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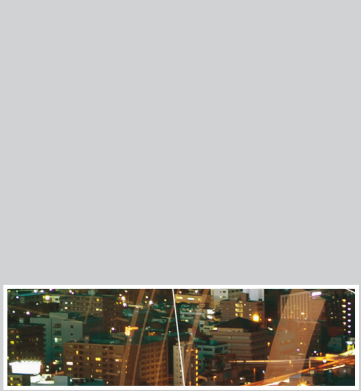
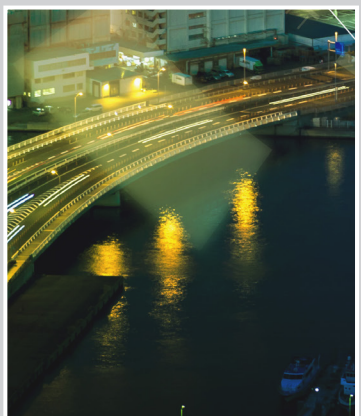
India as an Innovation Economy

The Role of IP and ICT








INDIA AS AN INNOVATION ECONOMY

The Role of IP and ICT

June 2018

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Foreword

In the era of the fourth industrial revolution, the notion 'Innovation Economy' is widely used, though very diverse in its interpretation. This white paper strives to set in context global indicators for innovativeness at an economic level to shed light on India as an Innovation Economy.

In this regard, the importance of innovation in and related to Information and Communications Technology (ICT) is becoming evident. ICT as a sector arguably has a double-sided effect, as the sector both thrives from innovation as well as enables innovation. This clearly demonstrates both the power and potential of the sector. However, this enormous economic scope can be leveraged through a solid Intellectual Property (IP) regime that allows for monetization of IP. Thereby, the innovation culture is nurtured and can be the driver for India to become a global innovation and technology development hub. The Government of India has already taken large and remarkable steps in this direction that help to foster this trend.

Also, enhancing the conduciveness of the business environment, incentivising and encouraging India-made innovation, will positively affect bilateral cooperation, leading to further foreign direct investments and creation of high quality jobs. India and Europe are natural and strong partners and innovation in both territories is an essential part of that strong partnership. India's transition into a global design and manufacturing hub creates market access points for European businesses as well as a hotbed for more joint research programmes that are mutually beneficial.

This white paper offers new insights on the relevance of the ICT sector in India's transformation to an innovation led economy. The paper makes recommendations on how India can support that transition and identifies how the key European stakeholders can contribute through collaborations and mutually beneficial partnership in India's journey towards an "Innovation Economy".

I would like to thank the representatives of the European Union Member States here in India, partners of the Europe India IP Facilitation Forum, and individual experts, who have all given their valuable perspectives.

My special thanks goes to ICRIER for helping us bring out this white paper.

Poul V. Jensen
Director, EBTC

Foreword

As India emerges to fortify its status as the fastest growing market in the world and move towards an Innovation Economy, researchers from European Business and Technology Centre (EBTC) and Indian Council for Research on International Economic Relations (ICRIER) have come together to produce this joint white paper.

The paper highlights India's several advantages including a vast pool of educated and skilled workforce, and favourable government policies that can support its journey towards an innovation economy. The country's ranking in the Global Innovation Index of the World Intellectual Property Organization (WIPO) among 130 countries improved from 81 in 2015 to 60 in 2017. According to the Department of Industrial Policy and Promotion (DIPP), Ministry of Commerce and Industry, there has been an increase in patent filings in the last three years. The country has signed over 100 Memoranda of Understanding across different central government ministries/departments/organisations with a number of countries including many European Union (EU) Member States to strengthen research and development (R&D), innovation and startup ecosystems. All these factors will contribute in the journey towards an innovation economy.

The paper focuses on two key pillars of the innovation economy namely Information and Communications Technology (ICT) and Intellectual Property (IP), and discusses how they can help to enhance India's positioning as a global hub for innovation and technology development, bring in investment, and creating high quality jobs. It compares India *vis-à-vis* other developed and developing countries in some key innovation indices, identifies the gaps, and makes policy recommendations on how India can improve its global standing in key ICT and IP indicators.

In this context, the role of EU, one of the largest trading partners and source of foreign investment and technology inflows is crucial. The paper examines how EU can contribute to India's journey towards an innovation economy, identifies areas of mutually beneficial collaborations and partnerships and makes recommendations to strengthen the ties between the two economies.

The paper also lays down certain strategies for fast tracking the journey towards an innovation economy. These include setting up of a task force to identify the short-term and long-term strategies and to lay down a roadmap, strengthening data protection regulations, initiating measures on how to ensure IP protection for the ICT sector, how to link different government initiatives and policies and how to work closely with innovators, start-ups and other stakeholders. I am sure that if some of these recommendations are implemented, India will emerge as an innovation economy soon. I also feel that there is need for more research in the areas of ICT, IP and innovation and one of the recommendations related to funding of Chairs for professors/technical experts in research institutes for innovation related policy research deserves government attention. We at ICRIER, with our partner EBTC, look forward to more collaborative research in the area of innovation, ICT and IP.

Dr. Rajat Kathuria
Director & CE, ICRIER

Acknowledgement

We express our gratitude to Poul V. Jensen, Director, EBTC, and Rajat Kathuria, Director and Chief Executive, ICRIER, for giving us the opportunity to work in this area and for their constant support.

We would like to thank the Delegation of the European Union to India and Bhutan, Embassies and representatives of the European Union Member States in India, other European Embassies and R&D centres, and partners of the Europe India Intellectual Property (IP) Facilitation Forum who supported our research and shared their views on the subject. We are grateful to Indian and European industries, industry associations, incubators, academia, governments, autonomous organisations, public sector organisations and IP attorneys and to all those who participated at the Europe-India IP Dialogue in March 2018 and gave us their valuable inputs. In this regard, we would like to express our special thanks to the European Patent Office.

We are grateful to Sachin Arora, Head IPR, EBTC; Angana Parashar Sarma, Research Assistant, ICRIER; and Divya Satija, Consultant, ICRIER, for their help in compilation of the white paper. Chhaya Singh deserves a special mention for procuring the journal articles for the paper and Anu Mohandas helped us to fix meetings. We would like to thank Genesis Printers for report formatting and printing and Manmeet Ahuja and his team to facilitate the launch of this white paper.

