RESEARCH PAPER | Economics | Volume : 3 | Issue : 10 | Oct 2013 | ISSN - 2249-555X

Innovation in Production Process and Labour Productivity in Industries

KEYWORDS: Labour Productivity, Innovation Process, Technical Progress, Innovation

Dr. Satya Ranjan Nayak

Asst. Professor of Economics and Business Administration Gandhi Institute for Technological Advancement, Bhubaneswar, India.

ABSTRACT *The production function is the relation between the quantities of factors and the quantity of product and is naturally given by technical consideration. But in this paper an honest attempt has been made to study the role of innovation in production process and its impact on labour productivity in Industries. The study is supported by an appropriate review of literature with some profound analysis of renowned models like Cobb-Douglas production function and Harrod-Domar model.*

I. Introduction

The production function is purely a technical relation which connects factor inputs and outputs. In another way it can be defined as the physical transformation of inputs into output. So it represents the technology of a firm of an industry or of the economy as a whole. The method of production process is a combination of factor inputs required for the production of one unit of output. The efficiency of production system depends on science, technology and strategic management. Production facilities and a developed work force are two important factors for the growth of a country production force. In this context, it is required to apply complex economic index like "labour productivity". Any improvement of labour productivity depends on increase in production facility (technology) and innovation in production process and this result in decrease in quantity of workforce. So, Innovation literally means, 'introducing something new.' In the business context, an innovation occurs is considered only when it is successfully Introduced and commercialized. Innovation in manufacturing covers wide areas Like introduction of new processes/practices, new technology/equipment, new materials, etc. "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations." [*Oslo Manual* (OECD 2005), third edition, pp. 46.]

In contrast, the relevance of the innovation process in firms doing business in developing countries is not always properly acknowledged, especially by mainstream economists, who tend to assume that openness to foreign technology sources is all that matters in terms of firms' productivity. It is no surprise, then, that there is a lack of detailed studies on the subject, especially after the application of deep structural reforms in the 1990s.

II. Literature Background

A large strand of literature on the impact of R&D on firm's productivity and profitability was estimated within a Cobb-Douglas production function framework. Good overview of such studies can be found in Griliches (1995).

The availability of innovation surveys in the European Community and in other countries such as Canada in the 1990s has provided valuable information on several dimensions of the innovation process at the firm level. These dimensions had been previously outlined in the chain-linked model proposed by Kline and Rosenberg (1986) as well as in the national system of innovation (NSI) literature (Edquist, 1997). The rich information available from those surveys has also fostered new ways of doing research on key issues of the received literature on technological change, such as the determinants and consequences of innovation activities, applying advanced econometric techniques.

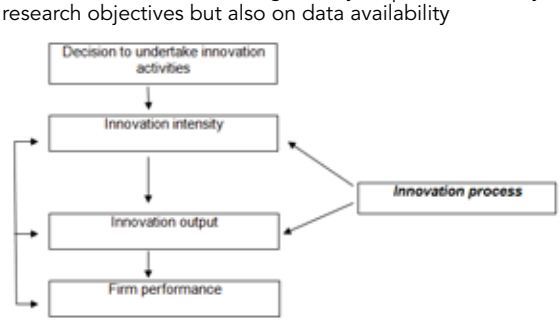
With a sample of French manufacturing enterprises Crépon et al.(1998)obtained results which have shown that the firm innovation output, measured as patent numbers or innovative sales, increases with intensity of expenditures on R&D, and that firm's productivity rises with innovation output, even when controlling for physical capital intensity and for the labor skill composition.

An alternative approach to measure the contribution of innovation to productivity growth at the aggregate level uses newly available national account data on investment innovation and intangibles. This approach has been pioneered by Corrado *et al.* (2006) and is now the subject of considerable effort in the UK (UK NESTA 2009) and the EU (INNODRIVE).

Hall (2011) provides a detailed review of the studies that have attempted to estimate a quantitative relationship between firm-level productivity and innovation measures explicitly.

III. Analysis and Interpretation

A firms' performance is captured through a variety of indicators, including labour and total factor productivity, profits, rates of growth of sales, total assets, exports, etc. The selection of the indicators generally depends not only on research objectives but also on data availability



Available studies also take explicitly into account features of the innovation process that may impact on the efficiency with which firms transform innovation inputs into innovation outputs. As innovation is an interactive process, the cooperation with other firms or industries, linkages with suppliers, knowledge about customers, etc. are key issues in this regard.

Volume : 3 | Issue : 10 | Oct 2013 | ISSN - 2249-555X

Associative representation of productivity and innovation: (A) When looking at the part of innovative activity to productivity, the usual starting Point is to add a measure of the knowledge or intangible capital created by innovative activity to the production function:

$Y = AC\alpha L\beta$

Where Y is the value added, L the labor force (number of employees), C the physical capital, and β the elasticity of output with respect to labor force and physical capital respectively. Here A is some kind of proxy for the knowledge stock of the firm. K can stand for a number of aspects of the entity's innovative capability: its technological knowledge obtained via R&D, its competency at transforming research results into useful products and processes, and so forth. It can even be based on innovative success rather than capability. Traditionally K has been measured as a stock of past R&D spending.

