (where N = sample size and m = number of independent variables). Which leads into 296> 74.

2.11.3.2 Normality test
To establish the validity of these assumptions, the researcher also checks for the normality through histogram and P-P plot as follows.
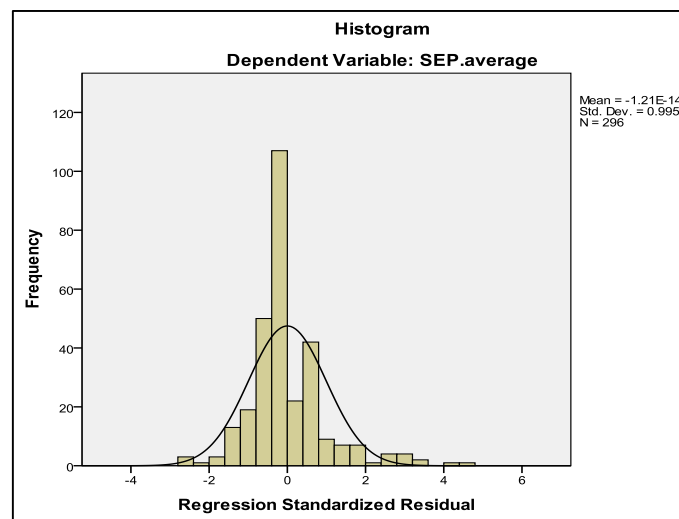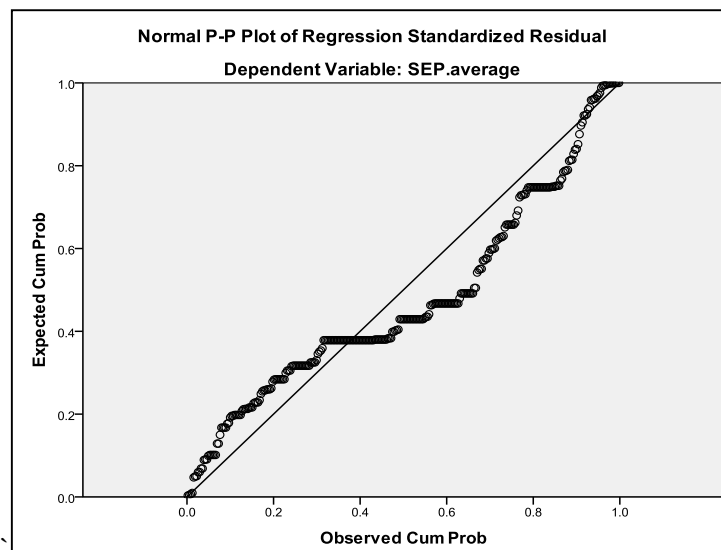

Sources: Own Survey, computed in SPSS, 2021

Fig 1: Normality Test Using Histogram

Figure 1 above shows the underlying frequency distribution that look like bell-shaped curve. In the below figure 2, the dots are closely plotted to the straight line, which indicate a small deviation from normality and there are no extreme cases observed.
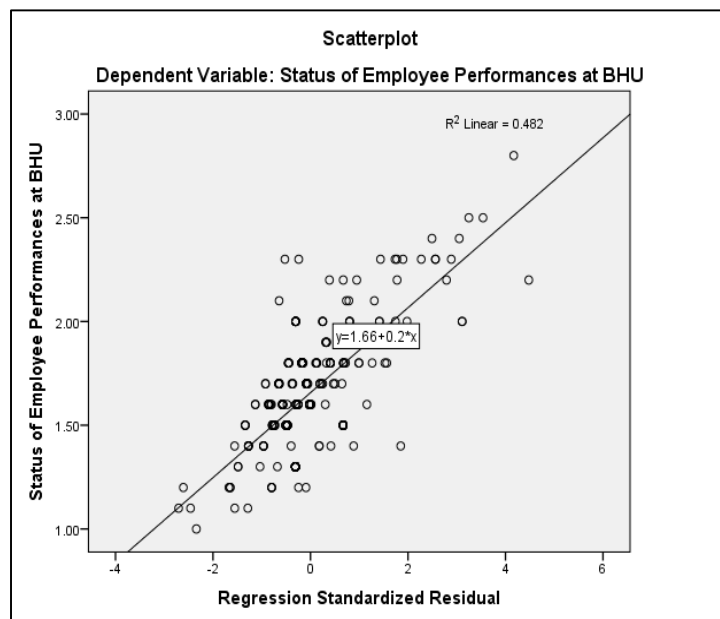