Contents

List of Tables

List of Figures

List of Boxes

List of Abbreviations

ADR	Alternative Dispute Resolution
AI	Artificial Intelligence
App	Application
CAGR	Compound Annual Growth Rate
CGPDTM	Controller General of Patents, Designs & Trade Marks
CIPAM	Cell for IPR Promotion and Management
CRI	Computer Related Inventions
DIPP	Department of Industrial Policy & Promotion
EPO	European Patent Office
ETSI	European Telecommunications Standards Institute
EU	European Union
FDI	Foreign Direct Investment
FRAND	Fair, Reasonable, and Non-Discriminatory
GDP	Gross Domestic Product
GI	Geographical Indications
GII	Global Innovation Index
GIS	Geographic Information System
ICT	Information and Communications Technology
IEEE	Institute of Electrical and Electronics Engineers
IFCAR	Indo-French Centre for Advanced Research
IoT	Internet of Things
IP	Intellectual Property
IPR	Intellectual Property Right
IT	Information Technology
IT-BPM	Information Technology-Business Process Management
ITeS	Information Technology-enabled Services
OECD	Organisation for Economic Co-operation and Development
OSS	Open Source Software
PAN	Permanent Account Number
R&D	Research and Development
SEP	Standard Essential Patent
SEZ	Special Economic Zone
SME	small and medium enterprise
SSO	Standard Setting Organisation
TISC	Technology and Innovation Support Centre
UNCTAD	United Nations Conference on Trade and Development
US	United States of America
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

1 Introduction

"The advent of the Fourth Industrial Revolution can help India leapfrog traditional phases of development and accelerate its transition to a developed nation. Deploying these technologies optimally and strategically can create a potent mix of resources and infrastructure that can yield better quality, more sustainable growth. With more than 50% of its population under the age of 27, India's role is also going to be pivotal in shaping the global 'Fourth Industrial Revolution' agenda in a responsible, scalable and inclusive manner."

Brende (2018)

India is one of the fastest growing economies in the world. According to the International Monetary Fund (IMF), India's growth rate in 2018 is estimated to be 7.4 per cent, and is expected to increase to 7.8 per cent in 2019, surpassing the growth rate of China (6 per cent in 2018 and 6.4 per cent in 2019).[1] India has the third largest group of scientists and technicians in the world and is predicted to be the world's largest supplier of university graduates by 2020.[2] India's ranking in the Global Innovation Index (GII) of the World Intellectual Property Organization (WIPO) improved from 81 in 2015 to 60 in 2017 among 130 countries.[3] The country's rank in the World Bank's 'Ease of Doing Business Index' also improved from 130 in 2016 to 100 in the year 2017.[4] In 2016, India was ranked 8th among World Trade Organization (WTO) members in export of commercial services [including Information Technology (IT) and Information Technology-enabled Services (ITeS)].[5] According to United Nations Conference on Trade and Development (UNCTAD), India is the third most favourable investment destination for foreign investment, after the United States of America (US) and China (UNCTAD, 2017b). Given this, the Indian economy is getting ready to become an **Innovation Economy**, which is supported by skilled workforce, adaptation of technology such as Artificial Intelligence (AI), and the Internet of Things (IoT), and government policies and initiatives such as Digital India, Atal Innovation Mission, Make in India, Skill India, and Startup India.

The Indian government has entered into collaborations and Memoranda of Understanding (MoUs) with a number of countries including many European countries and European Union (EU) Member States to strengthen research and development (R&D), innovation and startup ecosystems. Foreign investment up to 100 per cent is allowed in the information and communications technology (ICT) sector and in R&D to attract foreign companies.[6] The progressive liberalisation of the telecommunications sector and allied

1 Source: http://www.imf.org/external/pubs/ft/weo/2017/update/01/ (accessed on 16 May 2018)

2 Source: https://www.investindia.gov.in/why-india (accessed on 16 May 2018)

3 Source: https://www.globalinnovationindex.org/analysis-indicator (accessed on 16 May 2018)

4 Source: http://www.doingbusiness.org/rankings (accessed on 16 May 2018)

5 Source: http://stat.wto.org/CountryProfile/WSDBCountryPFView.aspx?Country=IN&Language=F (accessed on 17 May 2018)

6 Source: http://dipp.nic.in/sites/default/files/CFPC_2017_FINAL_RELEASED_28.8.17_0.pdf (accessed on 17 May 2018)

reforms have led to the reduction in cost of services and increased its access and reach, which has led to diffusion of ICT. Indian and foreign companies have responded positively to government reform initiatives and a number of them are investing in ICT and high technology sectors in India.

> *"In the long run, innovation and employment creation go hand in hand, contributing to an inclusive and high-employment economy."*
>
> **(OECD, 2010; pp. 16)**

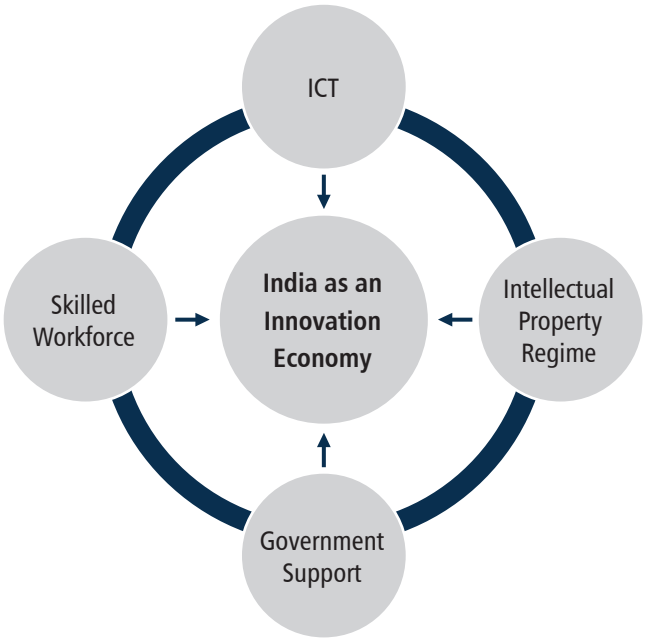
Global studies show that ICT and intellectual property (IP) are two key pillars of an **Innovation Economy**. The ability to create, distribute and exploit knowledge is a major driver of economic performance [Organisation for Economic Co-operation and Development (OECD), 2000]. The EU has highlighted the importance of innovation in its growth strategy, stating that smart growth means strengthening knowledge and innovation drives future growth and increases productivity. It has set a target of 3 per cent of the EU's Gross Domestic Product (GDP) (public and private combined) to be invested in R&D and innovation by 2020 (European Commission, 2014).

