

Assessing The Linkage Between Vocational Education And Economic Growth Using Autoregression Analysis: Evidence From India

Sultan Ahmad¹, Rafat Fatima², Syed Shahid Mazhar³,
Saurabh Bajpai⁴, Rahul Ranjan Yadav⁵,
Daya Shanker Kanaujia⁶

¹ Assistant Professor, Department of Commerce & Business
Management, Integral University, Lucknow, India s.ahmadkhan123@gmail.com

² Assistant Professor, Department of Commerce, Karamat Husain
Muslim Girls P.G College India phdrafatfatima14@gmail.com

³ Professor, Department of Commerce & Business Management,
Integral University, Lucknow, India ssmazhar@iul.ac.in

^{4*} Assistant Professor, Department of Commerce & Business
Management, Integral University, Lucknow, India
saurabhbajpai.ac@gmail.com (Corresponding Author)

⁵ Academician and Researcher rriyadav.yadav@gmail.com

⁶ Assistant Professor Department of Commerce, Lucknow
Public College of Professional Studies, datsmedaya@gmail.com

ABSTRACT

The focus of Sustainable Development Goal is to provide opportunities for lifelong learning and equip individuals with practical skills through high-quality technical and vocational education. This study delves into the connection between vocational education and economic development and growth in India, with a focus on employment, capital formation, and productivity. Using an autoregression analysis and statistical models, the research examines the long-term impact of vocational education on these variables from 1993 to 2021. The results show that there is a significant and substantial link between vocational and skill development education and production, and between vocational and skill development and capital formation. The study advised that increasing access to vocational education can lead to economic development and growth and contribute to human development in India by boosting capital formation.

Key Words: Autoregression; Durbin-Watson test; employment; production; R square model; vocational education enrolment.

1. Introduction

In today's interconnected and globalized economy, education and training play a critical role in a nation's advancement. Basic education alone is insufficient in preparing individuals for the demands of a constantly evolving knowledge economy. A well-skilled workforce is crucial for a country's growth. In a competitive environment, a labour force equipped with the necessary skills and training can meet the industrial demand and serve as a significant driver for economic development. The updated strategy of the World Bank's Education Sector places emphasis on the significance of the knowledge economy and the need for a workforce that is more skilled to meet the evolving demands and maintain competitiveness (World Bank, 2005). Technical Education and Training (TVET) is now recognized as a crucial means for national development, as it offers opportunities for continuing education and training for both employed and unemployed members of society (Foster, 2005). The role of TVET in the development of nations and combating poverty in developing countries cannot be overemphasized. While possessing skills does not guarantee formal employment, it is still considered essential for personal and societal growth. The provision of TVET is, however, a costly affair that requires significant financial resources. Given the connection of TVET to the labour market and the need for extensive training, the role of non-state actors has been highlighted in the World Bank's position paper on TVET (World Bank, 1991). However, the contribution of the public sector should not be disregarded, and both private and public actors should collaborate in providing TVET. A balanced approach is required. Vocational Education, on the other hand, focuses on acquiring practical skills, knowledge, attitudes, and an understanding of various occupations in social and economic life.

2. Review of literature and development of hypotheses.

The aim of this research is to instigate the effectiveness of formal education and vocational education in the labour market (Shavit and Miiller, 1998; Bol and van de Werthorst, 2011). It has been noted that individuals who abandon their vocational education but acquire three years of formal education tend to earn higher salaries and secure better job opportunities (Kane and Rouse, 1995; Grubb, 2002; Bailey et al., 2004; Matkovic and Kogan, 2012; Reisel, 2013;

UK, USA and Austria are characterized by vocational training systems and its positive impact on the capital formation and employment in selected countries. (Bol and van de Werfhorst, 2013), The current education i.e. vocational education outcomes that how vocational education and training provide effective human capital to the occupational market. The economic context is very important in the human development of vocational education pursuing students. (Lizzion, Wilsons and Simonsan, 2002; Dietrichi, Pfeiferer and Wenzelman, 2016).

The results of this study indicate that in developed nations, vocational education is linked to occupational stratification and a strong emphasis on occupational credentials (Solgan and Konietza, 1999; Bola and van-de-Werfhorst, 2011; Bola and Weedeni, 2015). By examining the career progression of individuals who dropped out of formal education and pursued vocational training, researchers were able to test the mechanisms driving these trends. Additionally, the increased demand for technical skills in developed nations has led to a higher demand for vocational training courses (e.g. Jacob and Solga, 2015). This, in turn, has caught the attention of policy makers and led to a focus on enhancing or implementing dual apprenticeship programs in these countries (European Memorandum, 2012).