Sources: Own Survey, computed in SPSS, 2021

Fig 2: Plot of standardized residuals

2.11.3.3 Test for Homoscedasticity
Homoscedasticity of the study is tested by using scatter plots. Plot of standardized regression residuals and standardized predicted values showed no observable signs of funneling so that the assumption of homoscedasticity has been met.

Sources: Researchers Own Survey, computed in SPSS, 2020

Fig 3: Scatter plots for test of homoscedasticity

2.11.3.4 Test for autocorrelation
The Durbin-Watson statistic is the common method used to test for the presence of serial correlation among the residuals. The test statistic varies from 0 to 4, a value of 2 indicate that there is no autocorrelation.

Durbin-Watson statistic from our model summary showed that this assumption had been met, as the computed value for Durbin-Watson was almost 2.00 which show no autocorrelation.

2.11.3.5 Tests for Multi-co linearity
It can be detected using tolerance value and variance inflator factor (VIF) value.

Table 5: Durbin-Watson Autocorrelation Test

Durbin-Watson Autocorrelation Test	Durbin-Watson
Model 1	1.663

Sources: Own Survey, computed in SPSS, 2021

Table 6

Variables	VIF	1/VIF (Tolerance)
Digital technology practices	5.100	.196
Education sector development programme	5.311	.188
Information and communication technology	3.115	. 397

Sources: Researchers Own Survey, computed in SPSS, 2021

Table above shows that value of tolerance of each independent variable ranges from 0.188 to 0.397 and the value of variance inflation (VIF) factor ranges from 3.115 to 5.311, hence, the tolerance value in all independent variable were greater than 0.1 and the VIF values of all independent variables are less than 10, which indicate there is no multi-co linearity problem among the variables on this study.

2.12 Regression Analysis
Regression analysis is a statistical procedure used for estimating the relationships between one or more predictor variables and response variable.

Table 7: Model Summary

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	
Dimension 1	.720[a]	.518	.513	.20476	
a. Predictors: (Constant), information and communication technology, digital technology, education sector development programmer.					
b. Dependent Variable: Education Sector Transformation					

Source: SPSS output, 2021

From the above table the R value 0.720 indicate that the presence of strong correlation between the independent variables and dependent variable. The value of R2= 0.518 which indicate that the independent variables explain 51.8 % the dependent variable with unexplained factors of 48.2 %.

2.12.1 ANOVA result table
The analysis of variance (ANOVA) tells us whether the overall results of a model are significantly good degree prediction of the outcome variable. The regression Sum of squares is 25.385. Here, each sum squares (i.e., Regression, residual and Total under the source column) has a corresponding degrees of freedom (DF) associated with it. Total degree of freedom is n-1 (DF=295-3=292), one less than the number of observations.

Table 7: ANOVA result table

ANOVA[b]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13.142	3	4.381	104.486	.000[a]
	Residual	12.243	292	.042		
	Total	25.385	295			
a. Predictors: (Constant), Information and communication technology, digital technology, education sector development programmer						
b. Dependent Variable: Education Sector Transformation						

Source: Researchers Own Survey, computed in SPSS, 2021

In general the above ANOVA table shows a strong relationship between the dependent and independent variables of the study with F-statistic or F- ratio of 104.486 for the overall analysis, and is worth-mentioning that the F-value is highly significant (as p=.000<.01).

2.12.2 Test of Significance
In below regression coefficient table, Digital technology (t = 2.438, P <0.05), education sector development programme (t = 3.266, P <0.05), and Information and communication technology; (t = 6.069, P <0.05) found to be the strange and statistically significant influence on education sector transformation. β is different from 0 and the researcher found that the predictor variables make a statistically significant contribution in predicting education sector transformation, Digital technology (β1) = .222, Education sector development programme (β2) =. 303, Information and communication technology (β3) = .314 are statistically significant variables in predicting education sector transformation.

