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Role of the ICT in Exacerbating the Knowledge Economy of India

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The process of globalization has led to the spread of new technologies across the world, particularly in the form of ICT, which has spurred up economic development both at global and local levels. ICTs increase opportunities for income growth and employment generation either directly in ICT industry itself or indirectly through their productivity enhancing effects on economic activities. Keeping in mind the growth and contribution of this sunrise sector of the Indian industry, an attempt has been made in this paper to explore the role of ICT in four knowledge intensive sectors of India.The study encompasses the role of IT spending as a percentage of total cost in four sectors namely manufacturing, drugs and pharmaceuticals, health, and education in India.

Field of Research: Economics

1. Introduction

The adoption and rapid diffusion of information and communication technologies (ICT) has been the most radical technological change of recent decades. Economists have been exploring the economic consequences of this technical revolution on education, wages, workplace organization, markets and competition, network and innovation for quite some time now.

The growth of ICT has led to the emergence of a 'Knowledge Economy'. Knowledge economy is one in which the generation and exploitation of knowledge plays an important role in creation of wealth. Knowledge is considered at the core of technical and economic development and it is a primary resource in a knowledge economy(Bezborah, 2006; Kalam, 2006).Since information is the raw material, information and communication technologies play a crucial role in shaping the

knowledge economy. In any knowledge society the growth rate of service sector is higher than that of manufacturing sector. Services themselves are also becoming an Increasingly integral part of all production businesses and there are relatively more people working in this sector now (Dahlamn and Utz, 2005).

Information and communication technology today permeates almost every sphere of human endeavor. Investment in ICT has largest multiplier effect rippling through the economy. It takes place through three ways. First, it results in the growth and diversification of the ICT sector itself and leads to rapid expansion of output and employment in manufacturing of IT products. Second, the use of ICT in the

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agriculture, non-ICT manufacturing and service sector will transform the nature of production in these sectors with major implications in terms of labour productivity, growth and employment. Third, the use of ICT will reshape structure of markets, improves quality of life, and will lead to changes in human development indicators.

The paper is divided into four sections. First section reviews the literature pertaining to role of ICT in the emergence and development of knowledge economy; Second section explains the data and methodology used to explore the role of ICT in knowledge economy of India. Third section examines the role of ICT investment in the four knowledge intensive sectors of India and finally Fourth section concludes the findings.

2. ICT and the Knowledge Economy- A Review

There has been a long debate in the business information system and economic literature over whether the information technology revolution is paying off in higher productivity and economic growth. The first studies, conducted in 1980s, found no connection between IT investment and productivity at the level of firms, industries or the economy as a whole (Strassman, 1990; Roach, 1991; Loveman, 1994). This is called 'productivity paradox'. This paradox has stimulated economists, management scientists and information system researchers to conduct more rigorous scientific analysis on the relationship between IT and productivity [Brynjolfsosn,1996; Brynjolfsson and Hitt, 1996; Bressnahan, 1999; Bosworth and Triplett, 2000; Oliner and Sichel, 2000]. The studies revealed positive and significant impacts from IT investment at the firm and country level. Moreover, some of these studies showed that the economic boom and the rise in productivity in late 1990s were largely due to heavy investment in IT and the growth of internet. This may signify that there are substantial adjustment costs in implementing IT and policy makers should not expect dramatic improvements in the growth in the short run. The economic returns come only after a substantial increase in IT investment.

While some of the firm-level studies have compared results from different sectors (for example services vs. manufacturing), there is dearth of studies using aggregate data at the industry level. The results are substantially different in different industry sectors. There is a considerable agreement among economists that productivity has increased in IT-producing industries (Oliner and Sichel, 2002; Dedrick et al, 2003; Dutta et al., 2003). On the other hand, there is some debate about whether productivity growth has also occurred in the IT-using industries. Most studies have attributed growth in productivity in late 1990s to the IT-using industries as well as IT-producing industries (Baily and Lawrence, 2001; Van Ark et al., 2004). However, Gorden (2000) found no evidence of productivity acceleration outside IT-producing and durable goods manufacturing industries.

