An Assessment of Impact of Globalization on Indian IT and ITES Exports

Manzoor Hassan Malik*
Research Scholar
Department of Economics
Pondicherry University, India
Email: - malikmanzoor2022@gmail.com

Dr. Nirmala Velan
Professor
Department of Economics
Pondicherry University, India
Email: - nirmalvelan@gmail.com

Abstract

The new economic policy initiated in the 1990s, advocating Liberalization, Privatization and Globalization (LPG), has had a substantial impact on all major sectors of the Indian economy. Consequently, the country has grown to become globally competitive especially with respect to the service sector; and more specifically in the case of Information Technology and Information Technology Enabled Services (IT-ITES). Against this background, this paper attempts to over-view the trends and patterns of growth of the Indian IT sector during the period 1990-2015. Further, it deviates from most of the earlier studies by attempting to investigate the dynamic relationship among IT exports, openness and economic growth in India over the period 1980 to 2015. The study is based on secondary data extracted from National Association of Software and Service Companies (NASSCOM) annual reports, Reserve bank of India database on Indian economy and World Bank. Vector Auto Regression (VAR) model has been employed based on variance decomposition (VD) and impulse response function (IRF) to analyze the relationship among economic growth, IT exports and openness index. The results of IRF and VD suggest that economic growth responds positively to a shock in IT exports and openness of economy post globalization. Further, IT exports and openness contribute to economic growth more in the long-run rather than in the short-run. This implies that economic growth can be enhanced by implementing policies that not only improve the efficiency of the sector, but also focus on optimization of the potential of the Indian IT industry.

Keywords: Economic Growth, IT exports, Openness Index, VAR Model, Variance Decomposition (VD), Impulse Response Function (IRF).

*Corresponding Author

1.1 Introduction

The fast growing computer software and services industry is a key example of knowledge production, as the value of its products and services is almost entirely knowledge embodied. Although it is dominated by firms based in major industrialized countries of the world, it continues to offer great prospects for economic growth and industrial development within developing economies. Especially, the software industry has become a leading source of employment creation and economic growth in the world (Schware 1995). Software is a key facilitating technology, making it major strategic means of growth and development. Software and computer services centrally underpin the actual creation, besides the efficient utilization of core aspects of modern manufacturing and the physical products that are produced (Alic 1994).

The importance of software and service industry has enormously increased over time in India, especially after the economic reforms. This is reflected by its growing shares in national income, employment, total exports, forex reserves and standard of living of the people. The emergence of the country as a center for outsourcing a highly knowledge-intensive service, such as software, is contributing to changing the public perception about India and is diverting attention to its potential in knowledge-based industries. As a consequence, a significant number of multi-national enterprises in other knowledge-based industries have set-up global or regional R&D centers in India to benefit from the expertise and software houses available in the country. The software industry's development has also facilitated capital flows to the economy, including Foreign Institutional Investments (FIIs) in the stocks of software companies in India, Foreign Direct Investment (FDI) by multinational corporations (MNCs), and Joint Ventures.

Analysis of the dynamics of relationship between software exports and economic growth has received significant attention from scholars world-wide since the last decade. More specifically, the relationship between export and economic growth is well-explored in the existing literature in the context of both developed as well as developing countries. The findings on the direction of causation of exports and economic growth are quite mixed. Some studies have found evidence of uni-directional relationship running from exports to economic growth, widely known as export-led growth under which increasing export boosts the allocation of countries resources, productivity growth, technological progress and economies of scale (Kruger 1980; David and Loewy 1998; and Edwards 1998). Export-led growth hypothesis has been analyzed by several

scholars, using different econometric methods. Researchers like Marin (1992), Henrques and Sadorsky (1996), and Yamada (1998) examined export-led growth hypothesis in the context of developed economies and found that 'out-ward looking strategy' favoured productivity growth in them. Meanwhile, Balaasa (1978) and Chow (1987) found that export-led growth strategy not only promoted economic growth in the developing economies, but also caused structural transformation in them. Jordan and Eita (2007), and Ullah, et. al. (2009) examined long-run equilibrium relationship between exports and economic growth using multivariate Granger and causality technique and found that export-led growth strategy through various policies had positively influenced economic growth. Using multivariate vector auto-regressive model, Love and Chandra (2005) also confirmed the existence of long-run equilibrium relationship between exports and economic growth in Bangladesh. Based on Toda Yammoto framework, Siliverstors and Herzer (2006) found evidence of manufacturing exports affecting economic growth through increased productivity in Chile.

In the context of India, Jung and Marshall (1985), and Dodaro (1993) found no evidence of causality between export growth and real income growth. Whereas, Dhawan and Biswal (1999) analyzed the equilibrium relationship between GDP, exports and terms of trade, and found causality running from exports to GDP to be a short-run phenomenon. In contrast to these studies, a few research studies favour export-led hypothesis in the case of India. Based on Engle-Granger cointegration and error-correction mechanism, Malick (1996) found the evidence of growth led exports during 1950 to 1992. Ekanayake (1999) again found evidence of causality between real export and economic growth during the period 1960 to 1997. However, using time series data, Asafu and Chakraborty (1999) and Panagiotiasis (2004) found no evidence of the existence of long-run relationship between the exports, imports and GDP. Nidugala (2001) also concluded that export growth had significant and positive relationship with economic growth. Sharma and Dhakal (1994), Islam (1998), Singh and Konya (2006), and Dash (2009) also found uni-directional causality running from export to economic growth, supporting export-led growth in the case of India. Vijayasri (2012) found that software and services sector had contributed significantly to export earnings and GDP. The exports of electronic and computer software and services sector had maintained outstanding annual average growth rates, with the exports being directed to 217 countries during the year 2010-11, in which North America followed by European Union topped the list.

The reviewed studies reveal the availability of a large number of studies across and within countries examining export-led growth hypothesis with varying conclusions. However, studies examining the relationship between software exports, openness and economic growth in India are scant. Most of the previous studies, have not considered the effect of software and service industry as an important component of export-growth relationship, despite India's software and service exports significantly contributing to the national income, especially after the economic reforms. Hence, the present study attempts to fill this lacuna by examining the relationship between software and service exports and economic growth in India over the period 1980-2015. Further, among the existing studies for India, hardly any study has adopted VAR analysis using the variables of interest. In this context, this study would be one of the first in the case of India that would make significant contribution by bridging a gap in the existing literature by addressing the issue, not focused upon by previous studies.

1.2 Objectives of the study:-

1. To overview the trends and patterns of growth of the Indian IT sector during the period 1990-2015; and
2. To investigate the dynamic relationship among IT exports, openness index and economic growth in India over the period 1980 to 2015.