Table 8: Regression Coefficients of the Variables

Variables	Unstandardized Coefficients		Standardized Coefficients	T value	Sig.	Zero order(r)
	B	S.E	Beta			
(Constant)	.020	.102		-.197	.844	
Digital Technology	.222	.091	.224	2.438	.015	.589
Education Sector Development Programme	.303	.094	.306	3.266	.001	.623
Information And Communication Technology	.314	.059	.374	8.704	.000	.523

Source: Own Survey, computed in SPSS, 2021

One unit change in digital technology will cause 22.2 % change in dependent variable, education sector transformation. One unit change in Education sector development programme will cause 30.3 % change in education sector transformation. One unit change in Information and communication technology will cause 31.4

% change in education sector transformation. Thus Information and communication technology is the most influencing factor among all three explored variables.

The estimated linear function for this study was presented as:
Education sector transformation (Yi) =-0.020 + 0.224DTP + 0.306 ESDP+0.374ICT
Where, DTP = Digital technology practices
ESDP = Education sector development programme
ICT = Information and communication technology

2.13 Hypothesis Testing
In this part, the researcher tests both hypotheses regarding the relationship between dimensions of coffee market and coffee marketing supply side. This hypothesis testing is based on standardized coefficients Beta (β) and P-value to test whether the hypotheses were reaccepted or rejected.

2.13.1 Training
The results of Multiple Regression, as presented on regression table, revealed that digital technology has a positive and significant influential relationship (contribution) to education sector transformation with β= 0.222, at 95% confidence level ($p < 0.01$). The Beta value (β) i.e. 0.222 shows that if there is one unit increase in training, there will be 22.2 % increase on education sector transformation at Bule Hora University. Therefore, the researcher rejected the (Ho1) hypothesis and accepted the (H01) hypothesis. This indicates that digital technology has a positive and statistically significant influential relationship (contribution) to performance of the employees at Bule Hora University.

2.13.2 Education sector development programme
On the results of Multiple Regression, as presented in table above, revealed that government Education sector development programme has a positive and statistically significant influential relationship (contribution) to education sector transformation with β= .303, at 95% confidence level ($p >0.05$). The Beta value (β) i.e. .303shows that if there is one unit increase in Education sector development programme, there will be 30.3 % influence on Bule Hora University education sector transformation. Therefore, the researcher accepted (H2) hypothesis and rejected the (H02) hypothesis. This indicates that government Education sector development programme has a positive and statistically significant influential relationship (contribution) to Bule Hora University employee's performance.

2.13.3 Information and communication technology
The results of Multiple Regression, as presented in table above, revealed that Information and communication technology has a positive and statistically significant influential relationship (contribution) to education sector transformation with β= 0.314, at 95% confidence level ($p <0.01$). The Beta value (β) i.e. 0.314 shows that if there is one unit increase in Information and communication technology there will be 31.4 % increase in education sector transformation of the Bule Hora University. Therefore, the researcher rejected the (H03) hypothesis and accepted the (H3) hypothesis, and this indicates that Information and communication technology has a positive and statistically significant influential relationship (contribution) with education sector transformation in the Bule Hora University.

3. Results and Discussion
In this study as it is revealed from R^2 value, 51.8% of the variation in dependent variable is explained by independent variables used in model, so the model is fitted at 5% ($p<0.05$) significant level. Thus, the independent variables (digital technology practices, Information and communication technology and education sector development programme) account for 51.8 percent of the change in education sector transformation in general. The F statistics shows the overall significance of the model. Since the F value is found to be 104.486 is significant at $P<0.05$, the Post COVID-19 practices significantly predicts education sector transformation. The beta values show the magnitude of relationship between variables, higher values being an indication of strong relationship. In this study, Information and communication technology has got the highest Beta coefficient of 0.374. This result implies that the Information and communication technology the most significant of all the post COVID-19 education practices.

4. Acknowledgement

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