Thus, the empirical findings on IT and economic performance have found a positive correlation between some proxy for IT investment and some proxy for economic performance at firm, industry and country level. Furthermore, complementary investment in IT-related labour and organizational factors (improvement in communication, networking and better coordination made possible by ICT) provide environment for maximizing the returns on IT investment which lead to improvement in productivity growth. The evidence suggests that IT investment will have sustained, long-lasting impact on productivity and economic growth if government policies

facilitates faster diffusion of information technology and better allocation of resources.

Karnik (2005); Malhotra and Gupta (2007); Joseph (2009); Ramesh (2009) observe that ICT industry in India is in an intensive phase of economic upgrading. It is expected to bring certain favourable results in the economy as well as labour market, which include enhanced contribution to GDP and export earning, advancement in technology and economic infrastructure, gain in employment level and quality of employment, increase in labour standards, increased allocation of funds towards training and up gradation of workforce, more resources for social spending and so on. The analysts are optimistic about the Indian ICT services due to the fact that these services are gradually proliferating across the domestic Indian landscape.

It is in this context that we intend to investigate, if during the recent past since the gradual intervention and subsequent eruption of the ICT in the Indian economy since the economic reforms, it has contributed in strengthening the knowledge economy of India.

3. Data and Methodology

The hypotheses of the study aim to explore that more intervention of ICT in knowledge intensive verticals will give push to knowledge economy of India. The sectors will become more knowledge intensive and knowledge economy will be reinforced. To testify it, regression will be run and the significance of beta coefficient will be tested.

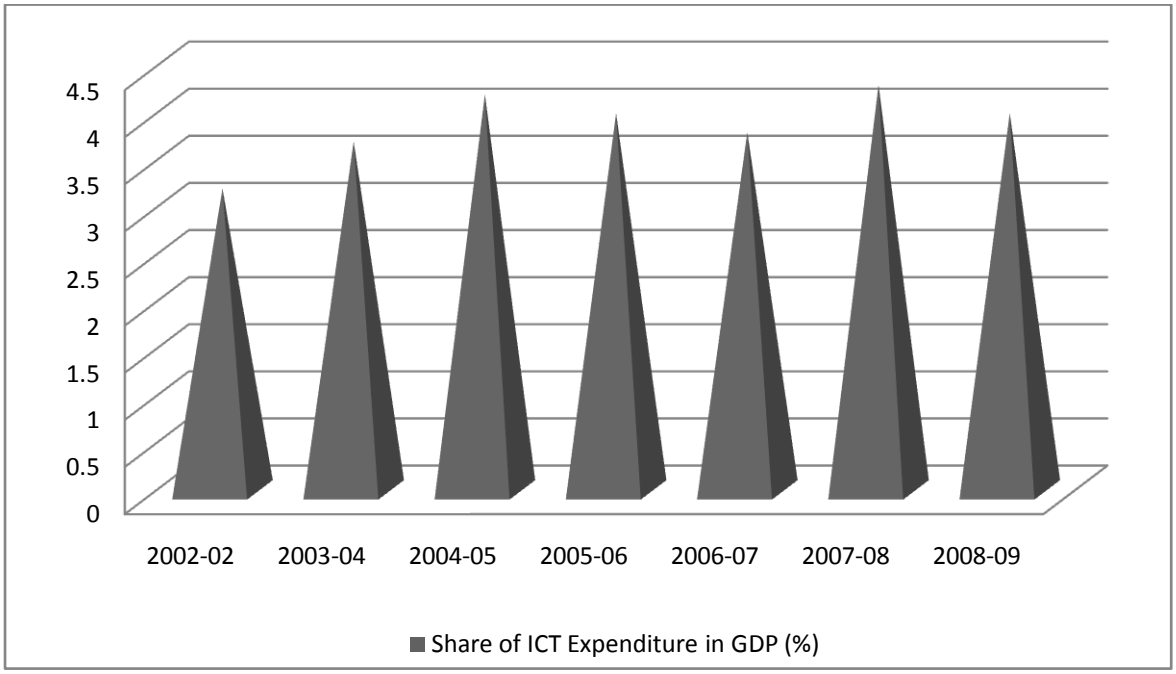
In India, IT applications were made in different sectors of the economy in early 2000s. As a result data relating to IT spending were available for a relatively smaller period of time. Data for the study of the ICT sectors have been collected from different sources like International Data Corporation (IDC), Gurgaon, Ministry of Commerce and Industry, National Health Profile, Ministry of Human Resource development. We have used step wise regression analysis for the period 2001-08 to analyze the effectiveness of the ICT in four knowledge intensive sectors namely drugs and pharmaceuticals, education, health and manufacturing.