Given the commonalities in the vision of the policymakers of two economies - India and the EU, the 14th Annual Summit between India and the EU held on 6 October 2017, reaffirmed the joint commitment of the two economies towards enhanced cooperation on innovation and technology development.[7] Flagship programmes by the EU and Indian governments in common priority sectors such as digital economy (EU Digital Single Market and Digital India) and entrepreneurship (Startup Europe and Startup India) have further strengthened the EU-India partnership.

Both India and the EU recognise that ICT and IP have positive socio-economic impact and can lead to inclusive growth and progress (also see United Nations, 2012). Digital technology and innovation boost global trade and push the world towards an increasingly integrated global economy. Studies have shown that the use of ICT can result in systematic upgradation in productivity of firms and can lead to an economy-wide rise in total factor productivity (Guo, 2016). Studies also show that innovation and technology today are more market driven, and government plays the role of a facilitator by providing a fair and competitive environment through the right policy and by removing barriers to creation of innovation networks (OECD, 2000).

In case of India, studies have pointed out that to sustain the rapid growth and help alleviate poverty, India needs to

> *"…aggressively harness its innovation potential, relying on innovation-led, rapid, and inclusive growth to achieve economic and social transformation."*
>
> **(Dutz, 2007; pp. xv)**



These studies also highlight that to unleash its innovation potential, India needs better information flow, commercialisation of knowledge, knowledge diffusion, private investment in R&D, active engagement with diasporas, and more international collaborations and partnerships, which will lead to inflow of technology and investment.

[7] Refer to Clause 40, India – EU Joint Statement 14th India-EU Summit, New Delhi, 6 October 2017. Available at http://pib.nic.in/newsite/PrintRelease.aspx?relid=171462 (accessed on 26 March 2018)

1.1 Objective

Given this background, the objective of this white paper is to discuss the essential role of ICT and IP for India to become an **Innovation Economy**. The paper also looks at India's position *vis-à-vis* other developed and developing countries in some key innovation indices, identifies the gaps, discusses how ICT and IP can help to enhance India's global positioning as a hub for innovation and technology development, bring in investment, and create high quality jobs. In the end, the paper makes policy recommendations on how India can leapfrog into an **Innovation Economy** and identifies how the EU and its Member States can contribute through collaborations and mutually beneficial partnerships in India's journey towards becoming an **Innovation Economy**.

1.2 Approach

The paper is based on secondary information analysis and three focused group discussions. The secondary analysis comprises of literature review, examination of government policies and analysis of various indices of innovation to understand India's ranking *vis-a-vis* other countries. The focused group discussions were held under the Europe-India IP Dialogue in March 2018 which were organised in cooperation with the European Patent Office (EPO).

Representatives from the Delegation of the European Union to India and Bhutan, European Embassies, Indian and European industries, industry associations, incubators, academia, governments, autonomous organisations, public sector organisations and IP attorneys, among others, interacted at the focused group discussions. This white paper takes into account key findings of the focused group discussions linking it to secondary analysis and suggesting a way forward for India to move towards an **Innovation Economy**.

1.3 Layout of the Paper

The next chapter, Chapter 2, presents the definition of an **Innovation Economy** and the role of ICT and IP in developing an **Innovation Economy**. Chapter 3 analyses India's relative position as an **Innovation Economy** *vis-à-vis* selected developed and developing countries, using the GII and the Networked Readiness Index. Chapter 4 focuses on the ICT sector. It examines how and why ICT is a key sector for India's global positioning, the impact of the sector, government support and incentives, and how this sector has helped India to attain inclusive growth and move towards an **Innovation Economy**. Chapter 5 discusses the role of IPRs in an **Innovation Economy** and Chapter 6 presents the current challenges that lead to scope for India-Europe collaboration. The last chapter, Chapter 7, provides policy recommendations and thoughts on the way forward.

2

Definition of Innovation Economy and the Role of IP and ICT

The term innovation is widely used to define the creation and commercialisation of knowledge, leading to state-of-the-art technologies. In the context of India,

"Innovation is broadly defined to include 'new to the world' knowledge creation and commercialization as well as 'new to the market' knowledge diffusion and absorption."

(Dutz, 2007; pp. 2)

The second type of innovative activities involves enterprises applying existing technologies in new locations and product areas. Both these activities are essential to leapfrog into an **Innovation Economy**.

There is no globally approved definition of an **Innovation Economy**. Broadly, it refers to an economy driven by knowledge, entrepreneurship, technology and innovation.

As early as 1947, economist Joseph Schumpeter in his book, *Capitalism, Socialism and Democracy*, introduced the notion of an **Innovation Economy**. He argued that evolving institutions, entrepreneurs, and technological changes were at the heart of economic growth (Schumpeter, 1947).

2.1 Role of ICT in Moving Towards an Innovation Economy

West (2011), highlights the role of technology in enabling innovation and creating economic prosperity, thereby leading to an **Innovation Economy**. ICT offers new ways of exchanging information and has led to development of new and efficient business models. While the telecommunication sector remains to define the primary digital infrastructure for the growth and modernisation of the economy, emerging technologies like blockchain and the IoT will become increasingly important for assuring inclusive growth. ICT not only enhances the choice available to consumers but also enables governments to have better and more efficient governance using technology. In the Indian context, Konana and Balasubramanian (2014) pointed out that sophisticated network infrastructure (e.g. computers, cable, fiber, and routers) and connectivity is a prerequisite for the knowledge economy resulting in an **Innovation Economy**. Moreover, the ICT sector in itself offers massive employment opportunities to India's skilled workforce.

According to Davenport et al. (2006), a common denominator of the drivers of the **Innovation Economy** is that each driver draws on ICT advances, which enables universal access to knowledge that was previously dispersed and difficult to reach, and this access to knowledge is based on accepted compatibility standards. This has enabled a shift from the industrial economy (with limited knowledge) to the **Innovation Economy** (enabling global orientation and co-creation of knowledge).

2.2 IP and Innovation

"The term 'IP' refers to unique, value-adding creations of the human intellect that results from human ingenuity, creativity and inventiveness. An IP right is thus a legal right, which is based on the relevant national law encompassing that particular type of intellectual property right (IPR). Such a legal right comes into existence only when the requirements of the relevant IP law are met and, if required, it is granted or registered after following the prescribed procedure under that law."