The purpose of this research is to explore the influence of Technical Education and Training (TVET) on early career advancement opportunities, with a particular emphasis on the demand aspect of the labor market. This examination is of particular importance as previous studies in the field of labor market sociology have primarily centered around the supply side (Billsi, Di-Stasio, and Grxhanie, 2017).

This investigation adds to the growing body of knowledge that focuses on the demand side of the labor market, particularly the impact of Technical Education and Training (TVET) as a form of human capital and capital formation (Di Stasio, 2014; Di Stasio and van de Werfhorst, 2016).

The study concentrates on labour market outcomes, utilizing a two-step estimation method. First, we analyze employment and wage data through linear regression models. Then, we examine the evolution of employment and wage patterns through fixed-effects growth analysis. Assessing the impact of TVET on career progression is crucial. Drawing from the above literature review, the researcher has established the following objectives and hypotheses.

Objectives of the Study

- To examine the effect of Technical Education and Training

(TVET) on employment.

- To assess the impact of vocational education on Capital Formation in India
- To assess the effect of Technical Education and Training (TVET) on production.

Hypothesis 1 (H1). The enrolment in Technical Education and Training (TVET) in India does not have a significant impact on total employment.

Hypothesis 2 (H2). The enrolment in TVET does not have a meaningful connection with capital formation.

Hypothesis 3 (H3). The enrolment in TV ET does not have a significant relationship with total production.

3. Research Methods

The study primarily utilizes secondary data sourced from various governmental institutions such as the Ministry of Minority Affairs, Ministry of Skill Development and Entrepreneurship, and the Department of Vocational and Skill Development in Uttar Pradesh, as well as Census data from 2001 and 2011. The focus is on the analysis of vocational education courses and enrolment trends from 1993 to 2021, and the examination of macroeconomic variables that are influenced by vocational education, either directly or indirectly. These variables, including employment, capital formation, skill development, and productivity, are deemed to be crucial elements in the field of vocational education. The following tools and techniques have been used for the analysis of data.

The Sample Regression Function

The study applies regression analysis, in which the relationship between a dependent variable and a sin explanatory variable is analyzed. The purpose of regression analysis is to determine the average value of the dependent variable based on specific values of the explanatory variable. In this study, human development is considered to be influenced by multiple explanatory variables, expressed mathematically. Simply we can express that

$$y=f(Xs)$$

y = Dependent variable Xs = explanatory variable or independent variable (Total Enrolment in Vocational Education)

This research employs a regression analysis method, which involves the assessment of the connection between two variables. The dependent variables, Capital Formation, Employment, and Productivity, are related to the single explanatory variable, Total Enrollment in Technical

Education and Training (TVET). The regression model is expressed as

$$y = p_1 + p_2X_i + \mu_i,$$

where y represents the dependent variable, (Capital Formation, Employment, and Productivity) X_i the variable X_i represents the independent variable, Total Enrolment in Vocational

Education, which is used to explain the changes in the dependent variable.

p_1 and p_2 are the parameters or slope coefficients,

μ_i represents the residual or error term. The objective is to estimate the population regression function for the sample information using n sets of observations

4. Data Analytical Methods

I The impact of Vocational Education on Employment:

Table 1. ANOVA INTERPRETATION

Model Value	Sum of Squares Value	Degree of Freedom	F Test	Significance Value
1 Regression Data	.060	1	395.770	.000
Residual Value	.004	27		
Total	.065	28		
Dependent Variable: Employment				
Predictors: (Constant), Enrolment in Vocational Courses				

The analysis in Table 1 shows the connection between employment and enrolment in vocational courses. The results of the analysis revealed a statistically significant association, with a P value of less than 0.05 and an F value of 395.770, implying that there is a substantial effect of vocational education on the level of employment. The test was conducted at a 5% level of significance.