4. Impact of Investment in ICT on the Knowledge Economy of India

In the past 15 years, there have been profound changes in the country and around the world. India is transforming itself into a knowledge-based economy, such that it is increasingly using new and existing knowledge to improve the productivity of agriculture, industry and services. High-tech science and technology, research and development, linkages between technical development and business, growth of IT sectors, education and health sectors, biotechnology sectors and manufacturing sectors and growth in services are critical areas in knowledge economy of India.

The growth of IT economy/new economy depends primarily on IT spending as part of aggregate investment that ultimately increases overall growth of economy. Information and communication expenditure is on the rise in India. It was 3 per cent of the gross domestic product in 2002-03 and shot up to 4 per cent of GDP in 2008-09 (WTO, 2009) as shown in Figure 1.

FIGURE 1
SHARE OF ICT EXPENDITURE IN INDIA'S GDP



Source: http://data.worldbank.org/indicators/BX.GSR.CCIS.ZS/countries

Knowledge intensive sectors operate in a highly competitive environment. Another key characteristic of such sectors is the intrinsically global nature of their operations. They are usually export-intensive and have customers across the globe. India has the potential to develop a strong competitive advantage in knowledge-based industries.

The potential growth areas in Indian IT using industry includes manufacturing, telecommunications, banking and financial services, utilities, retail and wholesale trade, and healthcare. These sectors have been traditionally low spenders on IT but are now increasing IT spends due to regulatory and market pressures. The level of IT investment varies across the sectors depending upon level of competition and expectations regarding profits and growth.

To look into the growth effects of ICT industry, we have selected four knowledge intensive sectors- drugs and pharmaceuticals, education, health and manufacturing.

(i) Impact of IT Spending on Indian Manufacturing Sector

Manufacturing sector comprises sub-industries like apparel and textile products, leather and leather products, fabricated metal products, automobile industry, auto-component sector and fast moving consumer goods industry. While the earlier technologies favoured mass production of a given model of a product, the current micro-electronic and information technologies support flexibility in designs, model and product mix. The modern manufacturing methods characterized by computer aided designs, computer aided manufacturing and flexible manufacturing systems encourage repeated changes in product specifications. In Indian manufacturing sector, IT spending increased from Rs. 3382 crore in 2001 to Rs. 12498 crore in 2008 and accounted for 14 per cent of total domestic IT market spending in 2008

(Gupta et al, 2008). To analyze the effect of IT spending on the growth of manufacturing sector, we have regressed profitability on export intensity, advertising intensity and ratio of IT spending to total cost in manufacturing sector for the period 2001-08, as depicted in Table 1.

In the present study, the regression model deployed is based on the following variables:

$Y= a+\beta_1X_1+ \beta_2X_2+ \beta_3X_3+\mu$

Where,

Y = Ratio of profit after tax to net worth.

X_1 = Export intensity (ratio of export to sales turnover of manufacturing sector).

X_2= Advertising intensity (ratio of advertising expenditure to sales turnover of manufacturing sector).