Christopher M. Kalanje, Consultant, SMEs Division, WIPO[8]

[8] Source: http://www.wipo.int/sme/en/documents/ip_innovation_development_fulltext.html (accessed on 18 May 2018)

The IP system plays a significant role in helping a business to gain and retain its innovation-based advantage. IP helps facilitate the process of taking innovative technology to the marketplace and reduces risk for the players involved. IP rights allow innovative entrepreneurs to protect their inventions and get acceptable returns from their innovations. It provides the holder with several opportunities including ability to get investors for funding, licensing, and various types of strategic business partnerships or alliances in commercialising it, which can facilitate the successful completion of an innovation. It also prevents rivals from patenting-related inventions.[9] Moreover, in the future development of an invention/ design and taking it to the market through partnerships (such as joint ventures, licensing agreements, merger or acquisition) and the ownership of IP provides a strong negotiating position in the process of getting into such a partnership.

Patents are the most preferred IP rights in relation to technological innovations. They often play a crucial role in facilitating access to business angels, providers of early stage capital, including seed capital, venture capitalists, financial institutions, and anyone else who may provide assistance for an invention to reach the marketplace.[10] The number of patents owned by an enterprise has often been used as one of the main indicators for determining innovation intensity of that enterprise. The number of patents is used as a metric for measuring innovation in an economy (Powell and Snellman, 2004), although the broad notion of IP includes trademarks, copyright, geographical indications (GIs), designs, topography of integrated circuits and undisclosed information. Given that patents are used as a measure for the output of innovation, the white paper's scope within IP shall be limited to patents to ensure a closer and more targeted focus.

The next chapter analyses India's position as an **Innovation Economy** *vis-à-vis* other countries.

[9] Source: https://www.innovationpolicyplatform.org/content/intellectual-property-rights-innovative-entrepreneurship (accessed on 17 May 2018)

[10] Source: http://www.wipo.int/sme/en/documents/ip_innovation_development_fulltext.html (accessed on 18 May 2018)

3

India's Global Position as an Innovation Economy

While innovation plays an essential role in the development of the modern global economy, there have been concerns about what should be the indicators of innovation (World Economic Forum, 2016). There is a large number of cross-country comparative studies that have used various indicators, which can place countries at different levels of innovation readiness or adaptation. In this section, two different indices are selected, namely the Global Innovation Index (GII) released by the World Intellectual Property Organization (WIPO), and the Networked Readiness Index, which is part of the Global Information Technology Report released by the World Economic Forum. These indices are used for cross-country comparisons in order to understand how India performs *vis-a-vis* select developed and developing countries in moving towards an **Innovation Economy**.

3.1 Global Innovation Index

In 2017, the GII provided a detailed ranking and analysis about the innovation performance of 127 countries out of which India ranks 60th. Its sub-indicators broadly explore countries' participation in various aspects of innovation, including political environment, education, infrastructure, and business sophistication. India's rank between 2013 and 2017 (see Table 3.1) shows a fluctuating trend, with improvements in 2016 and 2017.

The top three countries on the GII for 2017 were Switzerland (1st), Sweden (2nd) and the Netherlands (3rd). In terms of cross-country comparison, in 2017, all 28 EU Member States were ranked above India and a number of developed and developing countries including the US (4th), the UK (5th), Singapore (7th), Israel (17th), China (22nd), Vietnam (47th), Chile (46th), South Africa (57th), Mexico (58th), and Malaysia (37th) have been ranked above India. However, India has been ranked above developing countries such as Brazil (69th) and Indonesia (87th).

Table 3.1: India's Overall Global Innovation Index Rankings (2013-2017)

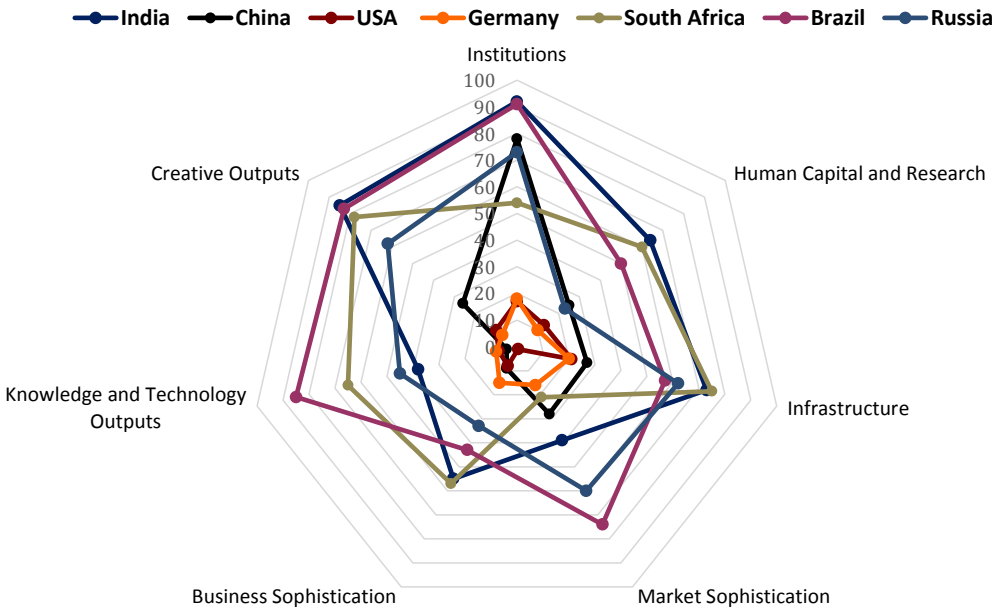
Year	Rank on the Global Innovation Index
2017	60
2016	66
2015	81
2014	76
2013	66

Source: https://www.globalinnovationindex.org/analysis-indicator (accessed on 18 May 2018)

Focusing on sub-indicators (see Figure 3.1), while countries such as the US, China and Germany have been ranked above India in all seven sub-indicators, India ranked better than South Africa, Brazil and Russia in some sub-indicators. For example, India ranked above South Africa in three sub-indicators, namely, infrastructure, business sophistication, and knowledge and technology outputs. India also performed better than Brazil and Russia in terms of market sophistication, and knowledge and technology outputs. Thus, the sub-indicator - knowledge and technology outputs, is a strength that India possesses which can be further strengthened to move India towards an **Innovation Economy**.