1.3.1 Data and Methodology

Annual time series data on software exports, net national product and openness index have been collected from NASSCOM, Reserve bank of India database on Indian economy, and World Bank for the present study for the period 1980-2015. The methodology adopted for studying the first objective are simple averages, percentages, growth rates, graphs prepared on the basis of data from the IT sector, and growth trend models. Trends and patterns in key performance indicators, such as total revenue, domestic revenue, export revenue, employment and exports of the software industry have been analyzed from 1991 to 2016.

Growth trend model have been used separately, to examine the relative performance of exports/receipts from various components of current account of balance of payment, like software services, transportation, travel and insurance services over time; the model measures the relative change in the dependent variable over time. Since the interest of the present paper is to measure the proportional or relative change in dependent variable and also to make a comparative analysis

of relative change which is more relevant than absolute change, growth trend model of exports has been fitted against the linear trend model. The logarithm transforms absolute values/data into a common value/data and enables simple comparisons of relative performance of different components of current account of the balance of payment, and helps to draw inferences about the relative volatility based on comparison of standard deviations of each component. Therefore growth trend model is estimated for comparative purposes (Gujarati 1995). The general form of the model (which is semi-log model or log-linear model) can be expressed as follows:

$$LEXP_t = \alpha_1 + \alpha_2 T + et \qquad (1)$$

Where, $LEXP_t$ = is the natural log of Exports in the growth model from a particular component over time;

α_1 = is the intercept in the growth model of exports from a particular component over time; and

α_2 = is the semi-elasticity coefficient of time variable (t) known as the trend variable in the growth model for a particular sector. The slope coefficient measures the proportional or relative change in EXPt for a given change in the value of the regressors (trend variable). When the relative change in EXPt is multiplied by 100, the percentage growth rate in EXPt is obtained for a given change in the trend variable. If the trend coefficient is positive, there is an overall growth in EXPt, whereas if it is negative, there is an overall decline in EXPt. Here, t = time variable (t), known as the trend variable, is measured in years (1, 2… *n*) in the growth trend model from a particular component; and e_t = is the error term in the growth model from a particular component.

In the case of second objective, Vector Auto Regression (VAR) model has been employed based on variance decomposition (VD) and impulse response function (IRF) to analyze the relationship among economic growth, IT exports and openness index. All the variables have been converted into natural logarithms for the analysis. The variable description and specification for the analysis are as follows:

SE: total value of software export from India in billion Rupees;

NNP: net national product in billion Rupees; and

OPI: index of openness, measured by total trade as a percentage of GDP.

1.3.2 Stationary test

In time series analysis, it is important to check the properties of the data. The test of order of integration for each variable has been checked using Augmented Dickey-Fuller (ADF) method. The functional form of the ADF can be expressed as

$$\Delta Y_t = \alpha + \Phi Y_{t-1} + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + et$$

Confirmation of stationarity of given variables also have been checked using Phillips-Perron (PP) test. The test is non-parametric and corrects statistic for the presence of serial correction and heterocedasiticity in the error term. This renders robustness to the presence of serial correction and heterocedasiticity. The test also has another benefit over the ADF test, as there is no need to specify the number of lags. The functional form of the PP test is given as:-

$$Y_t = \alpha + \rho Y_{t-1} + et$$

1.3.3 VAR representation of variables

VAR model is widely used to analyze the dynamic behaviour of economic variables. In the system of VAR model, each variable is explained by its own lagged value and the lagged value of other variables. The VAR model of the present study in a matrix form can be expressed as shown:-

$$\begin{bmatrix} y_t \\ m_t \\ z_t \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \\ \lambda_{30} \end{bmatrix} + \begin{bmatrix} \alpha_{11}^1 \cdots \alpha_{1n}^1 \\ \vdots \quad \ddots \quad \vdots \\ \alpha_{31}^1 \cdots \alpha_{3n}^1 \end{bmatrix} + \begin{bmatrix} y_{t-1} \\ \vdots \\ y_{t-n} \end{bmatrix} + \begin{bmatrix} \beta_{11}^2 \cdots \beta_{1n}^2 \\ \vdots \quad \ddots \quad \vdots \\ \beta_{31}^2 \cdots \beta_{3n}^2 \end{bmatrix} + \begin{bmatrix} m_{t-1} \\ \vdots \\ m_{t-n} \end{bmatrix} + \begin{bmatrix} \gamma_{11}^3 \cdots \gamma_{1n}^3 \\ \vdots \quad \ddots \quad \vdots \\ \gamma_{31}^3 \cdots \gamma_{3n}^3 \end{bmatrix} + \begin{bmatrix} z_{t-1} \\ \vdots \\ z_{t-n} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \end{bmatrix} \quad (1)$$

where, y_t, m_t, z_t are the given three matrix of endogenous variables NNP, SE and OPI respectively. The regression equation from the matrix can be written as follows:-

$$y_t = \lambda_{10} + \alpha_{11}^1 y_{t-1} + \cdots + \alpha_{3n}^1 y_{t-n} + \cdots + \beta_{11}^2 m_{t-1} + \cdots + \beta_{3n}^2 m_{t-n} + \cdots + \gamma_{11}^3 z_{t-1} + \cdots + \gamma_{3n}^3 z_{t-n} + e_{1t}$$

$$m_t = \lambda_{20} + \alpha_{11}^1 y_{t-1} + \cdots + \alpha_{3n}^1 y_{t-n} + \cdots + \beta_{11}^2 m_{t-1} + \cdots + \beta_{3n}^2 m_{t-n} + \cdots + \gamma_{11}^3 z_{t-1} + \cdots + \gamma_{3n}^3 z_{t-n} + e_{2t}$$

$$z_t = \lambda_{30} + \alpha_{11}^1 y_{t-1} + \cdots + \alpha_{3n}^1 y_{t-n} + \cdots + \beta_{11}^2 m_{t-1} + \cdots + \beta_{3n}^2 m_{t-n} + \cdots + \gamma_{11}^3 z_{t-1} + \cdots + \gamma_{3n}^3 z_{t-n} + e_{3t}$$

The above matrix formation of the given variables NNP, SE and OPI can be written in a simple equation form as:-

$$Y_t = \lambda + \alpha y + \beta m + \gamma z + et \quad (2)$$

In equation (2), the lagged value of NNP, SE and OPI are represented by the vectors y, m and z respectively. Similarly, coefficient of the three matrix of variables are represented by α, β and γ. Based on the outlined procedure, the relationship among the variables software exports, openness and national income of India have been estimated and the results are examined using following methods.

1.3.4 Impulse responses and Variance decomposition

In order to draw inferences from the VAR model, innovation accounting techniques like impulse responses (IRs) and variance decomposition (VD) have been used. IRs analyze the relative impact of each variable on the others, whereas VD analyses the portion of variance in the forecast error for each variable due to innovations. The resulting causal impacts of shocks or innovations of each concerned variables from the system of variables are summarized with impulse response function and variance decomposition.