X_3= Ratio of IT spending in manufacturing sector to total cost.

μ= Disturbance term and

β_1, --------- $\beta_3$are the parameters to be estimated.

Table 1:
Multiple Step Regression Results

Variable	First Run Equation		Final Run Equation	
	β Coefficient	**t-value**	**β Coefficient**	**t-value**
Constant	-70.747	-2.633	-28.995	-5.591
X_1	4.791*	3.742	3.389**	7.988
X_2	33.749	1.593		
X_3	10.363	0.382		
R^2	0.948		0.914	
F-Ratio	24.170		21.240	

Note: * and ** represents statistically significant value at 5 per cent and 1 per cent level of significance respectively.

Table 1 shows that export intensity has come out to be positive and significant variable in explaining the variations in the profitability of manufacturing sector with β coefficient 4.791. The contribution of advertising intensity and ratio of IT spending to total cost to the profitability of manufacturing sector comes out to be 3.40 per cent only and insignificant. Thus, we find that out of three variables only export intensity comes out to be significant variable and explains 91.40 per cent of variation in profitability of manufacturing sector. After going through correlation matrix, no multicolinearity problem was found (see Appendix I).

(ii) Impact of IT Spending on Indian Drugs and Pharmaceuticals

Indian drugs and pharmaceutical companies are among the best in the world at producing drugs and exporting these drugs to about 200 countries. The development of technological knowledge has led to the success of pharmaceutical companies in India. IT spending in pharmaceuticals increased from Rs. 391 crore in 2001 to Rs. 1493 crore in 2008 (Gupta et al, 2008). To analyze the effect of IT spend on the growth of pharmaceuticals, we have regressed the number of patent applications filed on two variables namely, research and development intensity (research and

development expenditure /sales turnover) in pharmaceutical sector, and the proportion of IT spending to total cost for the period 2001-08 as depicted in Table 2
The regression model deployed is based on the following explanatory variables:
$Y= a+\beta_1 X_1+ \beta_2 X_2+ \mu$
Where,
Y= Number of patent applications filed in drugs and pharmaceutical sector.
X_1= Ratio of IT spending to total cost in drugs and pharmaceutical sector.
X_2=Research and development intensity (ratio of research and development expenditure to sales turnover in drugs and pharmaceutical sector).
μ= Disturbance term and
β_1, --------- $\beta_2$are the parameters to be estimated.

The multiple step regression results show that research and development intensity

Table 2:
Multiple Step Regression Results

Variable	First Run Equation		Final Run Equation	
	β Coefficient	**t-value**	**β Coefficient**	**t-value**
Constant	-2468.806	-2.968	-2113.624	2.427
X_1	835.910	1.476		
X_2	1280.543*	2.499	1851.465**	5.039
R^2	0.867		0.809	
F-Ratio	16.277		14.05	

Note: * and ** represents statistically significant value at 5 per cent and 1 per cent level of significance respectively.

has been a statistically significant variable with coefficient 1280.543. It means that as research and development intensity increases by one crore, on average, the number of patent applications filed increases by 1280 units. The technical capability of an enterprise increases as the firm expands its research and development spending. The logic is that as a firm spends more on R&D; its knowledge of technology becomes richer. Chaudhuri (1995) found that the technological capability of the Indian electronics industry has increased with rise in R&D intensity during the period of 1980-90.

The coefficient of IT spending to TC is found to be positively related to the number of patent applications filed in drugs and pharmaceutical sector with β value 835.91. However, it explains only 5.8 per cent of the variation in the number of patent applications filed in the drugs and pharmaceutical sector and the rest 80.9 per cent variation is explained by research and development intensity which ultimately affects the growth of the sector. After going through correlation matrix, no multicolinearity problem was found (see Appendix II).

(iii) Impact of IT Spending in Indian Healthcare Sector

The healthcare sector comprises of, health insurance companies, hospitals, physician organizations, nursing and personal care facilities, pharmaceuticals, employees and government health organization. IT spending in India in healthcare

increased from Rs. 281 crore in 2001 to Rs. 1065 crore in 2008 with a meager share of 1 per cent in total domestic IT market spending (Gupta et al, 2008).