Table 2. Model Summary of Data

R coefficient

Change Statistics

Model Value	R	Adjusted R Square	Estimated Std. Error	R Square Change	F Test Change	df1	df2	Significance Value	Durbin-Watson Test Value
1	.968	.936	.01235	.936	395.770	1	27	.000	.382

Dependent Variable: Employment

Predictors: (Constant), Enrolment in Vocational Courses

Table 2 shows the model summary. The outcome of the analysis, as shown in Table 2, demonstrates a clear and positive correlation between employment and the number of individuals enrolled in vocational courses. With a correlation coefficient of 0.968, this indicates that 93.6% of the variability in employment can be explained by enrolment in vocational courses. Furthermore, the adjusted R-squared value of 0.934 highlights the important contribution of vocational education to employment levels in the country. The significance of this relationship is further confirmed by the Durbin-Watson test, which has a value of 0.382.

Table 3. Coefficients Value

Model Value	Unstandardized Coefficients Values		T Test	Significance Value
	B	Estimated Std. Error		
1 (Constant Estimation)	2.971	.134	22.202	.000
Enrolment in Vocational Courses	.336	.017	19.894	.000

Dependent Variable: Employment

Predictors: (Constant), Enrolment in Vocational Courses

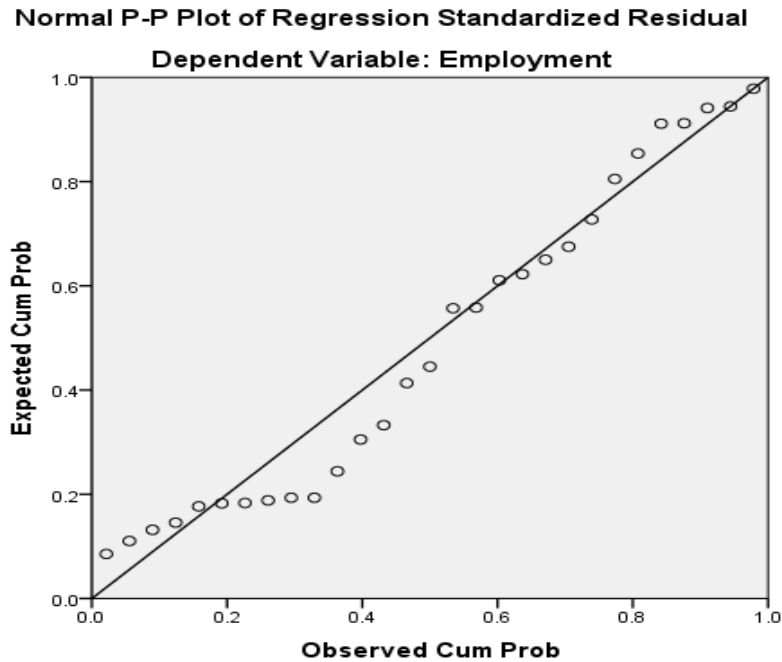
The results in Table 3 demonstrate the impact of enrolment in vocational education employment. The coefficient (8) in the function represents the rate of change in employment and has a value of 0.336. This means that for every one-unit increase in enrolment in vocational education, there will be a corresponding increase of 0.336 times in employment. The findings of the analysis reveal a positive association between total enrolment in vocational education and employment, as indicated by the

positive coefficient of the explanatory variable in the regression model.

$$Y = 2.971 + 0.336X$$

The above regression equation of employment on enrollment in vocational courses brings out clearly the exact relationship between enrolment in vocational courses and employment.

Figure 1.



The scatter plot in Figure 1 displays the distribution of the standardized residuals, which are evenly spread around zero. This indicates the validity of the model. The P value for productivity is statistically significant, as it falls below the 0.05 significance level. This indicates that enrolment in vocational courses positively impacts worker productivity and is a significant factor in determining it. The scatter plot supports this conclusion and highlights the significance and effect of vocational education on productivity.

The Effect of Vocational Training on India's Total Output

Table 4. ANOVA INTERPRETATION

Model Value		Sum of Squares Value	Degree of Freedom	F Test	Significance Value
1	Regression Data	1.465	1	914.082	.000
	Residual Value	.043	27		
	Total	1.508	28		

Dependent Variable: Employment

Predictors: (Constant), Enrolment in Vocational Courses

Table 4 analyses the variance between Total Production and enrolment in vocational courses. The value of $P < 0.05$ and $F = 914.082$ so the relationship is significant and vocational education in enhancing the productivity of workers. The test is calculated at a 5% level of significance.