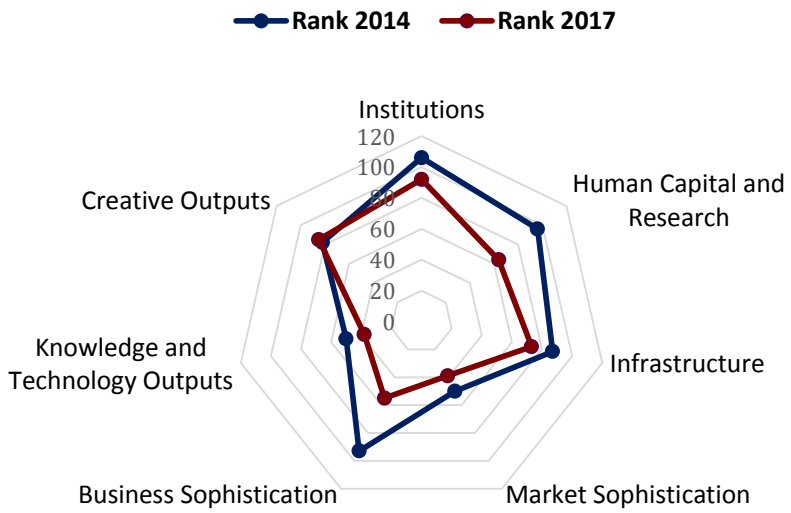
India's performance in the seven sub-indicators is mapped in Figure 3.2 for 2014 and 2017 to understand how the rank of the country has improved. Overall, there has been an improvement in ranking across most

Figure 3.1: India's Global Innovation Index Ranking *vis-à-vis* Select Countries across Sub-Indicators (2017)



Source: https://www.globalinnovationindex.org/analysis-indicator (accessed on 18 May 2018)

Figure 3.2: Changes in India's Ranking in Sub-Indicators in 2014 and 2017



Source: https://www.globalinnovationindex.org/analysis-indicator (accessed on 18 May 2018)

sub-indicators, except creative outputs, which needs government's attention. It is also important to focus on institutions, if the country wants to improve its ranking further. 'Institutions' comprises not only of the political environment and regulatory effectiveness, but also the business environment.

3.2 Networked Readiness Index

Networked readiness is a key indicator of how countries are faring in the digital world. The Index measures how well an economy is using ICT to boost competitiveness, and economic and social well-being. It also shows how ready each

country is to reap the benefits of technological transition.[11] Its parameters broadly compare countries' positions over the years regarding political and regulatory environment, infrastructure and digital content, ICT environment, tariffs, skills and usage of ICT across individuals and businesses. In this index, India's overall ranking has been low, and the rank has been declining since 2014 (see Table 3.2). This is a relative positioning and the low rank of the country does not indicate that the country has not taken initiative, it indicates that other countries may have taken more initiatives and/or are moving faster in the route towards an **Innovation Economy**. It is also important for India to understand the reasons for the low rank and learn from the best practices of other countries.

In terms of cross-country comparison, India ranked below all 28 EU Member States and countries such as Singapore (1st), the US (5th), China (59th) and Brazil (72nd). It has ranked above least developed countries such as Cambodia (109th), Myanmar (133rd), Bangladesh (112th) and Nepal (118th).

The comparison between the US, Germany and BRICS (Brazil, Russia, India, China, South Africa) nations across

Table 3.2: India's Overall Networked Readiness Index Ranking (2012-2016)

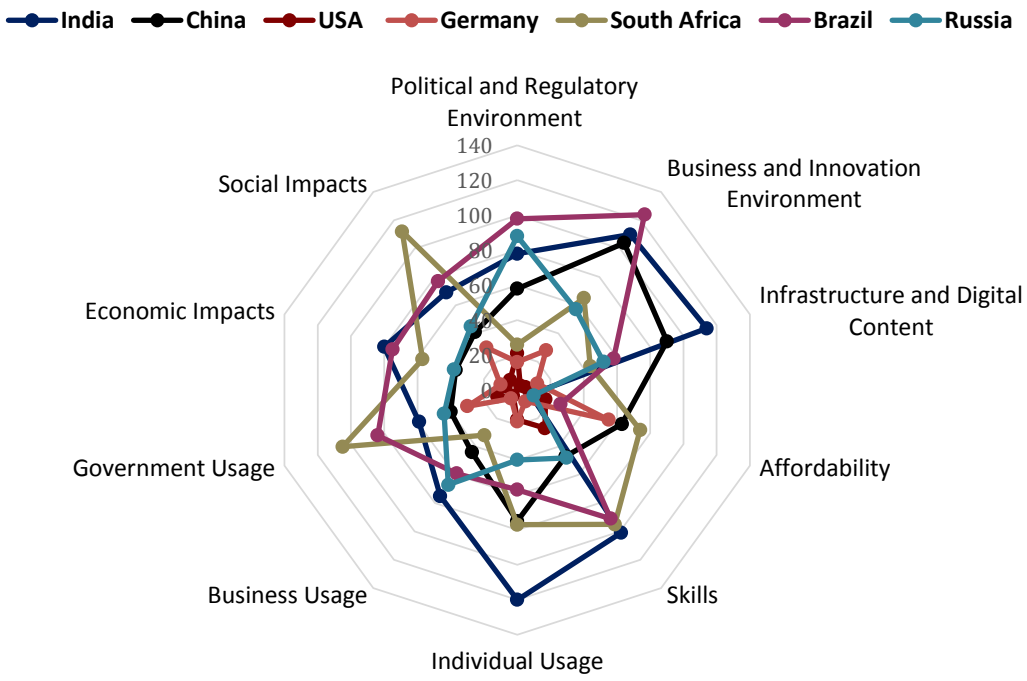
Year	Rank on the Networked Readiness Index
2016	91
2015	89
2014	83
2013	68
2012	69

Source: Compiled from World Economic Forum (2012), World Economic Forum (2013), World Economic Forum (2014), World Economic Forum (2015) and World Economic Forum (2016)

ten sub-indicators of the Networked Readiness Index for 2016 is depicted in Figure 3.3, to get a broader picture as to where India stands with regard to these ICT indicators *vis-à-vis* the selected countries.

