

**A STUDY OF SELECT DIMENSIONS OF
TECHNOLOGICAL INNOVATION:
A COUNTRY LEVEL AND FIRM LEVEL ANALYSIS**

by

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Submitted

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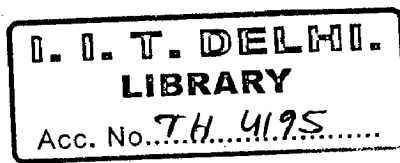
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The thesis entitled “**A Study of Select Dimensions of Technological Innovation: A Country Level and Firm Level Analysis**”, being submitted by Mr. Varkey Jon Thomas to the Indian Institute of Technology Delhi for the award of the degree of DOCTOR OF PHILOSOPHY is a record of bona-fide research work carried out by him. He has worked under our guidance and supervision and has fulfilled the requirements for the submission of this thesis which has attained the standard as required for a Ph.D. degree of the Institute. The results presented in this thesis have not been submitted elsewhere for the award of any other degree or diploma.



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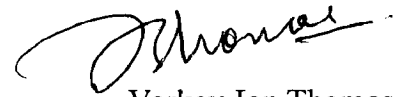
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ABSTRACT

Economic growth has been widely researched over the years and for the past few decades there has been increasing evidence that it is driven mainly by innovation. Recognizing this, developed countries like the USA have consistently spent a significant portion of their GDP on R&D. Technological innovation has mainly been studied from two major perspectives. The economics of innovation looks at the determinants of technological innovation external to the firm, and the management of innovation studies the determinants of innovation within the firm. However both these lines of inquiry have traditionally concentrated on developed countries with few studies of a comparative nature with developing countries. Additionally, there are fewer studies which examine technological innovation within firms in developing country industry sectors, particularly in high technology sectors.

This study is an attempt to fill the gap in the existing literature by conducting comparative analyses of technological innovation among developed and developing countries at the cross country level and then focusing on technological innovation in the biotechnology industry in India. The choice of the biotechnology sector for investigation is motivated by the fact that this industry is one of the most innovative worldwide. Recent studies also confirm that the biotechnology industry is one of the most proactive in patent filings in India. Technological innovation in the biotechnology industry has the potential to revolutionize agriculture and healthcare. Agriculture and healthcare are priorities not only for developing countries but also for the developed nations. Hence, the study assesses the determinants of technological innovation in the biotechnology industry in India.

Data Envelopment Analysis and its panel data form called the Malmquist Productivity Index are used to compare the technological innovation efficiencies of developed and developing countries. The results highlight the emergence of some developing nations on the technological innovation efficiency frontier and also show that China exhibits a rapid increase in number of scientific publications while the Republic of Korea shows exemplary performance in patenting among residents in recent years.

The USA has historically been at the forefront of technological innovation. Further analysis is conducted on regions within the USA as an example of technological

innovation efficiency in a large developed country. Only 14 states out of the 51 regions in the USA are found to exhibit positive changes in technological innovation efficiency between 2004 and 2008. Additional comparison of the USA with the BRICS nations in the same period shows that Brazil, India, China and South Korea show significant improvements in technological innovation efficiency with India taking the lead.

As India is a large developing country with multiple states, further analysis is undertaken to examine technological innovation efficiency for 18 Indian states. The results indicate that Delhi in the north and Tamil Nadu in the south are the leaders in technological innovation efficiency and the laggards are Uttarakhand in the north and Kerala in the south.

After establishing the leadership of India in technological innovation efficiency in recent years, an extensive postal survey is used to examine the status and determinants of technological innovation in the Indian biotechnology industry. Various count data regression models like the poisson, the negative binomial, the zero inflated poisson and the zero inflated negative binomial models are used. The results show that absorptive capacity and human capital should be given more importance than financial capital in firms desirous of achieving higher levels of technological innovation performance.

The overall picture that emerges from this study is the quiet but definite improvement in technological innovation capabilities in a group of developing nations and a moderate level of technological innovation in the high technology biotechnology sector in India which requires further enlightened policy interventions for greater growth.

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