Table 5. Synopsis of the Model

Model Value	R	R Square	R Square recalculated	Estimate's Standard Error	Change Statistics					Durbin-Watson
					Square Change in R	F Change	df1	df2	Change for Sig	
1	.986	.971	.970	.04004	.971	914.082	1	27	.000	.780

Total Production is a dependent variable.

Vocational course enrolment is a constant predictor.

The model summary is shown in Table 5, which shows that enrolment in vocational programmes and Total Production have a strong positive association, as shown by the value of R. (0.986). According to the R square statistic (0.971), enrolment in vocational programmes is responsible for 97.1% of the variation in Total Output. The modified R square value of 0.970 indicates that enrolment in vocational programmes is a significant contributor to the nation's workforce's productivity. Also, the Durbin-Watson test result of 0.780 indicates the significance of this link.

Table 6. Estimate of coefficients

Typical Value		Value of Unstandardized Coefficients		T Test	Value and Significance
		B Value	Normative Error Value		
1	(Estimated Constantly)	-9.394	.434	-21.657	.000
	Participation in vocational education	1.654	.055	30.234	.000

Total Production is a dependent variable.

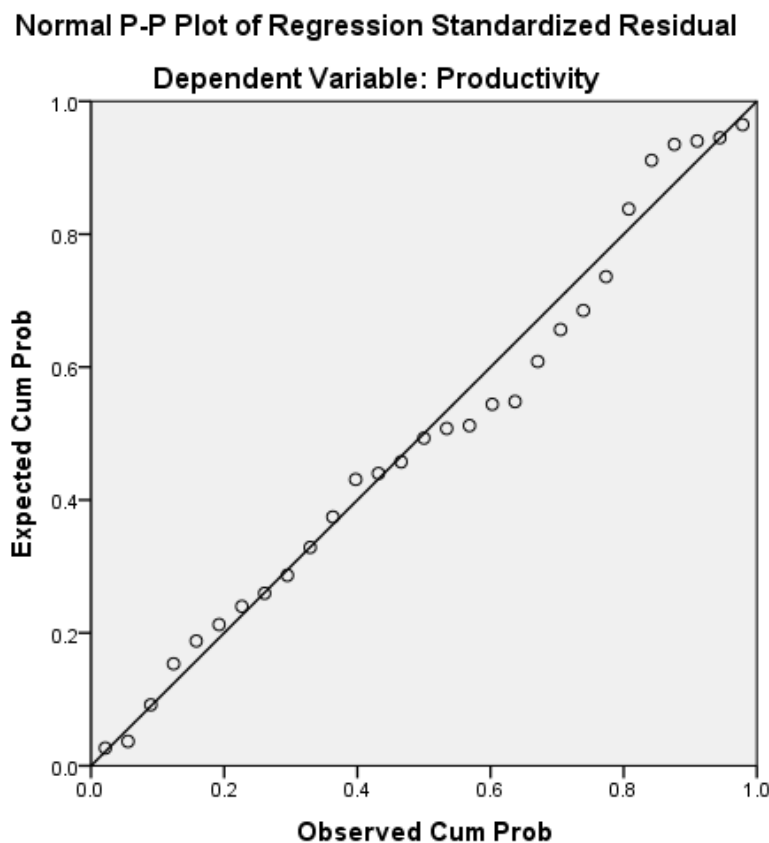
Vocational course enrolment is a constant predictor

The coefficient, or B value, of the function that displays the rate of change in productivity is shown in Table 6. The function's B value is 1.654, meaning that a unit change in enrollment in vocational education results in a 1.654-times change in productivity. As B is positive, it is obvious that if enrollment in vocational education courses rises by one unit, productivity will rise by 1.654 times.

$$Y = -9.394 + 1.654X$$

The relationship between enrolment in vocational courses and productivity is clearly depicted in the above regression equation of productivity on enrolment in vocational education

Figure 2.



As shown in Figure 2, the scatter plot of the standardised residuals shows a fairly even distribution around the value of zero on both sides. The model is thus valid. The P value for productivity for the variable is below the statistically significant level of 0.05. The scatter plot demonstrates that the test is meaningful and that enrollment in vocational courses is a factor that positively affects worker productivity in the nation, hence increasing Total Output in India. The

regression model does an excellent job of explaining the importance and bearing of vocational education on productivity.

The Relationship Between Capital Creation and Vocational Education

Table 7. ANOVA Interpretation

Typical Value		Total Squares	The extent of freedom	Typical Square Value	F Test	Value and Significance
1	Value for Regression Coefficient	1.617	1	1.617	858.327	.000
	Remaining Value	.051	27	.002		
	Total Value	1.668	28			

Capital Creation is a table's dependent variable.