While China, the US and Germany have ranked above India in almost all sub-indicators, India has performed better than

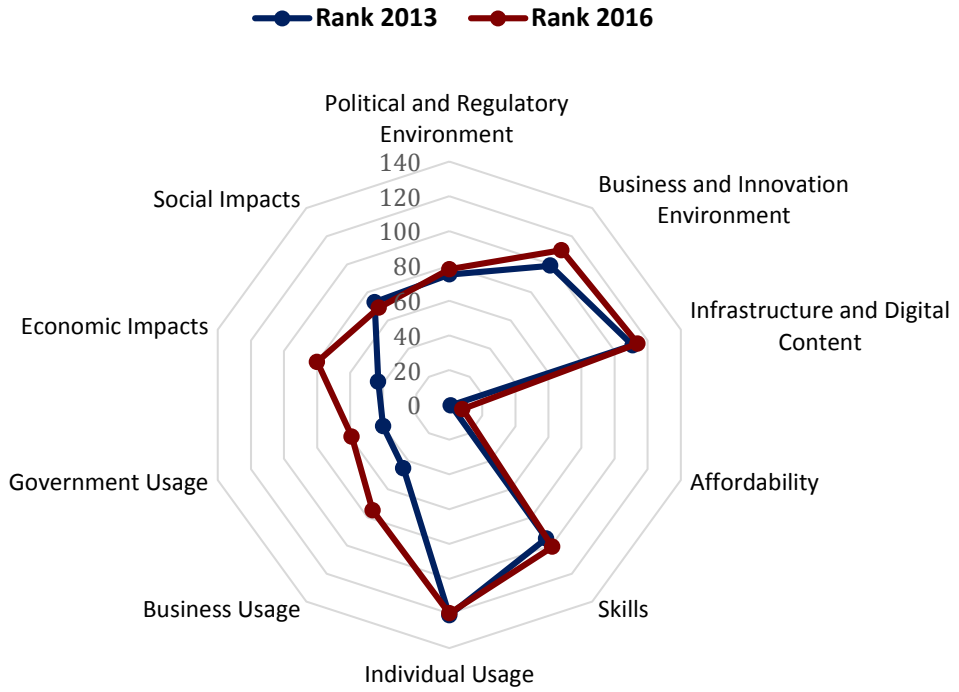
Figure 3.3: India's Networked Readiness Index Ranking *vis-à-vis* Select Countries across Sub-Indicators (2016)



Source: Compiled from World Economic Forum (2016)

[11] Source: https://www.weforum.org/agenda/2016/07/what-is-networked-readiness-and-why-does-it-matter/ (accessed on 21 May 2018)

Figure 3.4: Changes in India's Ranking in Sub-Indicators in 2013 and 2016



Source: Compiled from World Economic Forum (2013), and World Economic Forum (2016)

all in the affordability sub-indicator, which assesses the cost of accessing ICT, either *via* mobile telephone or fixed broadband internet, as well as the level of competition in the ICT sectors that determine this cost. India has also been ranked above South Africa in the government usage sub-indicator, which analyses the importance that governments place to carry out ICT policies for competitiveness, the efforts they carry out to implement their visions for ICT development and the number of government services they provide online. Compared to Brazil, India ranked higher in political and regulatory environment, business and innovation environment, government usage and social impacts (which analyses the ICT-driven improvements in well-being due to impact on environment, education, energy consumption, health progress and e-governance). In relation to Russia, India ranks higher in the political and regulatory environment sub-indicator. It is a matter of concern that in spite of the advantage of having a high rank in affordability indicator, India ranks lowest in individual usage[12] and business usage, among the countries studied. As a manpower surplus country, India needs to focus on skills and improve its ranking in this sub-indicator.

India's ranking and performance across the ten sub-indicators of the Networked Readiness Index in 2013 and 2016 is compared in Figure 3.4. India's comparative rank has fallen in sub-indicators - economic impact, government usage and business usage and this needs further investigation. During 2013-16, globally countries have implemented different policies including policies to attract foreign startups in ICT and innovation sectors. India has also introduced a number of policy initiatives, which are discussed in the next chapter, but there are some challenges, which are discussed in Chapter 6.

In light of these rankings, the next chapter focuses on the ICT sector. It examines how and why ICT is a key sector for India's global positioning, the impact of the sector, government support and incentives, and how this sector has helped India to attain an inclusive growth and move towards an **Innovation Economy**.

[12] Individual usage sub-indicator measures ICT penetration at the individual level, using indicators such as the number of mobile phone subscriptions, individuals using internet, households with personal computer, and households with internet access, broadband subscriptions or the use of social networks.

4

ICT as a Driver for Innovation

As discussed in Section 2.1, ICT is a prerequisite for the **Innovation Economy**. It is the backbone of the digital economy, which depends on connectivity, efficiency, use of technology, innovation, and linkages within and across sectors. This, in turn, is expected to lead to economic growth.

This chapter examines how and why ICT is a key sector for India's global positioning, its macro-economic impact, government support and incentives, and its socio-economic impact.

4.1 ICT - A Key Sector in India's Global Positioning and Macro Economic Contribution

In 2017, the global Information Technology-Business Process Management (IT-BPM) industry stood at US$ 1.3 trillion (excluding hardware), showing a growth of 4.3 per cent over 2016. IT services grew at 2.4 per cent and hardware segment grew at 1.5 per cent between 2016 and 2017, respectively, and the ICT sector crossed US$ 1 trillion (NASSCOM, 2018) in the year 2017. The global production of ICT goods and services was valued at 6.5 per cent of the global GDP in 2017, and the sector employed around 100 million people around the world (UNCTAD, 2017a). The sector contributed significantly to the GDP of a number of countries including India. India is among the top 10 economies by value addition of ICT services (see Table 4.1) and is also the fastest growing market for ICT usage.[13]

Given this, India's IT-BPM industry was valued at US$ 154

Table 4.1: Top 10 Economies by Value Added of ICT Services, 2015

Rank	Economy	Value Added (US$ Billion)	Share in Top 10 (in percentage)	Share in GDP (in percentage)
1	US	1,106	42	6.2
2	EU	697	26	4.3
3	China	284	11	2.6
4	Japan	223	8	5.4
5	India	92	3	4.5
6	Canada	65	2	4.2
7	Brazil	54	2	3.0
8	Republic of Korea	48	2	3.5
9	Australia	32	1	2.4
10	Indonesia	30	1	3.5
Total for Top 10		**2,657**	**100**	**4.5**

Source: Extracted from UNCTAD (2017a)

[13] Source: http://unctad.org/es/paginas/newsdetails.aspx?OriginalVersionID=1281&Sitemap_x0020_Taxono%20my=Information%20and%20Communication%20 (accessed on 29 May 2018)

billion in the year 2017 and is estimated to grow at 8 per cent to US$ 167 billion (excluding e-commerce) in 2018. The industry has seen an increasing number of startup companies (5,000 to 5,200), making India the world's third largest startup ecosystem. Many of these startups are digital companies and are working on technologies like blockchain, robotics, machine learning and AI (NASSCOM, 2018).

