1. Introduction

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This book describes the technology-driven economic development of India. India's development pattern over the last ten and a half years is distinctive when compared to other developing nations as it has become a highly visible participant in the intellectual capital-driven information technology (IT) services industry. Since the 1990s India has been one of the fastest growing economies in the world. A report authored by Goldman Sachs in 2003 (O'Neill et al., 2003) stated that by the year 2050, India will become the third largest economy in the world, behind China and the USA. The report predicts that India's gross domestic product (GDP) will overtake that of Italy by 2015, France by 2020, Germany by 2025 and Japan by 2035.

The reason why India's development is different may stem from the nature of the information communication technology (ICT) industry and the freedom it has enjoyed from government regulation to develop this industry. ICT is the synthesis of computers, telecommunication/communication technologies and databases enabled by digital electronics. This book examines how India developed its ICT capabilities and represents different perspectives on India's development. For example, one chapter examines how India established critical linkages with the US ICT industry in the 1990s. That relationship is thought to have played a significant role in the rapid development of India's ICT industry. Another chapter investigates India's strategy to develop ICT companies in a particular sub-national region of India, Bangalore in the state of Karnataka, and shows how it paid off by linking people in the state to the external world of information and knowledge through ICT diffusion.

This book also infuses new knowledge into a highly visible and often controversial debate going on in the USA currently regarding outsourcing jobs to India and other countries. They provide new knowledge regarding what has really happened to India's economic development as opposed to what one hears in the media. Finally, it reveals new insights regarding the complex process of globalization by showing how the generation and circulation of intellectual capital in the USA and India in ICT has led to greater productivity in the USA while facilitating the economic development of India.

ORGANIZATION OF THE BOOK

This book is organized around this Introduction and three major parts. Part I includes chapters that examine the ICT industry in India and its relationship to economic development. These contributions include a general examination of development theory and practice over the past 60–70 years and the ways in which India adopted or chose not to adopt aspects of this body of knowledge and practice. It also includes three specific analyses of India's ICT industry regarding the causes for its development and composition. Part II focuses specifically on the role of knowledge and innovation diffusion in the evolution of the ICT sector and its jump into the 21st century. Finally, Part III includes four chapters on specific topics in ICT development including ICT cluster development beyond its initial emergence in Bangalore, managerial know-how and diversification, intellectual property and offshore outsourcing.

This book treats the role of the ICT sector in India's development to date and speculates on its future including diversification and ICT spillover effects on other sectors. It provides a good introduction to the Indian development experience and the role ICT has and will likely play in the drive to sustained economic growth and development in India.

Part I Information Communication Technology and Economic Development of India

The chapters in Part I provide background information and analyses on Indian development, the nature of the ICT industry there, and how it has contributed to economic growth and development. In this context, Chapter 2 by Roger Stough, Kingsley Haynes and Maria Salazar begins Part I by setting the stage for the other contributions in the book. It reviews the major theories and practices deployed in an attempt to create developed countries out of developing ones over the past 60 or 70 years and offers interpretive asides of how all of this influenced India's development path. It examines critically stage theory formulations like Rostow's stages of economic growth, growth pole concepts and export-oriented growth policies. Further, hard and soft infrastructure approaches are considered and issues regarding the contemporary development situation in India are identified.

Tojo Thatchenkery, Roger Stough, Govindasamy Balatchandirane and Rupa Ranganathan get directly to the core focus of the book in Chapter 3 in their examination of the role of ICT in the Indian development experience. This chapter provides detailed data on the growth of the Indian ICT industry, its scale and scope, the forces that contributed to its rapid

growth and development and factor cost issues. Next they examine the role of ICT in India's economic and social development and not only advance the 'leapfrog hypothesis' in this context but also provide some reservations about this theory. The authors also examine the impact of ICT on such realms as education, health, gender, poverty and governance. The authors raise a variety of questions concerning the future of ICT in India and India's development including forward and backward linkage development of the ICT sector. Policies concerning positive and negative spillover effects are also examined.