Vocational course enrollment is a constant predictor.

The difference between capital formation and enrollment in vocational courses is analysed in Table 7. The association is significant because vocational education is a key factor in raising capital formation in the nation, as shown by the values of P 0.05 and F= 858.327. The test's level of significance is set at 5%.

Table 8. Synopsis of the Model

Typical Value	R	Square Root of R	R Square Modified	Estimate's Standard Error	Change Statistics					Durbin-Watson
					Adjustment Statistics	F Change	df1	df2	Change for Sig.	
1	.985	.970	.968	.04340	.970	858.327	1	27	.000	.673

Capital Creation is a table's dependent variable.

Vocational course enrollment is a constant predictor.

The outcomes of the model analysis are shown in Table 8. As evidenced by the high values of R (0.985) and R-square, the findings demonstrate that enrollment in vocational courses and capital generation have a significant positive association (0.970). This suggests that enrollment in vocational courses can account for 97.0% of the variability in capital formation. The modified R-square value of

0.968 emphasises even more how strongly vocational education affects capital accumulation. Additionally, the significance of the link is supported by the Durbin-Watson test score of 0.673.

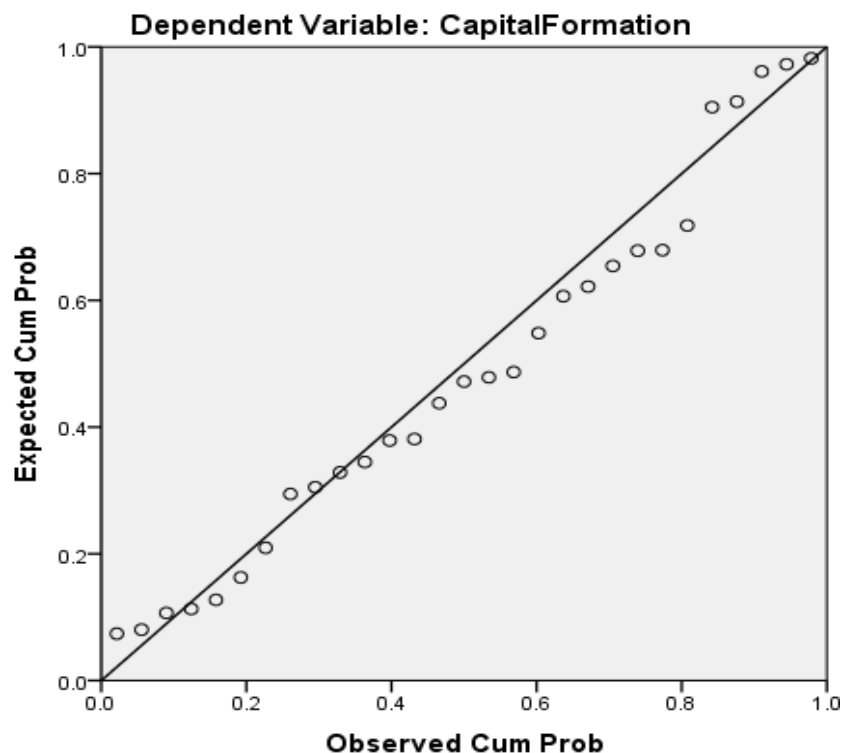
Table 9. Estimate of Coefficients

Typical Value		Unreliable Coefficients		T Test	Value and Significance
		B	Normative Error Value		
1	(Constant)	-6.558	.470	-13.947	.000
	Participation in vocational education	1.737	.059	29.297	.000

The coefficient (B) value of the association between enrollment in vocational education and capital formation is shown in Table 9. A one-unit increase in enrollment in vocational education corresponds to a 1.737-unit rise in capital creation, according to the B value of 1.737. The positive value of B indicates that the capital formation will rise proportionately if enrollment in vocational courses increases by one unit.

Figure 1.3

Normal P-P Plot of Regression Standardized Residual



The standardised residuals' scatter plot, which is rather uniformly distributed on both sides of zero, is shown in Figure 3. The model is thus valid. The P value for capital formation for the variable is below the statistically significant level of 0.05. As a result, the scatter plot demonstrates that the test is significant and that enrollment in vocational programmes is a factor that positively influences capital formation in the nation, indicating that learning vocational skills enhances capital formation in the nation. The model shows that there is a strong correlation between vocational training and capital formation, suggesting that obtaining a vocational education will boost capital formation in the country and advance human progress.