The proposition that this study intends to focus is that the development of innovation capabilities by firms positively influences their labor productivity. In other words, a higher ratio of value added per employee would not only be driven by an increase in the ratio of physical capital per employee, as the Cobb-Douglas production suggests, but also by the development of certain capabilities associated with the innovation process.

For a macro prospective, the 'new growth theories' aim to indigenize technical progress by incorporating some of these same effects, emphasizing education as well as learning and R&D. According to Lucas (1998), for example, the higher the level of education of the work force the higher the overall productivity of capital because the more educated are more likely to innovate, and thus affect everyone's productivity. In other models a similar externality is generated as the increased education of individuals raises not only their own productivity but also that of others with whom they interact, so that total productivity increases as the average level of education rises (Perotti, 1993). The impact of education on the nature and growth of exports, which, in turn, affect the aggregate growth rate, is another way in which human development influences macro performance. The education and skills of a developing country's labor force influence the nature of its factor endowment and consequently the composition of its trade. It has been argued that even 'unskilled' workers in a modern factory normally need the literacy, numeracy, and discipline, which are acquired in primary and lower secondary school (Wood ,1994).

(B) The link between output,Y , and capital services,K , labor input,L , and labor-augmenting (Harrod-neutral) technical progress, T , is given by the familiar aggregate production function

$Yt = f (Kt , Tt, Lt)$ (1)

Where, the neoclassical production function is typically assumed to have constant returns to scale, positive and diminishing returns with respect to each input, and marginal products of each input that approach zero (infinity) as each input goes to infinity (zero).

Investment enters through the capital accumulation equation, which governs the relationship between investment in tangible assets,I , and capital stock, S , via the perpetual inventory relationship

$S_t = (1-\delta). S_{t-1} + I_t$ (2),

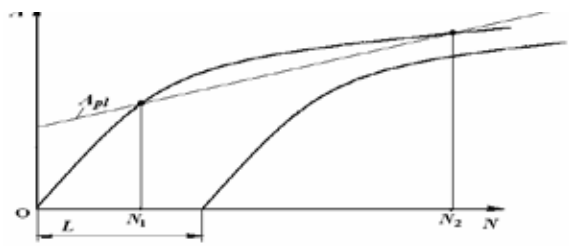
Where, is δ depreciation and I_t can either be determined endogenously by profit-maximizing firms or assumed to be some fixed proportion of output.

(C) Economic experts give the expression for labour productivity as ratio of results of quantity of products output W to labour expenses T that provided economical system

Where, W = Q*N products developed according to service years, T – common expenses of labour for developing products, Q - products developed per year, N - system service years, A - (products) / (man-hour)

Figure 1 shows the changes of A, T and Q for work term of economic system and the figure gives the following conclusions:

Figure-1



Any system provides high rates of growth of labour productivity during work term N2 > N > N1

If a work term has $N = 0 - N_1$, then the labour productivity can be less than the present system.

The labour productivity becomes slower when the work term N > N2. The planned growth in labour productivity rendered higher than what this system provides.

Any system has utilized old principle must be changed by a new, a more productive and a perfect one.

Conclusion:

This paper analyzes the contribution of innovation in production processes to labor productivity in an Economy. Since labor productivity can be regarded as an indicator of competitiveness, the study used a modified human capital model to analyze the importance of investments in different indicators of human capital for increasing the international competitiveness of manufacturing firms. In manufacturing firms, firms that undertake training were shown to exhibit significant higher levels of labor productivity than firms that do not train their workers. This is consistent with the argument that innovation enhances transmission of new technology, since the purpose of innovation often is to get employees thought of with new techniques of production, new machines, new kinds of raw materials, and all other new features in the production process.

REFERENCE

1. Corrado, C., C. R. Hulten, and D. E. SIchel (2006). Intangible Capital and Economic Growth, National Bureau of Economic Research Working Paper No. 127 | 2. Crépon, B., E. Duguet and J. Mairesse. 1998. Research, Innovation, and Productivity: an Econometric Analysis at the Firm Level. Working Paper 6696 | 3. Edquist (ed.) 1997. Systems of Innovation: Technologies, Institutions and Organizations, London (Pinter Publishers/Cassell Academic). | 4. Griliches, Z. 1995. R&D and Productivity: Econometric Results and Measument Issues. Handbook of the Economics of Innovation and Technological Change, Oxford, p.52-89. | 5. Hall B. H. and Mairesse J., 1995, Exploring the Relationship between R&D and Productivity in French Manufacturing Firms, Journal of Econometrics, 65 (1), pp. 263-293. | 6. Kline, S., Rosenberg, N., 1986. An overview of innovation, pp. 275–306 in R. Landau and N.Rosenberg (eds.), The positive sum strategy: harnessing technology for economic growth, Washington, D.C., National Academic Press. | 7. Lucas, Robert. (1998), "On the Mechanics of Economic Development", Journal of Monetary Economics, July 22(1).Mincer, Jacob, (1974), Schooling, Earnings, and Experience,New York, Colombia University Press. | 8. Oslo Manual (OECD 2005), third edition, pp. 46. | 9. Perotti, R., (1993), "Political Equilibrium Income Distribution, and Growth" Review of Economic Studies, pp.60. | 10. Wood, A., (1994), "North-South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World", IDS Development Studies Series, Oxford University Press. |