Cherian Samuel in Chapter 4 examines the evolution of the service sector in India showing that much of the decrease in employment in the agricultural sector has been countered by growth of service sector jobs and thus that India, in this respect, is like many other countries in the late 20th and early 21st centuries. This is important for two reasons. First, India is unlike many other countries at its stage of development such as for example, China, in that it has mostly substituted service jobs rather than manufacturing jobs for a loss in agricultural employment. In short, development-led structural change in India did not follow the expected or so-called classic pattern. The dominant role of the ICT services is documented and explained in the context of this analysis. The chapter concludes that numerous infrastructural-related constraints (hard and soft) may prevent ICT sector development from underpinning a successful example of development leapfrogging.

In the final chapter of Part I Aparna Sawhney conducts a detailed examination of the factors responsible for ICT growth in India. Part of the focus of this analysis is on the export component of the ICT sector which historically was largely in low-end ICT services including lower-end software design, coding components, maintenance of legacy systems and various back-office operations. Earlier ICT service exports focused on 'body shopping' but today specialization is mostly focused on providing on-site services versus offshore services. Only about 5 percent of exports today are provided offshore. With regard to the factors responsible for the rise of the ICT sector in India, the author introduces a long list of factors including low-cost technical labor, early entrant advantage, government support, access to technology from foreign countries, organizational skills, adjustment to global market trends and entrepreneurial dynamism. Among all of these, however, development and maintenance of high-quality and reliable ICT services is viewed as centrally important. This is illustrated by the almost religious commitment to signaling or conveying quality certification on the part of Indian software companies and their belief that this is absolutely necessary to climb the service value ladder.

Part II Knowledge Spillovers and Innovation in the ICT Sector

In Part II three chapters examine the way in which knowledge acquisition and innovation have evolved and manifested themselves in the Indian ICT experience. In Chapter 6 Mary Mathew assesses the development of innovation and diffusion patterns over the evolution of the Indian ICT industry. Initially the ramp-up of the ICT sector appropriated and adopted new technologies from abroad. The adoption of technology sequentially triggered a variety of innovations within the ICT and software sectors and later in other parts of the economy. Parallel to this expanding process of innovations was the growth of a knowledge base and skilled human capital. The author notes that patent data from India shows that there is now some indigenous innovation occurring but that insufficient evidence exists to conclude that there is significant domestic ICT product innovation. This may be due to the fact that much of the industry in India is services-oriented and related process innovations are more difficult to track as they rarely show up in the form of patents.

In Chapter 7 Gita Surie examines the effect that Indian company interaction with global firms has on performance and innovation. Evidence from the evolution of the Indian software industry and a leading global software firm is used to support a conclusion that interactions with global firms through the creation of cross-border communities of practice (COPs) catalyzed local development by initiating learning and replication through knowledge spillovers in the local environment. This, in turn, spurred competition and internationalization. In short, participating in communities of practice helped drive Indian software firms to adopt global best practices and to motivate innovative behavior.

Nagarajan Dayasindhu at the Infosys Software Engineering Technology Laboratories discusses in Chapter 8 the importance of tacit knowledge or more broadly inimitable network resources. Inimitable resources are those that are incapable of being imitated or copied and as such are a basis for sustained competitive advantage for organizations. While reasons for inimitable resources existence have been researched generally they have not been examined for network resources that exist within a network of organizations. Important network organizational resources include network membership, structure, tie modality and management. This chapter explains why such network resources become inimitable for an organization that is a part of a network of organizations in the context of the Indian ICT industry. The research reported classifies inimitability of network resources into path and knowledge dimensions. The path dimension, it is concluded, is important for the inimitability of all network resources but the knowledge dimension is important for tie modality and network management only.

In short, the path dimension of inimitability is more important than the knowledge dimension.