1.4 India - The Leading Global Sourcing Hub

Table – 1 illustrates the global services location index, which examines the off-shoring locations across the globe and ranks the top destinations for global off-shoring for 2016.

Table -1

Assessment of Location Attractiveness for Global Outsourcing Hub 2016.

Rank	Change in Ranking	Country	Financial attractiveness	People skills and availability	Business environment	Total
1	0	India	3.22	2.55	1.19	6.96
2	0	China	2.28	2.71	1.51	6.49
3	0	Malaysia	2.75	1.42	1.89	6.05
4	+4	Brazil	2.34	2.07	1.59	6.00
5	0	Indonesia	3.23	1.54	1.22	5.99
6	0	Thailand	3.04	1.44	1.44	5.92
7	0	Philippines	3.17	1.43	1.29	5.88
8	-4	Mexico	2.71	1.56	1.61	5.87
9	+4	Chile	2.58	1.26	1.88	5.72
10	+13	Poland	2.41	1.37	1.90	5.68
11	+1	Vietnam	3.19	1.25	1.22	5.66
12	-3	Bulgaria	2.99	0.94	1.66	5.60
13	+5	Romania	2.79	1.16	1.64	5.59
14	+2	Sri Lanka	3.37	1.03	1.14	5.54

15	-1	United states	0.52	2.88	2.11	5.51
16	-6	Egypt	3.20	1.29	0.96	5.45
17	+4	Russia	2.23	1.80	1.34	5.38
18	+5	Latvia	2.70	0.99	1.64	5.33
19	+5	Costa Rica	2.70	0.90	1.72	5.32
20	+23	Colombia	2.48	1.38	1.46	5.32
21	+18	Turkey	2.37	1.40	1.54	5.31
22	+4	Bangladesh	3.34	1.10	0.87	5.31
23	-6	Germany	0.84	2.14	2.32	5.31
24	+17	Ukraine	3.03	1.14	1.12	5.29
25	+2	United Kingdom	0.67	2.28	2.33	5.28
26	+7	Czech Republic	2.19	1.14	1.94	5.27
27	-12	Lithuania	2.59	0.93	1.73	5.24
28	-3	Pakistan	3.26	1.30	0.64	5.20
29	0	Ghana	3.27	0.85	1.07	5.19
30	6	Mauritius	2.55	0.94	1.68	5.17
31	-1	Panama	2.69	0.76	1.69	5.14
32	-1	Hungary	2.28	1.14	1.71	5.14
33	-11	Estonia	2.29	0.94	1.87	5.09
34	0	Morocco	2.80	0.93	1.34	5.07
35	-15	Jordan	2.86	0.89	1.31	5.07
36	2	Argentina	2.36	1.50	1.20	5.06
37	-18	United Arab Emirates	1.93	1.06	2.07	5.06
38	-10	Tunisia	3.04	0.82	1.18	5.05
39	NA	Kenya	3.06	0.86	1.11	5.03
40	+4	Portugal	1.72	1.26	2.05	5.03
41	+5	France	0.71	2.10	2.15	4.96
42	NA	Trinidad and Tobago	2.51	0.99	1.46	4.96
43	+2	Jamaica	2.58	1.02	1.31	4.92
44	-7	Canada	0.56	1.97	2.36	4.89
45	-5	Senegal	3.06	0.70	1.13	4.89
46	-14	Spain	0.94	1.88	2.06	4.88
47	NA	Peru	2.43	1.12	1.26	4.82
48	-1	South Africa	2.20	1.08	1.50	4.77
49	-14	Slovakia	2.03	0.97	1.74	4.74
50	-2	Singapore	0.74	1.48	2.45	4.67
51	-9	Uruguay	1.97	0.94	1.62	4.53
52	-3	Australia	0.36	1.64	2.34	4.34
53	-2	Ireland	0.44	1.71	2.09	4.25
54	-4	Israel	1.15	1.27	1.65	4.07
55	NA	New Zealand	0.64	1.22	2.19	4.05

Source: A.T. Kearney Global Services Location Index 2016.
Note: Scores by Service Line

Asia has remained the best region in the world for off-shore location, with India, China and Malaysia representing the top three in the index. Thanks to the education system, infrastructure and

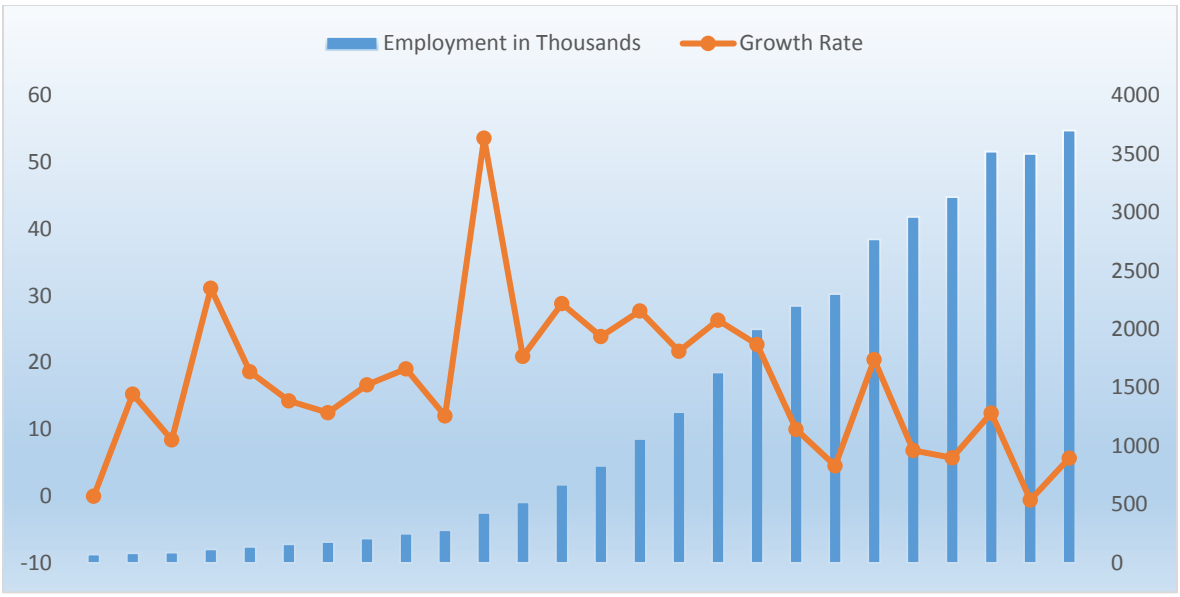
fiscal incentives offered by the government, India has continuously remained the top off-shoring destination, followed by china and Malaysia, which has remained stable. This is due to the availability of large number of private and public educational institutions, vast output of qualified engineers and enormous English-language capability, which has remained the real point of attraction of the country. India has almost competed in all three dimensions of financial attractiveness, people's skill, and availability; but lags behind China in the case of people's skills and availability, and business environment by a margin of 0.16 and 0.32 respectively. China is also increasing its IT production potential, particularly hardware production, and ranks second in the index.