5. Debate and conclusion

In this study, autoregression analysis was used to analyse the relationship between vocational and skill development education and its effects on employment, capital formation, and production in India. The favourable effects of vocational education on employment, capital formation, and productivity are highlighted in this study as evidence of the considerable and substantial relationship between vocational education and economic growth in India. The findings of this study indicate that expanding access to high-quality technical and vocational education in India may promote capital production, which in turn may promote economic growth and human development.

6. Conversations

For policymakers and other stakeholders in India who are trying to assist the nation's economic growth and human development, the study's conclusions have significant ramifications. Vocational education is crucial in this regard because it equips people with the information and skills they need to function well in the workforce and support economic growth.

This study's use of statistical models and autoregression analysis to investigate the long-term effects of vocational education on economic growth in India is one of its strongest points. By using this method, the link between these variables is thoroughly and robustly analysed, and it is possible to see clearly what potential advantages could result from increased investment in vocational education.

It should be noted, though, that this study only looks at the connection between vocational education and India's economic growth; additional research is required to look at how vocational education affects other crucial measures of human development, like the reduction of poverty and gender inequality.

The findings of this study show the value of funding vocational education for India's economic development and social advancement. By widening access to top-notch technical and vocational education, India can give people the information and skills they need to participate successfully in the workforce and support the nation's economic development.

7. Limitations and Future Paths of Research

This study aims to explore the relationship between vocational and skill development education and its effects on capital creation, productivity, and employment in India. In this study, autoregression analysis was employed, but in the future, the quantiles regression method might be applied to examine asymmetrical relationships between the variables.

8. Practical Implications

The study highlights the positive relationship between vocational education and economic growth in India, through increased employment, capital formation, and productivity. Increasing access to vocational education in India can lead to economic growth, contributing to human development by boosting capital formation.

The results of this study indicate that vocational education has a positive impact on employment in India, which can lead to a reduction in unemployment and underemployment. The study shows that there is a significant and substantial link between vocational education and capital formation, which means that increased investment in this area could result in increased capital formation in India.

Given the results of this study, policymakers in India should prioritize vocational education and make investments to increase access to high-quality technical and vocational education.

In conclusion, this study provides valuable insights into the relationship between vocational education and economic growth in India, and highlights the importance of investing in vocational education for human development and economic growth. The importance of creating effective educational policies to encourage vocational and skill development education among the youth in formal education cannot be overstated. Policymakers are recommended to incorporate such education during the early education years. This study is also valuable for policymakers in terms of promoting employment and self-employment through the creation of skilled human capital. The government of India has implemented various programs to support the growth of vocational and skill development education, which has a significant impact on employment generation across various industries.

Author Contribution

Conceptualization, S.Ahmad.; Data curation, S.Ahmad.; Formal analysis, S.B. and R.F.; Methodology, S.A. and S.A; Resources, R.R.Y; Software, S.A.; Visualization, .D.S.K and R.R.Y.; Writing—original draft, S.A and R.F. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

The data presented in this study are available upon request from the authors.

Conflicts of Interest

The authors declare no conflict of interest.

References

1. Abbott, B., Heery, E., & Williams, S. (2011). Civil society organizations and the exercise of power in the employment relationship. *Employee Relations*, 34(1).
2. Agrawal T (2012) Vocational education and training in India: challenges, status and labour market outcomes. *J Vocational Educ Train* 64(4):453–474.
3. Agrawal T (2014) Skill development in India: An Examination. *J Educ Work* 27(6):629–650.
4. Bhatnagar, Asha and Gulati, Sushma,(2021) “Vocational Behaviour of Creative Adolescents: A Proposed Framework for Research”, *Indian Educational Review*, 24(1), 1989, p.150-156.
5. Bajpai, Saurabh and Khan Farhina (2023)Analyzing Role of Training and Development in Job Performance of Company Executives in Public Sector Undertakings in Uttar Pradesh” *Res Militaris*, Vol 13, No- 3 p. 171-184
6. Bajpai, Saurabh and Mazhar, S.S (2022)Empirical study on customer satisfaction towards services of Life Insurance Corporation at Lucknow” *Tylor and Francis-Journal of Information and Optimization Sciences*, Volume 43, Issue 7,p.1871-1883
7. Bajpai, Saurabh and S. S. Shukla, (2019) Customer Taste & Buying Behavior for FMCGProducts A Special Reference to the Rural & Sub-Urban Area of Lucknow City of Uttar Pradesh . *Restaurant Business*, ISSN No- 0097-8043,Volume 15 , Issue 9 , p.13-27.