To analyze the effect of ICT expansion on the growth of healthcare sector, we have regressed the number of people benefitted from anti-epidemics measure per one million population on three variables namely, number of registered doctors per one lakh population, number of hospital bed per one lakh population and IT spend/TC in healthcare sector for the period 2001-08 as shown in Table 3.
The regression model deployed is based on the following explanatory variables:

$Y= a+\beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+\mu$

Where,

Y= Number of people benefitted from anti-epidemic measures per one million population.
X_1= Number of registered doctors per one lakh population.
X_2= Number of hospital bed per one lakh population.
X_3= Ratio of IT spending in healthcare sector to total cost.
μ= Disturbance term and
β_1, --------- $\beta_3$are the parameters to be estimated.

The multiple step regression results for the period 2001-08 shows that in healthcare sector, effect of the proportionate spending on ICT in the healthcare sector has been found to be positive and significant with β coefficient 0.095. It means that if IT spending /TC increases by one crore in healthcare sector, the number of people benefitted from epidemics will increase by 95 thousand. It explains 51.60 per cent of the variation in the number of people benefitted from the anti-epidemic measures of the Government. The influence of number of hospital beds per one lakh population and number of registered doctors per one lakh population on the number of people benefitted from epidemics is found to be positive but insignificant and explains 15.50

Table 3:
Multiple Step Regression Results

Variable	First Run Equation		Final Run Equation	
	β Coefficient	t-value	β Coefficient	t-value
Constant	3.069	0.208	9.902	7.212
X_1	0.074	0.313		
X_2	0.037	0.873		
X_3	0.095	1.754	0.084*	2.528
R^2	0.671		0.516	
F-Ratio	2.721		2.186	

Note: * represents statistically significant at 5 per cent level of significance.

per cent of the variation in the dependent variable. After going through correlation matrix, no multicolinearity problem was found (see Appendix III).

(iv) Impact of IT Spending in Indian Education Sector

Knowledge has been recognized as the key driving force in the 21st century and India's ability to emerge as a globally competitive player will substantially depend on its knowledge resources. The knowledge economy demands a new set of competencies, which include not only ICT skills but also soft skills. Fostering such skills requires an education system that is flexible and develops core skills that encourage creative and critical thinking. In its size and diversity, India has the third largest higher education system in the world, next only to China and the United States. Total budgeted expenditure (plan and non plan) on education has escalated to Rs. 11718 crore in 2006-07 from Rs. 23413 crore in 1993-94. The landmark policy on computer education in India was evolved in July 1998 with an objective to enhance the quality of learning through the use of ICTs and provide equal opportunities to the children in remote areas (World Bank, 2004).

To analyze the effect of the ICT expansion on the growth of education sector, we have regressed the gross enrollment ratio at secondary level on three variables namely, pupil-teacher ratio at secondary level, plan expenditure on education to total plan expenditure and ICT expenditure to total plan expenditure in secondary education for the period 2001-08 as shown in Table 4.

The regression model deployed is based on the following explanatory variables:

$Y= a+\beta_1 X_1+ \beta_2 X_2+ \beta_3 X_3+\mu$

Where,
Y= Gross Enrollment Ratio (GER) at secondary level.
X_1= Pupil-teacher ratio at secondary level.
X_2= ICT expenditure to total plan expenditure in secondary education.
X_3= Plan expenditure on education to total plan expenditure.
μ= Disturbance term and
β_1, --------- $\beta_3$are the parameters to be estimated.

Table 4:
Multiple Step Regression Results

Variable	First Run Equation		Final Run Equation	
	β Coefficient	t-value	β Coefficient	t-value
Constant	2.195	0.085	37.059	16.363
X_1	1.109	1.357		
X_2	0.586	0.192		
X_3	1.427*	2.898	1.745**	6.821
R^2	0.922		0.886	
F-Ratio	15.718		13.48	

Note: * and ** represents statistically significant value at 5 per cent and 1 per cent level of significance respectively.