1.5 Employment in Indian IT Sector

IT sector has mitigated the educated unemployment problem in India to a large extent. The number of IT technical professionals in the industry are increasing sharply year after year. According to DEITY (2014-15), the IT sector is a large employment generator and has catalyzed the growth of several ancillary industries, such as transportation, real estate, catering, security, housekeeping and others. The total IT Software and Services employment was estimated to touch 3.7 million in 2015-16 and the indirect employment generated by the sector to about 10 million in 2015-16. According to NASSCOM (2015-16), India is having the world's largest talent for IT services. The employee growth in IT sector is supplemented by non-linear growth model. Foreign nationals engaged in the IT sector are about 100,000. Women are no exception in IT sector, with about 34 percent employees being women in the sector as per NASSCOM FY 2015.

Figure - 1 gives details on direct employment and its growth rate in the IT sector during 1991-2013.

Figure – 1
Direct Employment and Growth Rates



Source: Author's calculations based on Nasscom data.

The figure indicates that direct employment, excluding hardware, in IT sector increased from 72 thousand in 1991 to 3,700 thousand in 2016. It has increased at an average growth rate of 16.88 percent during the same period. The year 1994 witnessed the highest growth in direct employment in the sector. The absolute employment figures of the sector show continuous increase up-to 2014, but its growth rate decreased sharply and turns negative in 2015. Apart from the global economic recession in 2008 in the U.S.A, which had an adverse impact on Indian IT sector; the pace of hiring in the sector has been declining over the last couple of years, mainly because new technologies are making Indian low skilled labour redundant. Skilled labour, which was one of the main comparative advantage at global software and service market, is becoming obsolete by offering low-level jobs. Automation has been making possible to do repetitive and low-skill jobs. It has had substantial negative impact on low-skilled labor force of Indian IT sector because with the help of new technologies, it is now possible that a person can control ten to fifty servers. The hiring trend, which was increasing sharply year after year in IT sector, is now changing downwards after the globalization period. The industry is hiring lesser staff, with the IT firms trying to perform low-skilled jobs through automation and making their existing staff more productive by giving more control on servers per person. Also, the focus has been shifting to new niche areas like artificial intelligence and cloud computing. The people skilled in the areas are now in high demand. Others, particularly new engineering graduates, IT diploma and Bachelor of computer application

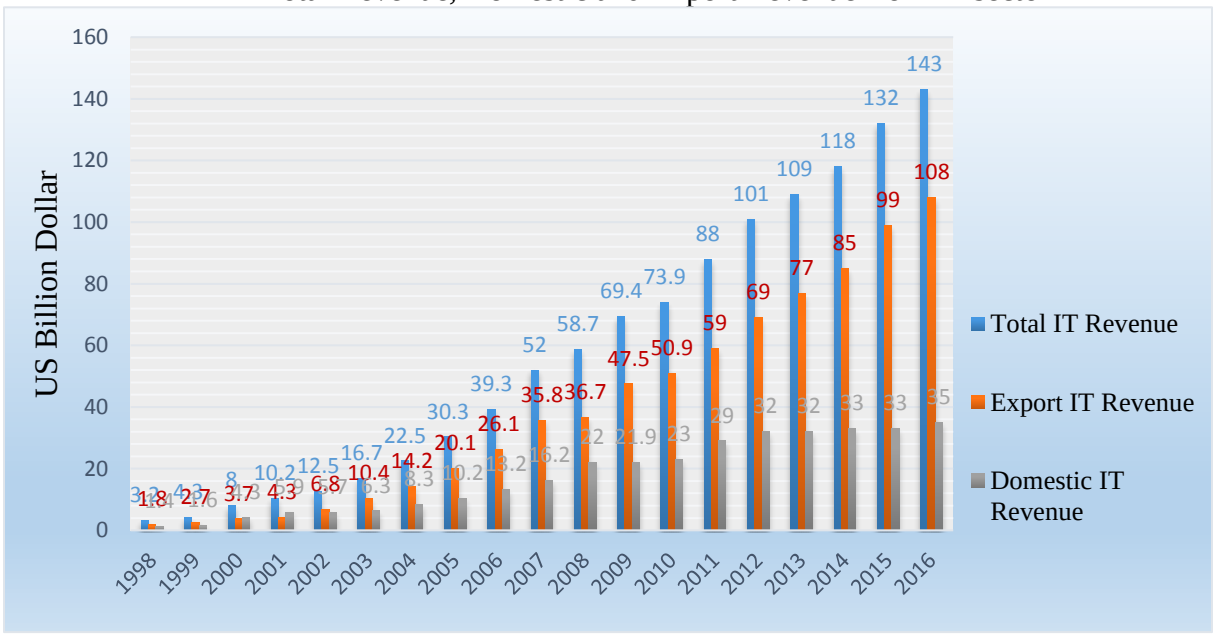
(BCA) holders, who were in great demand after the globalization are now finding difficulty in getting job (NASSCOM 2016).

1.6 Total, Domestic and Export Revenue

Figure - 2 shows total, domestic and export revenues of the Indian IT sector during 1998-2016.

