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DIGITAL INDIA AND ECONOMIC DEVELOPMENT

RAMESHA N G

Assistant Prof., Department of Economics, R.T.E.S College,
Haveri, District- Ranebennur-581115, Karnataka, India

ABSTRACT

Information technology (IT) is an example of a general purpose technology that has the potential to play an important role in economic growth, as well as other dimensions of economic and social development. This paper reviews several interrelated aspects of the role of information technology in the evolution of India's economy. It considers the unexpected success of India's software export sector and the spillovers of this success into various IT enabled services, attempts to make IT and its benefits available to India's rural masses, e-commerce for the country's growing middle class, the use and impacts of IT in India's manufacturing sector, and various forms of e-governance, including internal systems as well as citizen interfaces. The paper concludes with an overall assessment of these different facets of IT in the context of the Indian economy.

Keywords: IT, Spillovers, E-commerce

1. INTRODUCTION

Introduction In his foreword to the NASSCOM-McKinsey Report (2002) over a decade ago, India's Minister for Communications and Information Technology called for a joint industry government effort to "ensure that the Indian IT sector remains a dominant player in the global market and that we emerge as one of the leading countries of the new millennium". The first of these goals pertains specifically to India's information technology (IT) industry,1 which has done quite well in the ensuing decade. The second stated goal is much broader, much deeper, and much harder to achieve, seeming to imply that IT can be the cornerstone of India's development. Does it make sense to pin so much hope on India's IT industry? What contribution can it make to India's overall economic development? Can it help change the country, reduce poverty, change people's lives for the better? Or will the benefits be restricted to an educated elite with access to jobs and power? This paper offers a conceptual overview of the possible roles of IT in

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development, and the different dimensions in which IT impacts, or might impact India's economy.

IT may have a special role to play in growth and development simply because of empirical characteristics that apply at the current time. In particular, the recent and continuing rapid innovation in IT make it a dynamic sector that is an attractive candidate as a contributor to growth for that reason alone, much as the automobile industry was targeted by the Japanese after World War II. On the other hand, there may be features of IT that make it attractive from a theoretical perspective on economic growth. For example, IT may be one of the sectors in which countries such as India have, or can develop, a comparative advantage. Even if this is so, IT is likely to share this characteristic with several other sectors. A somewhat more special characteristic of IT may be that it is a 'general purpose technology' (GPT, Bresnahan and Trajtenberg, 1995), distinguished by pervasiveness, technological dynamism and innovational complementarities. In this case, IT is one of a special few technologies: other examples of GPTs include steam and electricity (both advances in power delivery systems) and synthetic materials. Finally, IT may be unique in its impact on growth. In this view, IT has a special role in the process of innovation, because it affects the rate at which potential new ideas are converted into additions to the usable stock of knowledge in ways that nothing else can. The formalization of this special role is based on the model of recombinant growth (Weitzman, 1998).

2. PLANNING

The static theory of international trade is based on comparative advantage, determined by relative factor endowments and/or technology differences. In the former case, a country will export goods which use more intensively the factors of production in which it has relative abundance. In the case of software, the life cycle of development and use includes analysis and specification of requirements, design, coding, testing, installation, maintenance and support. Many of these activities, particularly coding and testing, involve relatively routine IT skills that India's workforce has in large absolute numbers (though small relative to the total population). Hence, attributing India's software export boom at least partly to standard comparative advantage seems reasonable.

Static comparative advantage theory explains patterns of trade, but not growth. For that one can turn to theories of endogenous growth. The ingredients of these models typically include differentiated capital inputs, monopolistic competition, and production of new inputs through R&D, and ultimately economy-wide increasing returns that allow sustained growth to occur. Hence these models shift away from the exclusive focus on capital accumulation that characterized the neoclassical growth model (as well as the core of Indian post-independence

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economic policy). The work of Grossman and Helpman (1991) and Rivera-Batiz and Romer (1991a, b) incorporate international trade and the evolution of comparative advantage into endogenous growth models. In these analyses, the economy is typically divided into manufacturing, R&D and traditional sectors, so the IT sector does not necessarily fit neatly into any single model category.

For example, design and development of software have characteristics of R&D, while IT-enabled services are more like manufacturing in their use of established techniques for production. The general message of these models, however, is that externalities associated with monopolistic competition may give policy a role in influencing the evolution of comparative advantage in a direction that increases economic growth.

General models of endogenous growth emphasize the importance of R&D in general (for adding to the stock of knowledge, which in turn raises productivity of physical inputs), rather than IT per se. The concept of GPTs provides a somewhat special role for IT, as an example of a GPT. GPTs have three key characteristics: pervasiveness, technological dynamism and innovational complementarities.3 Helpman and Trajtenberg (1998a, 1998b) model GPT-led growth, in which sustained growth comes from the periodic, exogenous introduction of new GPTs. Mechanisms that would give endogenous growth are ruled out, but otherwise, the framework, consisting of endogenous R&D, monopolistic competition and the introduction of new intermediate inputs as the implementation channels for growth, is similar to endogenous growth models. In these models, any GPT has similar abstract effects.

One can say a little more about how well IT fits the characteristics of GPTs. Pervasiveness seems to be potentially a natural property of IT. In the Indian context, doubts about achieving pervasiveness are centered on issues of cost and access. Table 1, however, illustrates the important positive trends that support pervasiveness. The complementarities of GPTs are vertical complementarities, because GPTs spur innovation and lower manufacturing costs in downstream sectors, with positive feedback effects to the GPT itself.4 There are also horizontal complementarities, since the downstream sectors may face a coordination problem in expanding sufficiently to encourage the improvement of the GPT (thus creating positive feedback). Note that international trade with a more advanced country may be one way to overcome some of these externality problems.

The general importance of complementarities (aside from being one feature of GPTs) in understanding growth processes has been described in most detail by Matsuyama (1995; see also Ciccone and Matsuyama, 1996). Matsuyama makes three useful observations. The first is the identification of the differing roles played by horizontal and vertical complementarities, such as

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Volume:03, Issue:06 "June 2018"

was discussed in the previous paragraph. The second is the difference between technological complementarities, emphasized by writers such as Kremer (1993) and Milgrom, Qian and Roberts (1991) and the demand-based complementarities and pecuniary externalities that drive models such as those of Matsuyama. The third point is the difference between the effects of history and of expectations in affecting equilibrium outcomes and growth. Either or both may work against development and growth, by preventing coordinated movement out of a 'bad' equilibrium.

CONCLUSION

The possibilities for interactivity with digital IT-based educational materials illustrate the advantages of digital IT over older technologies based only on recording and duplication. Interactivity also implies personalization, in that an individual can select the precise content that he or she wishes to see. This feature also distinguishes IT-based content from what was available through previous technologies. Finally, the sheer volume of information that is accessible through IT is much greater than before: this also allows new kinds of services to be provided at a cost that is affordable to larger segments of the population.

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