The Indian telecommunications industry which forms an essential pillar of ICT has undergone tremendous growth over the past few years and stands as the second largest telecommunications market in the world after China (Parvez and Chary T, 2017). The number of telephone subscribers in India were 1.2 billion as on November 2017.[14] Also, with the help of smartphones, more than 292 million people are connected and the Indian smartphone market witnessed a 14 per cent annual growth in production between 2016 and 2017, with a total production of 124 million units in 2017, making it the fastest growing market amongst the top 20 smartphone markets globally.[15] As per industry estimates, the Indian telecommunications sector accounted for 6.5 per cent of India's GDP while providing direct and indirect employment to four million people in 2015. India is also the world's second largest mobile handset market after China, and was estimated to be worth US$15 billion in 2017 with low-priced handset brands such as Xiaomi, Gionee, Vivo and Oppo flooding the Indian mobile handset market. The number of smartphone units sold has increased from 16 million in 2012 to 109 million in 2016.[16]

According to a report by ICRIER researchers in collaboration with the Broadband India Forum, internet usage has a positive impact on GDP. A 10 per cent increase in total internet traffic and mobile internet traffic increases India's GDP by 3.3 per cent and 1.3 per cent, respectively, as against the global average of 1.3 per cent and 0.7 per cent respectively (Kathuria et al., 2017). Moreover, a 10 per cent increase in mobile penetration can lead to a 1.5 per cent rise in GDP (Kathuria et al., 2009). Therefore, the role of mobile handsets and mobile network is important as the digital connectivity majorly relies on mobile devices (Boston Consulting Group, 2015).

Box 4.1: Key Results from Kathuria et al. (2017) Econometric Estimation

- A 17 per cent increase in India's internet traffic during the period 2015-16 resulted in an absolute increase of US$ 103.9 billion in India's GDP during the year. An equivalent increase in India's mobile internet traffic during the period 2015-16 would result in an absolute increase of US$ 41.4 billion in India's GDP during the year.
- Mobile applications contributed a minimum of US$ 20.4 billion to India's GDP in the year 2015-16.
- The internet economy could contribute up to US$ 537.4 billion to India's GDP in 2020, of which a minimum of US$ 270.9 billion could be attributed to mobile applications.

Source: Kathuria et al., 2017

With gradual increased use of smartphones, since 2016, India has become a large mobile phone application (app) market in terms of app downloads and usage. In 2017, the number of internet subscribers stood at approximately 465 million and that number is expected to rise to 750 million by 2018 (NASSCOM, 2018). The percentage of internet users solely on mobile devices has increased from 52 per cent in 2014 to 73 per cent in 2016 (Boston Consulting Group and Retailers Association of India, 2017). Further, with increased use of smartphones, India has become a large mobile phone application market in terms of app downloads and usage. In 2017, India had the world's second largest number of app downloads (more than 11 billion) (NASSCOM, 2018). Out of the 830 million young

[14] Source: https://www.trai.gov.in/sites/default/files/Recommendation_NTP_2018_02022018.pdf (accessed on 30 May 2018)

[15] Source: http://trai.gov.in/sites/default/files/PRNo56Eng23052018.pdf (accessed on 4 June 2018)

[16] Source: https://www.trai.gov.in/sites/default/files/Recommendation_NTP_2018_02022018.pdf (accessed on 30 May 2018)

people who are online worldwide, 39 per cent are in China and India (2017 estimates).[17] Also, due to high competitiveness, the cost of telecommunication (including ICT) services is now low. In the Networked Readiness Index for 2016, India was ranked 8th in the affordability sub-indicator, which is a very good rank. Specifically, with respect to mobile telephony, India is one of the cheapest countries for using a mobile phone. According to International Telecommunications Union, in the year 2015, the monthly cost of using a mobile phone in India was only US$ 2.8 (2014 US Dollars), compared to US$ 35.62 in the US, US$ 4.07 in China, US$ 6.09 in Russia and US$ 8.63 in Singapore. The data also shows that it is cheaper to use a mobile phone in India than in all EU Member States.[18]

In context of international trade, the telecommunications sector is the second largest sector in India attracting foreign direct investment (FDI) inflows. The telecommunications sector, along with the services sector (which includes software services) together contribute 15 per cent to the total FDI inflows in India, which is the largest contribution compared to any other sector.[19]

The ICT sector has helped transform India as a major exporter of services and India is the top exporter of IT/ITeS services. In 2018, the IT-BPM exports from India are expected to reach US$ 126 billion, which is a 7.7 per cent growth over 2017 (NASSCOM, 2018). India is among the major importers of ICT goods. According to ASSOCHAM and NEC Technologies India Private Limited (2017), the demand for electronic products in India is expected to grow at a compound annual growth rate (CAGR) of 41 per cent during 2017-2020 to reach US$ 400 billion by 2020. Domestic production, which was growing at a CAGR of 27 per cent in 2017, may reach US$ 104 billion, leaving a gap of approximately US$ 300 billion, which has to be covered by imports. Thus, India is a net exporter of ICT services and net importer of ICT goods.

4.2 ICT and its Impact

According to NASSCOM, India is on its way to become a trillion-dollar digital economy. India's ICT revenue is expected to be US$ 225 billion in 2020.[20] India's total software product market grew at 9.5 per cent from April 2016 to March 2017 to reach US$ 7 billion. In term of employment, between 2013 and 2016, the IT sector added 600,000 jobs, and had a total employee base of 3.9 million by the end of 2016.[21]

The double digit growth of the ICT sector has in the past been supported by conducive government policies, lower cost of mobile telephones and other ICT products and services, rising incomes, growing educated middle-class and a young population (NASSCOM, 2018). The future growth will be driven by technology. Some of the key technologies that are underpinning the evolution of the digital economy include AI, advanced robotics, IoT, big data analytics, cloud computing, 3-dimensional printing, and electronic payments (UNCTAD, 2017a). Some of the key drivers of growth of the sector in India will be digital transformation, automation, use of AI and IoT, IP-led business, and fifth generation (5G) network. Digital technologies are increasingly being adopted by Indian industries, and the use of technologies such as AI, DevOps (development and operations) and machine learning in manufacturing, services and agriculture can improve efficiency and productivity of these sectors, drive growth and enhance competiveness. Some of the examples of how ICT is benefiting different sectors are presented in Section 4.4.

Apart from this, ICT has also helped in improved government services in terms of e-governance, increased transparency, and growth in the number of government services (such as disbursement of government scholarships, digital payments, online educational courses, etc.). The sector has also helped in enhancing business and economic activities

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17 Source: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf (accessed on 29 May 2018)

18 Source: http://blogs.worldbank.org/opendata/where-are-cheapest-and-most-expensive-countries-own-mobile-phone (accessed on 29 May 2018)

19 Source: http://dipp.nic.in/sites/default/files/FDI_FactSheet_21February2018.pdf (accessed on 30 May 2018)

20 Source: http://www.assocham.org/newsdetail.php?id=6656 (accessed on 29 May 2018)

21 Source: http://pib.nic.in/newsite/PrintRelease.aspx?relid=162046 (accessed on 4 June 2018)

with development of e-commerce, financial services, efficiency in agricultural and manufacturing activities, and online portals for filing taxes, starting a business, etc., among others.