Figure – 2

Total Revenue, Domestic and Export Revenue from IT sector



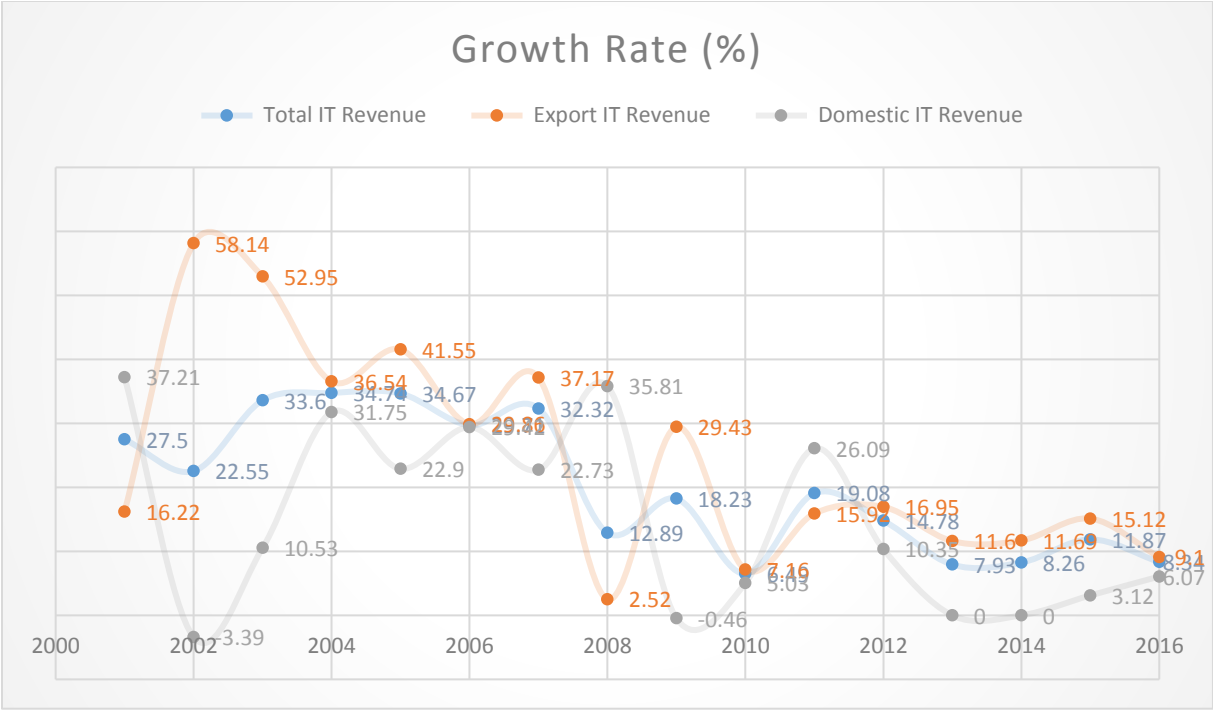
Source: Author's calculations based on NASSCOM data.

The figure indicates that total revenue from IT sector increased from 3.2$ billion in 1998 to 143$ billion in 2016, at an average of 47.58$ billion during the period. The export revenue from IT sector increased from 1.8$ billion to 108$ billion, at an average of 49.90$ billion during the period 1998 to 2016. The export revenue from IT sector increased continuously year on year, at an average growth rate of 23.06 percent during the study period. Domestic revenue from IT sector increased from 1.4$ billion in 1998 to 35$ billion in 2016. Indian IT firms could generate enough revenues from the domestic market. But, because Indian domestic IT market is mostly captured by the MNCs, and its firms do not possess full comparative advantage in the sector, these firms are concentrated in low skill activities required for production, and mainly focus only on export revenue (Kumar 2010).

Figure - 3 shows growth rates in total revenue, domestic revenue and revenue from export of the Indian IT sector during the period 2001-2016.

Figure - 3

Growth Rates of Total, Domestic and Export Revenue of Indian IT Sector



Source: Author's calculations based on Nasscom data.

The figure shows year-wise fluctuations in export, domestic and total revenue growth from IT sector during the study period. The total revenue from IT sector increased at an average growth rate of 19.01 percent during the period FY 2001 to FY2016. Revenue growth of IT sector was 27.50 percent in FY2001 when the domestic IT revenues were at its peak, but declined drastically to 22.55 percent in FY2002 because of severe competitions from the MNC giants. The revenue growth started increasing again in 2003, which increased at an average growth rate of 18.20 percent during FY2003 to FY2016. However, a low trough emerges during FY 2008 to 2010, corresponding to the global economic slowdown. It picked up slightly in 2011, and increased at an average growth rate of 11.71 percent from 2011 to 2016.

The figure indicates that export revenue dominates total revenue of the IT sector during the period 2001 to 2016. Export revenue from the IT sector demonstrates an increasing trend with slight fluctuations, whereas domestic revenue from IT sector shows relatively large year-wise

fluctuations over the period 2001-2016. The reason for large fluctuations and miserable growth rates in domestic revenue was the entering of multinational firms into the domestic market (kumar et. al 2005).

1.7.1 Empirical Results

Before analyzing the component-wise growth instability/volatility of current account of balance of payment of India, it would be useful to review the growth trends of exports from different components of the current account of balance of payment of the Indian economy. The relative exports/receipts performance of the various components of current account of balance payment, such as software services, transportation, travel and insurance services, over time are presented in table – 2.

Table – 2

Estimated Results of the Log-Trend Models

Dep. Variable: Natural Log of receipts on Software Service (LNSX)							
Variable	Coefficient	S.E.	Prob.	R^2	σ of Reg.	Mean	C.V
C	8.9311	0.0137	0.0000	0.9017	0.8560	10.3798	8.24
TREND	0.1609	0.1406	0.0000				
Dep. Variable: Natural Log of receipts on Travel (LNTX)							
Variable	Coefficient	S.E.	Prob.	R^2	σ of Reg.	Mean	C.V
C	8.0422	0.0898	0.0000	0.9371	0.6835	9.2216	7.41
TREND	0.1310	0.0087	0.0000				
Dep. Variable: Natural Log of receipts on Transportation (LNTRX)							
Variable	Coefficient	S.E.	Prob.	R^2	σ of Reg.	Mean	C.V
C	7.7037	0.0149	0.0000	0.8627	0.7885	9.0090	8.75
TREND	0.1450	0.0149	0.0000				
Dep. Variable: Natural Log of receipts on Insurance (LNINX)							
Variable	Coefficient	S.E.	Prob.	R^2	σ of Reg.	Mean	C.V
C	5.8025	0.1735	0.0000	0.8174	0.7752	7.0518	10.99
TREND	0.1388	0.0169	0.0000				

The table shows that receipts of software service increased at the annual rate of 16.09 percent, while that of travel increased at an annual rate of 13.10 percent during the period 2000-

2016. Transportation and insurance receipts increased at an annual rate of 14.50 percent and 0.14 percent respectively. The relative growth performance of software services receipts shows its strong advancement compared to the other sub-components of current account of the balance of payments of the India. Growth rate of software service receipts predicts a bright future for mitigating deficit in the current account of balance of payment and demands a special attention on part of Indian policy making.

Receipts from software service, transportation, travel and insurance are prone to fluctuate widely over time. It may be misleading to arrive at any conclusion regarding the instability/volatility of any component of current account on the basis of averages only. In reality, wide variations in these components over time may lead to many strains on the Indian economy. Hence, it might be helpful for the purpose of policy making to study which of the components is/are more stable/unstable than the other. For the purpose, the usual measure of coefficient of variation (CV) has been used to measure instability/volatility.

The component-wise coefficients of variation are calculated separately for different components of the current account of balance of payment of India.