The multiple regression results show that the effect of share of plan expenditure on education in total plan expenditure on education is found to be positive on gross enrolment ratio with β coefficient 1.427 and it explains 88.60 per cent of variation in

the gross enrollment ratio. Whereas, the effect of share of ICT expenditure in total plan expenditure at secondary level and pupil- teacher ratio on the gross enrolment ratio at secondary level in India is positive but insignificant and contributes only 3.6 per cent to the variation in the gross enrolment ratio at secondary level. After going through correlation matrix, no multicolinearity problem was found (see Appendix IV).

5. Summary and Conclusions

In nutshell, we find that Investment in ICT provides environment for maximizing the returns in different sectors of the economy. The evidence suggests that IT investment will have sustained, long-lasting impact on productivity and economic growth if government policies facilitates faster diffusion of information technology and better allocation of resources.

The effect of IT investment on the profitability (net return on capital) of manufacturing sector has been found positive but non-significant in explaining the variation in it. It is argued in literature that the relation between technology spending and industrial performance is complex one and all the participants in the industry may not gain by it. All the firms in the industry are not alike and benefit differently from expenditure on technology. Similarly, in education and pharmaceutical sector the effect of IT spending/TC has been found positive but insignificant. It might be due to the less diffusion of IT in the two sectors. Although education has expanded several times since independence, the major issues of access, equity, and quality continue to be areas of concern. In contrast to it, the effect of IT spending/TC in the health sector has been positive and significant in explaining the variation in number of people benefitted from anti-epidemic measures of the Government of India. Thus there should be more ICT penetration, massive expansion of ICT literacy and skill among the population and greater scope for technology diffusion to realize the benefits of ICT in the knowledge economy of India.

As mentioned above, in India, IT applications were made in different sectors of the economy in early 2000s only. As a result data relating to IT spending were available for a lesser period of time. I was constrained to use regression analysis for a short span i.e., from 2001-08, in the four sectors namely manufacturing; drugs and pharmaceuticals; health and education, which might underplay the intensity of results. Any future study could use a larger time series data to infer better about the euphoric contribution of the ICT sectors. Similarly, the set of knowledge sector could be enlarged to include banks; transport; engineering services; business services and entertainment sector as well.

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Appendix I

Manufacturing Sector

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.974[a]	.948	.909	2.6675	.948	24.170	3	4	.005
2	.973[b]	.946	.924	2.4290	-.002	.146	1	4	.722
3	.956[c]	.914	.900	2.7926	-.032	2.931	1	5	.148
a. Predictors: (Constant), X_3, X_2, X_1									
b. Predictors: (Constant), X_2, X_1									
c. Predictors: (Constant), X_1									

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	β	Std. Error			
1 (Constant)	-70.747	26.867		-2.633	.058
X1	4.791	1.280	1.352	3.742	.020
X2	33.749	21.181	.540	1.593	.186
X3	10.363	27.139	.118	.382	.722
2 (Constant)	-66.698	22.479		-2.967	.031
X1	5.025	1.024	1.418	4.906	.004
X2	30.892	18.043	.495	1.712	.148
3 (Constant)	-28.995	5.186		-5.591	.001
X1	3.389	.424	.956	7.988	.000
a. Dependent Variable: Y					

Correlation Matrix

	Y	X_1	X_2
X_1	0.956		
X_2	-0.828	-0.933	
X_3	0.870	0.928	-0.923
Critical Value of r at 5% = 0.707			

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Appendix II

Indian Drugs and Pharmaceuticals Sector

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.931[a]	.867	0.814	534.157	0.867	16.277	2	5	.006
2	.899[b]	.809	0.777	584.221	-.058	2.177	1	5	.200
Predictors: (Constants), X_2 , X_1									
Predictors: (Constants) X_2									