8. Commonwealth of Australia, Australian Government, Productivity Commission. (2011, April). Productivity Commission Research Report, Vocational Education and training Workforce.
9. Das, P. (2007) "Economic Reform, Output and Employment Growth in Registered.
10. Dearden L, McIntosh S, Myck M, Vignola's M (2002) The returns to academic and vocational qualifications in Britain. *Bull Econ Res* 54(3):249–274.
11. Desai G. & T. Whiteside (2000): Vocational Higher Secondary Education Graduates in the State of Gujarat. In: *Journal of Vocational Education and Training*, Vol. 52/1: 49-61.
12. Directorate General of Employment & Training, Ministry of Labour, Government of India. (2014). List of 100 it is to be upgraded into Centres of Excellence. Retrieved from: <http://dget.nic.in/coe/main/100ITIs.htm>.
13. Eichengreen B, Gupta P (2011) The Service sector as India's Road to economic growth. NBER Working Paper No: 16757. National Bureau of Economic Research, Cambridge, MA.
14. Gautam, Vimallesh,(1997) "An Investigation into the Educational and Vocational Interests of Students at the Delta Stages and its Implication for Their Future Curricula", NCERT, 1997, p.479.
15. Johnston, Bruce F. and John W. Mellor (1961), "Role of Agriculture in Economic Development", *American Economic Review*, Vol. 51, No.4.
16. Kadiyala, S., Harris, J., Headey, D., Yosef, S., Gillespie, S., 2014. Agriculture and nutrition in India: mapping evidence to pathways. *Ann. N.Y. Acad. Sci.* 1331, 43–56.
17. Kaldor, N. (1967), *Strategic factors in Economic Development*. Ithaca: Cornell University Press.
18. Learning for jobs: OECD policy review of vocational education and training, initial report, Oct. (Paris). Available at: <http://www.oecd.org/edu/learningforjobs>.
19. Mehta, et al., (1998) Vocational Planning among Tribal First Generation Learners of Meghalaya, *Journal of the Indian Academy of Applied Psychology*, Vol.15(1), p.33-42.
20. Mehta, et al.(1989), *A Study of Home Background Selected Psychological Academic Achievement and Educational Vocational Planning Variables of Tribal High School Students in an around Shillong (Meghalaya)*, Independent Study, New Delhi, NCERT, 1989.
21. National Centre for Vocational Education Research. (2013). *National VET in Schools, Australian Vocational Education And Training Statistics: VET In Schools Data Tables Queensland*, NCVER, Adelaide.
22. NSS, National sample Survey Report: Employment and Unemployment in India, Report No. 455 & 458, 55th Round, (July 1999-June 2000), GOI, 2000.
23. S. Ahmad, R.Fatima, A. Hussain, (2015)The Impact Of Globalisation On India's CAD, *EPRA International Journal of Economic and Business Review*, Vol-3, Issue- 12, p.75-82,.

24. S. Ahmad, S. Bano D.A.Ansari, (2015) Tourism: A Prospective Source of Forex, EPRA International Journal of Economic and Business Review, Vol -4, Issue- 1, p.65-72,.
25. S.S.Shukla, M. Tiwari, A. C. Lokhande, T. Tiwari, R. Singh and A. Beri, (2022) A Comparative Study of Cyber Security Awareness, Competence and Behavior," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, p. 1704-1709.
26. S.S.Shukla (2020) Building Knowledgeable Society through E-Education, Today's Requirements for Better Tomorrow" E-Business: Issues and Challenges of 21st Century, Vol 1 Issue2, p.72.
27. Sacheti, A.K., (2005) A Comprehensive System for Management of Technical and Vocational Education in India", Vocational Education and Training: Challenges and Strategies, (Eds. Sacheti, A.K. et al.), Bhopal, PSS Central Institute of Vocational Education, p.81.
28. World Bank. (2008a). Skill development in India: The vocational education and training system. Washington, DC: South Asia Human Development Sector, The World Bank