The usual measure of Coefficient of variation is follows:-

$$\text{CV} = \text{Standard Deviation} \div \text{Mean} \times 100$$

$$\text{CV} = \frac{\sigma}{\text{X}} * 100.$$

The component-wise growth instability/volatility of the current account shows that insurance receipts is the most volatile component (CV = 10.99) of Indian economy, followed by transportation (CV = 8.75) and software service (CV = 8.24), while travel receipts are the least volatile (CV = 7.41). Travel receipts are dependent on the mercy of the number of foreign visitors, which makes it more volatile in nature than the other components of current account of balance of payment. This suggests that software services component is relatively more consistent based on least volatility of growth rate, and demand strong interventions on part of the policy recommendation to boost current account of the balance of payment.

1.7.2 Stationarity results

The results of the test of order of integration for each variable using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are presented in table - 3.

Table-3

Unit Root Tests

Variables	ADF Levels	ADF First Difference	PP Levels	PP First Difference
LSE	-0.166	-4.354*	-0.368	-4.251*
LNNP	-1.883	-4.445*	-1.911	-4.429*
LOPN	-1.973	-4.318*	-2.217	-4.374*

Note: * indicates significance at one percent level.

The results show that the null hypothesis that there is the presence of unit root is not rejected at levels for all variables. However, the null hypothesis is rejected against the alternative hypothesis that there is presence of unit root, when the first difference of the variables are taken. Thus, the first difference of all variables are found to be stationary and hence all series are integrated of order one. The tests of unit root support the unit root hypothesis at one percent level of significance for all variables.

1.7.3 Optimal lag selection

Analysis based on vector auto regression (VAR) is required to deal with optimum lag selection. The lag selection in this paper is conducted by following lag order selection criteria, such as Sequential modified LR test, Hannan-Quinn Criterion (HQ), Akaike Information Criterion (AIC) and Schwarz Information Criterion. The lag order selection results are presented in table - 4.

Table - 4

Lag Selection Criterion

Lag	LR	AIC	SIC	HQC
0	-	-8.06	-7.92*	-8.08
1	24.20*	-8.40*	-7.84	-8.23*
2	4.19	-7.97	-6.98	-7.66
3	1.98	-7.46	-6.04	-7.01
4	6.79	-7.26	-5.42	-6.68
5	4.65	-6.10	-4.73	-7.29
6	14.75	-7.85	-5.16	-7.01

Note: *indicates optimal lag order selected by the criteria.

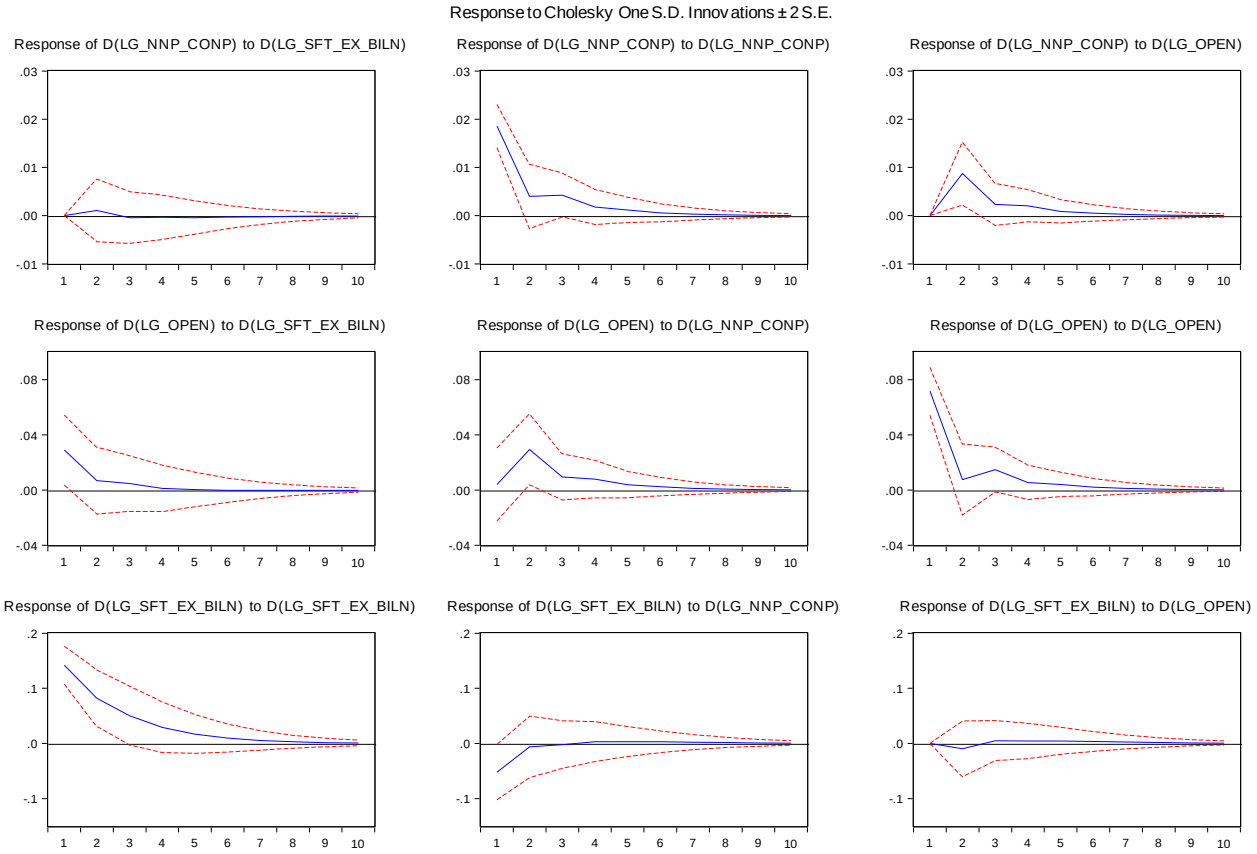
The table indicates that LR, AIC and HQC recommend the optimum lag to be one, whereas SIC criteria recommends zero lag. Based on majority lag selection criteria, lag one has been considered for the present analysis.

1.7.4 Impulse response function result

Figure - 4 illustrates the results of impulse response function.

Figure – 4

Results of Impulse Response Function



The first row of the figure shows the response of NNP to a shock in SE and OPI. As a result of the shocks in both SE and OPI, NNP responds positively upto three years. It also responds positively upto six years, when a shock is given to OPI.

The second row shows the response of OPI to a shock in NNP and SE. OPI is found to respond positively to a shock in SE from the first to fifth year. It also responds positively over the same period when a shock is given to NNP.

The third row of the figure shows the response of SE to a shock in NNP and OPI. As a result of a shock in NNP, SE responds negatively upto first two years, after which it disappears. When a shock is given to OPI, SE responds negatively in the second year, but after that it becomes positive upto the fifth year. In sum, the impulse response function suggests that a shock to either SE or OPI would lead to an increase in NNP in the first couple of years, after which it would disappear.