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	β	Std. Error			
(Constant)	-2468.806	831.791		-2.968	.031
X1	835.910	566.485	.367	1.476	.200
X2	1280.543	512.393	.622	2.499	.055
(Constant)	-2113.624	870.828		-2.427	.051
X2	1851.465	367.417	.899	5.039	.002
a. Dependent Variable: Y					

Correlation Matrix

	Y	X_1
X_1	0.837	
X_2	0.899	0.755
Critical Value of r at 5% = .707		

Variables	Mean	SE
Y	2149.38	1237.213
X_1	2.00	0.544
X_2	2.30	0.601
NV	3	
No. of obs.	8	

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Appendix III

Indian Health Sector

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.819[a]	0.671	0.424	0.477	0.671	2.721	3	4	0.179
2	0.814[b]	0.663	0.528	0.431	-0.008	0.098	1	4	0.77
3	0.718[c]	0.516	0.435	0.472	0.147	2.186	1	5	0.19
a. Predictors: (Constant), X_3, X_2, X_1									
b. Predictors: (Constant), X_2, X_3									
c. Predictors: (Constant), X_3									

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	β	Std. Error			
1 (Constant)	3.069	14.778		0.208	0.846
X_1	0.074	0.237	0.283	0.313	0.770
X_2	0.037	0.043	0.636	0.873	0.432
X_3	0.095	0.054	0.810	1.754	0.154
2 (Constant)	7.649	1.974		3.875	0.012
X_2	0.025	0.017	0.431	1.479	0.199
X_3	0.107	0.034	0.914	3.136	0.026
3 (Constant)	9.902	1.373		7.212	0.000
X_3	0.084	0.033	0.718	2.528	0.045
a. Dependent Variable: Y					

Correlation Matrix

	Y	X_1	X_2
X_1	0.281		
X_2	0.015	-0.890	
X_3	0.718	0.696	-0.455
Critical Value of r at 5% = .707			

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Appendix IV

Indian Education Sector

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.960[a]	.922	.863	1.87896	.922	15.718	3	4	.011
2	.960[b]	.921	.890	1.68834	.000	.037	1	4	.857
3	.941[c]	.886	.867	1.85430	-.035	2.238	1	5	.195
a. Predictors: (Constant), X3, X1, X2									
b. Predictors: (Constant), X3, X1									
c. Predictors: (Constant), X3									

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	β	Std. Error			
1. (Constant)	2.195	25.801		.085	.936
X1	1.109	.817	.233	1.357	.246
X2	.586	3.047	.046	.192	.857
X3	1.427	.493	.770	2.898	.044
2. (Constant)	3.090	22.803		.136	.897
X1	1.092	.730	.230	1.496	.195
X3	1.500	.285	.809	5.261	.003
3. (Constant)	37.059	2.265		16.363	.000
X3	1.745	.256	.941	6.821	.000
a. Dependent Variable: Y					

Correlation Matrix

	Y	X_1	X_2
X_1	0.696		
X_2	0.765	0.416	
X_3	0.941	0.576	0.808

Major Revisions in the Paper

Sr. no.	Comment	Revision
1	Review of more recent literature	Recent literature is given on page no. 4
2	Empirical methodology	Methodology is discussed clearly on page no. 4
3	Less number of years	Reason is provided on page no. 4
4	Summary Statistics of variables	Summary statistics of the variables is reported on page no. 13-16
5	Extensive discussion of multivariate regression results	Results are discussed in the respective sector analysis on page no. 6-10
6	Problem of multicollinearity	Problem of multicollinearity is not found and the correlation matrix is given in Appendix 1-4 on page no. 13-16
8.	In Table 2 coefficients of constants, X_1 , X_2 are high and difficult to interpret	The constant (number of patent applications filed) is expressed in measured in number. The mean is given on page no. 14
9	Limitation and scope of further research	In conclusion it is added on page no. 11