Part III Industry Issues and Patterns

In Part III four chapters are presented that deal with specific ICT-related issues and their importance to the development process. The first of these, Chapter 9 by Kavil Ramachandran and Sougata Ray focuses on the formation of ICT-dominated industrial clusters and how they evolved. While the ICT industry has played a major role in India's development, as explained above, this success has not been evenly distributed across the country. Today notable clusters exist in Bangalore, Chennai, Hyderabad and Pune as well as in large urban agglomerations like Mumbai and Delhi but these are not so notable because they are embedded in the broad and deep industrial structure that exists there. It is noted that some of these centers like in Bangalore are naturally formed clusters but others are more driven by public policy and leadership like in Hyderabad where the government itself had to exhibit entrepreneurial properties to create a viable cluster. Much of the chapter is a comparison and contrast analysis of ICT cluster formation in Bangalore and Hyderabad. The chapter examines factors that contribute to the creation of ICT clusters in general and in particular where conditions are not ripe for natural cluster formation such as with late entrants like Hyderabad and Pune. A major conclusion reached by Ramachandran and Ray is that the entrepreneurial strength of the state and the pool of local entrepreneurs are equally important for rapid cluster formation.

Suma Athreye and Vasanthi Srinivasan in Chapter 10 examine practices adopted by Indian software services firms in the late 1990s and show that they developed considerable organizational capability in the management of large-scale labor resources and related processes crucial to the successful operations of offshore business models. The apparent similarity of the business models whereby most of the programming work was done in India with firms managing the development of software to offshore client specifications led to many software firms entering the sector. This model was progressively adopted over the mid to late 1990s resulting in nearly 60 percent of all revenues to Indian software firms today. The similarity of the model and managing relations with the offshore company contributed to increased market entry in the Indian software industry. In this context, the authors investigate the question of whether the managerial similarities between software and business process outsourcing (BPO) give diversifying firms a performance advantage in the expanding ICT sector. The focus of this research is on firms that diversified into BPO compared to other types of entrants into the ICT sector.

Intellectual property (IP) issues are of considerable importance in the global ICT industry in general and increasingly so in India. Stanley Nollen in Chapter 11 examines the emergence of IP issues in India in the ICT industry of the early 21st century. There is a wealth of specific information on IP in India in this chapter that ranges from input and output patterns to infringement and copyrighting practices. In sum, IP is an awakening element of the Indian ICT industry with notable increases in attempts to define value and protect it. Copyrighting and patents are at much higher levels than in the past, which bodes well for the broader integration of the Indian ICT industry into a global best practices framework.

Recently the most visible policy issue regarding Indian offshoring and back-office operations is in connection with the exportation of jobs from the developed countries to the developing ones. This is a particularly important issue for the ICT sector in India as both inshoring of workers from India and outsourcing of work to India has been a central element of India's competitiveness in this sector. Ron Hira in the concluding chapter of the book, Chapter 12, examines how offshore outsourcing may affect Indian ICT firms' labor mobility needs and the politics of liberalizing US labor mobility policies. The analysis shows that the vast majority of high-skilled temporary workers to the USA come from India and most of these work in the ICT sector. The chapter examines how demand for labor mobility may change due to offshoring and offshore outsourcing. In conclusion the chapter speculates on the US labor mobility context and what some of the policies' impact will be on the Indian ICT industry.

Overall, the chapters provide a balanced view of the link between ICT and economic development of India. What stands out from the various chapters is how unique India's development has been. A country whose GDP is still influenced mostly by the monsoons has quietly grown to have the largest trained workforce in the world and is likely to emerge as a world economic power. The recently released *National Intelligence Council Report* (Mapping the Global Future, December 2004) suggested that the world economy might be 80 percent larger in 2020 than it was in 2000. Though the USA may still be the world's dominant economic power in 2020, China and India will see their influence expand significantly. 'In the same way that commentators refer to the 1900s as the "American Century," the 21st century may be seen as a time when Asia, led by China and India, comes into its own', the council wrote in its report, which was produced as a synthesis of the views of all 15 of US intelligence agencies. According to the report, India is better positioned than most countries to make use of new technologies, which has helped it to leapfrog stages of development. With its well-entrenched democratic institutions, significant intellectual capital and world-class firms

in hi-tech sectors, India certainly appears to be on track to become one of the top economies of the world in a decade or two.

REFERENCES

- The National Intelligence Council (December 2004), *Mapping the Global Future: Report of the National Intelligence Council's 2020 Project*, Pittsburg, PA: Government Printing Office.
- O'Neill, Jim, Roopa Purushothaman, and Dominic Wilson (2003), *Dreaming with BRICS: the Path to 2050*, New York: Goldman Sachs Economic Research.