1.7.5 Variance decomposition results

Table - 5 presents the results of variance decomposition.

Table - 5

Variance Decomposition Results

Period	Variance Decomposition of NNP			Variance Decomposition of SE			Variance Decomposition of OPI		
	NNP	SE	OPI	NNP	SE	OPI	NNP	SE	OPI
1	100	0.00	0.00	6.37	93.64	0.00	0.02	8.76	91.25
2	82.84	0.35	16.83	5.63	91.10	3.28	13.64	10.72	75.66
3	82.21	0.40	17.41	8.52	88.48	3.01	14.75	9.94	75.33
4	74.30	1.51	24.21	9.12	87.96	2.93	14.47	9.75	75.80
5	69.49	1.51	29.02	9.65	87.35	3.02	16.25	9.25	74.51
6	66.71	1.67	31.64	11.93	83.09	4.10	16.83	9.60	73.58
7	65.99	1.72	32.31	13.24	80.06	6.72	17.12	9.65	73.24
8	65.68	1.71	32.63	13.56	78.43	8.02	17.16	9.74	73.11
9	65.60	1.70	32.71	13.35	76.92	9.75	17.11	9.76	73.15
10	65.61	1.74	32.66	13.14	75.63	11.25	17.13	9.72	73.17

The variance decomposition of NNP indicates that in the initial periods its variance is explained by its own innovations, but its explanatory power goes on declining over time. The explanatory power of OPI and SE goes on increasing over the period of time, but the pace of OPI is relatively higher as compared to that of SE. The result of first-step ahead the horizon shows that NNP is fully explained by itself. Whereas, in the fourth-step ahead horizon, the percentage of OPI and SE to total variance increases by 16.83 and 1.51 percent respectively. The relative percentage of variance of OPI and SE to total variance increases even up to the seventh-step time horizon by 32.31 and 1.72 percent respectively. Further, at the tenth-steps ahead the time horizon, 65.62 percent of the variance is explained by its own shocks, followed by 32.66 percent variance by OPI and 1.74 percent by the SE.

The variance decomposition of SE shows that it is largely explained by itself, followed by NNP and OPI. In the first-step ahead the time horizon, 93.64 percent of variance is explained by its own shocks, followed by 6.37 percent of variance by NNP. OPI has no contribution in the total variance over the same time period. However, from the second-steps onwards, its explanatory power goes on increasing upto 11.25 percent in the tenth-step ahead time horizon. The results imply that at the tenth-step ahead time horizon, SE accounts for 75.63 percent of the total variance, followed by NNP and OPI with 13.14 and 11.25 percent of total variance, respectively.

The variance decomposition of OPI shows that in the first-step ahead the time horizon, 91.25 percent of the variance is explained by its own shocks, followed by 8.76 percent of variance caused by SE. However, from the second-steps onwards, the explanatory power of NNP goes on increasing upto 17.13 percent in the tenth-step ahead the time horizon. This suggests that NNP contributes more to OPI in the long-run than in the short-run. At tenth-steps ahead the time horizon, 17.13 percent of the variance is explained by NNP, followed by 9.72 percent variance by SE.

1.8 Conclusion and Policy Implications

The success of Information Technology sector after the economic reforms has contributed enormously to the country's economic growth, employment and standard of living of the people. This study over-views the trends and patterns of growth of the Indian IT sector during the period 1990-2015. The study also employed Vector Auto Regression (VAR) model based on variance decomposition (VD) and impulse response function (IRF) to analyze the relationship among economic growth, IT exports and openness index during the period 1980-2015.

The study found that the contribution of Indian IT sector to Gross Domestic Product (GDP) increased remarkably from 1.2 percent in FY1998 to nearly 9.5 percent in FY2015 post globalization. It continues to be one of the largest private sector employer in the country, directly employing four million professionals. Software and service exports dominates the industry, becoming the sole contributor of about 77 percent of the total industry revenue. Besides, the country has continuously maintained leadership position in global sourcing, accounting for almost 56 percent of its global share in 2016. The industry's share in total Indian exports increased to about 25 percent during FY 2015. Moreover, the relative growth performance of software services receipts shows its strong advancement compared to the other sub-components of current account of balance of payments of India. Growth rate of software service receipts predicts a bright future for mitigating deficit in the current account of balance of payment in India and demands a special attention on part of the policy making.

The results of IRF and VD suggest that economic growth responds positively to a shock in IT exports and openness index post globalization. Further, IT exports and openness index contribute to economic growth more in the log-run rather than in the short-run. This implies that economic growth may be enhanced by implementing policies that not only improve the efficiency of the sector, but also focus on optimization of the potential of the Indian IT industry.

References

Arora, Ashish and Suma Athreye (2002): The Software Industry and India's Economic Development, Information Economics and Policy, 14(2), pp. 253-273.

Abraham, Vinoj (2010): Regional Skill Suppliers and Location of Firms: The Case of Information Technology Industry in India, MPRA Paper No. 28424, Centre for Development Studies (JNU), Kerala, India, pp. 1-27.

Adjaye, A. J and Chakraborty John (199): Export-Led Growth and Import Compression: Further Time Series Evidence from LDCs, Australian Economic papers, No. 38, pp. 164-175.

Alajoutsijarvi, Mannermaa and Tikkanen Henrikki (1999): Customer Relationships and the Small Software Firm A Framework for Understanding Challenges Faced in Marketing, Information and Management, 37(37), pp. 153-159.

Alic A. J (1994): Technology in the Service Industries, International Journal of Technology Management, 9(1), pp. 1-14.

Balaasa, Bela (1978): Export and Economic Growth, Journal of Development Economics, 5(2), pp. 181-189.

Ben-David, D. Loewy, M. B (1998): Free Trade Growth and Convergence, Journal of Economic Growth, 3(), pp. 143-170.

Bhatnagar, C. S (1992): Information Technology and Socio-Economic Development, Social Implications of Computers in Developing Countries, Tata McGraw-Hills, New Delhi, pp. 1-10.

Bhatt, Sheela and S.S. Sarangdevot (2013): Potential of Information and Communication Technology towards the Success of the Indian IT Software Industry, Journal of Computational Engineering Research, 3(1), pp. 159-166.

Biswal, B and Dhawan, U (1999): Re-examining Export-led Growth Hypothesis: A Multivariate Cointegration Analysis for India, Applied Economics, 31(4), pp. 525-530.

Chandra, Ramesh and Love, Jim (2005): Testing Export-led Growth in Bangladesh in a Multivariate VAR framework, Journal of Asian Economics, 15(6), pp. 1155-1168.

Chou, Chen and B.M. Shao (2014): Factor Productivity Total Growth in Information Technology Services Industries: A Multi-theoretical Perspective, Journal of Decision Support System, 62(2), pp. 106-118.

Chow, C. Y. P (1987): Causality between Export Growth and Industrial Development, Journal of Development Economics, 26(1), pp. 55-63.

Dash, R. K (2009): Revisited Export-Led Growth Hypothesis: An Empirical Study on India, South Asia Economic Journal, 10(2), pp. 306-324.

Dhawan, Urvashi and Bagala Biswal (1999): Re-examining Export Led Growth Hypothesis: A Multivariate Cointegration Analysis for India, Journal of Applied Economics, 31(4), pp. 525-530.

Dickey, D. A and Fuller, W. A (1981): Distribution of the Estimators for Autoregressive Time Series with a Unit Root, Econometrica, No. 49, pp. 1057-1072.

Edwards, S (1998): Productivity and Growth: What do We Really Know, The Economic Journal, 108(447), pp. 383-398.

Eita, H. J and Jordaan, C. A (2007): Export and Economic Growth in Namibia: A Granger Causality Analysis, South African Journal of Economics, No. 75, pp. 540-547.

Ekanayake, M. E (1999): Exports and Economic Growth in Asian Developing Countries: Cointegration and Error-Correction Models, Journal of Economic Development, 24(2), pp. 43-56.

Farok, J and Susan M. Mudambi (2008): The Influence of Human Capital Investment on the Exports of Services and Goods: An Analysis of the Top 25 Services Outsourcing Countries, Management International Review, 48(4), pp. 433-445.

Fialkowski K (1990): Software Industry in the Developing Countries: The Possibilities, Information Technology for Development, 5(2), pp. 187-194.

Granger, C. W. J (1969): Investigating Causal Relations by Econometrics Models and Cross-spectral Methods, Econometrica, 37(3), pp. 424-434.

Hutchinson, Francis and Ilavarasan Vigneswara (2008): The IT-ITES Sector and Economic Policy at the Sub-national Level in India, Economic and Political Weekly, 43(46), pp. 64-70.

Ilavarasan, P. Vigneswara and Arun Kumar Sharma (2003): Is Software Work Routinized: Some Empirical Observations from Indian Software Industry, Journal of Systems and Software, 66(1), pp. 1-6.

Islam, N. M (1998): Export Expansion and Economic Growth: Testing for Cointegration and Causality, Applied Economics, 30(3), pp. 415-425.

Kathpalia, Lalit and R. Raman (2014): The Road Ahead for the Indian IT and ITES Industry Considering its Service Offerings, Domestic Market and Technology Trends, Journal of Theoretical and Applied Information Technology, 60(2), pp. 263-273.

Krueger, O. A (1980): Trade Policy as an Input to Development, Working Paper. No. 466, National Bureau of Economic Research, Massachusetts Avenue Cambridge, pp. 1-9.

Kumar, Nagesh and K. J. Joseph (2005): Exports of Software and Business Process Out-sourcing from Developing Countries, Asia-Pacific Trade and Investment Review, 1(1), pp. 91-110.

Kumar, Nagesh (2001): Indian Software Industry Development: International and National Perspective, Economic and Political Weekly, 36(45), pp. 4282-4286.

Kumar, R (2010): "Development of the Software Industry in Post Reform India: Comparative Regional Experiences in Tamil Nadu, Andhra Pradesh, and Kerala, Cambria Press, New York.

Maallick, S. K (1996): Causality between Exports and Economic Growth in India: Evidence from Cointegration based Error-Correction Model, Indian Journal of Economics, No. 76, pp. 307-320.

Manthri, Pranusha, Ketan Bhokray and Kiran Kumar S. Momaya (2015): Export Competitiveness of Select Firms from India: Glimpse of Trends and Implications, Indian Journal of Marketing, 45(5), pp. 7-13.

Malik, H. M, and Nirmala V (2016): Trends and determinants of IT-BPM exports in India, *Journal of Science and Technology Policy Management*, 7(2), pp. 212 – 232.

Marshall, J. P and Jung, S. W (1985): Exports, Growth and Causality in Developing Countries, *Journal of Development Economics*, 18(2), pp. 1-12.

Marin, Dalia (1992): Is the Export-Led Growth Hypothesis Valid for Industrialized Countries, the Review of Economics and Statistics, 74(4), pp. 678-688.

National Association of Software and Services Companies (NASSCOM 2013): Nasscom Industry Trends, http://www.nasscom.org data.

NASSCOM (2014-15): Information Technology Annual Report, http://www.nasscom.org,

NASSCOM (2015-16): Information Technology Report, http://www.nasscom.org,

Nath, Pradosh and Hazra Amitava (2002): Configuration of Indian Software Industry, Economic and Political Weekly, 37(8), pp. 737-742.

Narayanan and Bhat (2009): Technological Efforts and Internationalization of IT Firms in India, Indian Journal of Industrial Relations, 45(1), pp.62-83.

Nidugala, Ganesh k (2001): Exports and Economic Growth in India: An Empirical Investigation, Indian Economic Journal, 47(3), pp. 67-78.

Panagiotidis, T and Sharma, A (2005): An Analysis of Exports and Growth in India: Cointegration and Causality Evidence, Review of Development Economics, 9(2), pp. 232-248.

Sadorsky, P and Henriques, I (1996): Export-Led Growth or Growth-Driven Exports? The Canadian Case, Canadian Journal of Economics, 29(3), pp. 540-555.

Phillips, B. C. P and Perron, P (1988): Testing for a Unit Root in Time Series Regression, Biometrika, 75(2), pp. 335-346.

Sharma, S. C and Dhakal, D (1994): Causal Analysis between Exports and Economic Growth in Developing Countries, Applied Economics, No. 26, pp. 145-157.

Schware, R (1990): Software for Developing Countries: Major Issues in the 1990s, Information Technology for Development, 5(2), pp. 101-107.

Singh, P. J and Konya, L (2006): Cointegration and causality between Indian Export, Import and Gdp, Pacific Journal of Economics and Business, No. 10, pp. 20-35.

Siliverstovs, B and Herzer D (2006): Export-Led Growth Hypothesis: Evidence for Chile, Applied Economics Letters, No. 13, pp. 319-324.

Vijajayasri, G. V (2012): Performance of India's Electronic and Computer Software Services Industry, Journal of Research in Arts and Education, 2(6), pp. 58-73.

Ullah S, Bedi-uz Z, Farooq M and Javed A (2009): Cointegration and Causality between Exports and Economic Growth in Pakistan, European Journal of Social Science, No. 10, pp. 264-272.

Yamada, H (1998): A note on the Causality between Export and Productivity: An Empirical Re-examination, Economic Letters, No. 61, pp. 111-114.