Therefore, the ICT sector has significant positive macro-economic impacts. Along with the creation of jobs, the increased mobile penetration can also help in reducing the digital divide by bringing about faster economic growth and enabling knowledge diffusion - a key indicator for innovation. In consequence, mobiles and mobile applications are acting as a social equity accelerator. This can be fostered by providing access to mobile applications for large sections of the (rural) population and thereby access to services in various fields like agriculture, health, and education, and more. Mixing the right accelerators such as educational ecosystem, increasing regulatory framework and government incentives, India can lead the fourth industrial revolution along with enhancing quality, sustainability and equity for its growth and development.[22]

4.3 Government Support and Incentives

The Indian government acknowledges that improving digital infrastructure will help attract investment and contribute to inclusive growth. It will also make India a more attractive location for global companies with an increased ease of doing business. To support the growth of the ICT sector, the government has given several direct and indirect incentives, some of which are listed in Box 4.2.

In India, the production and value addition of ICT goods have been low. According to figures published in 2016, the local value addition in the mobile manufacturing industry by India is only at 6 per cent of the absolute value as compared to 70 per cent by China (Pathak et al., 2016). To encourage domestic production and value addition, the Ministry of Electronics and Information Technology launched the Phased Manufacturing Programme to promote indigenous manufacturing of cellular mobile handsets with the intention of substantially increasing the value addition within the country. To support domestic

Box 4.2: Government Support and Incentives for the ICT Sector

1. **Digital India:** It is a flagship programme of the government to make India a digitally empowered society and knowledge economy. The programme is centered on three key vision areas – digital infrastructure as a core utility to every citizen, governance and services on demand, and digital empowerment of citizens.[23] Various initiatives such as *Unified Mobile Application for New-Age Governance (UMANG), Swayam and Single Window Interface for Trade (SWIFT)* have been taken under this programme.
2. **Startup India:** Startup India is a flagship initiative of the Government of India intended to build a strong ecosystem for nurturing innovation and startups in the country that will drive sustainable economic growth and generate large scale employment opportunities. The Government aims to empower startups to grow through innovation and design. As part of this initiative, the government introduced the Startup India Hub, an online platform for all stakeholders of the startup ecosystem in India, including startups, investors, mentors, incubators, accelerators, aspiring entrepreneurs, service providers and government bodies.
3. **Make in India:** Make in India was launched by the Government of India in September 2014 to encourage companies to manufacture their products in India and to increase their investment. This programme covers 25 sectors of the economy, provides various incentives to companies and investors to enhance the growth of these sectors, provides for electronic filing including digital signatures,

[22] Source: https://www.weforum.org/agenda/2018/04/india-s-opportunity-and-role-in-shaping-the-fourth-industrial-revolution/ (accessed on 19 June 2018)

[23] Source: http://digitalindia.gov.in/content/vision-and-vision-areas (accessed on 29 May 2018)

support to technology-driven startups, creation of world-class infrastructure, etc. Several initiatives have been undertaken under this programme to help India transform into an **Innovation Economy**. These are listed in Table A1 in Appendix A.

Source: Compiled from different government websites (accessed on 19 June 2018)

manufacturing in the country, duties have been imposed on imports of cell phones and certain benefits have been given for local manufacturing.

To attract investments in electronic manufacturing (both existing and new units), the Modified Special Incentive Package Scheme (M-SIPS) was notified in July 2012. The scheme provides a capital subsidy of 20 per cent in special economic zones (SEZs) (25 per cent in non-SEZs) for units engaged in electronics manufacturing for various electronic verticals, including nano-electronic products, semiconductor wafering, microprocessors, and chip components.[24] This scheme was amended in 2012, 2013 and 2017 to add more verticals under it.[25]

The Indian software and ITeS industry has benefited from two major schemes – the SEZ and Software Technology Park schemes. As on February 16, 2017, out of 411 SEZs that were formally approved, 263 were in the IT/ITeS/electronic hardware/telecom equipment sector and, out of 206 operational SEZs, 117 were in the IT/ITeS/electronic hardware/telecom equipment sector. There are some IT/ITeS SEZs present in multi-product and multi-service SEZs.[26]

In 2018, the Union Cabinet chaired by the Prime Minister Shri Narendra Modi approved the proposal of the Department of Commerce to give focused attention to 12 identified Champion Services Sectors for promoting their development and realising their potential. The IT and ITeS services, communication services and engineering services are included in these Champion Services Sectors. A dedicated fund of INR 5,000 crores has been proposed to support initiatives for sectoral Action Plans of the Champion Sectors. This initiative will enhance the competitiveness of India's service (including ICT) sectors, thereby promoting GDP growth, creating more jobs and promoting exports to global markets.[27]

The government has liberalised FDI in the ICT sector to attract investment and technology. In the software segment and in telecommunications equipment manufacturing, 100 per cent FDI is allowed. In the case of telecommunications services (including telecommunications infrastructure providers) too, 100 per cent FDI is allowed. The sector has been liberalised in a phased manner – for example, in 2013, the 74 per cent FDI cap was eliminated and 100 per cent investment in the sector was allowed.[28]

The government has also brought in policies for Open Source Software (OSS), IoT, cyber security, etc., to regulate as well as promote the ICT sector in India. These include the Policy on Adoption of Open Source Software for Government of India (released in 2015 to encourage the formal adoption and use of OSS in government organisations),[29] the National Cyber Security Policy 2013 for the security of cyberspace,[30] the draft Internet of Things (IoT) policy (drafted in 2015 and revised in 2016) to undertake capacity development and develop IoT products,[31] and the Personal Data Protection Bill 2014 for protection of personal data and information of an individual collected for a particular purpose by one organisation and to prevent its misuse by other organisations.[32]

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24 Source: http://meity.gov.in/writereaddata/files/MSIPS%20Notification.pdf (accessed on 2 February 2018)

25 Source: http://meity.gov.in/esdm/incentive-schemes (accessed on 2 February 2018)

26 Source: http://www.sezindia.nic.in/upload/uploadfiles/files/3StatewiseDistribution-SEZ(1).pdf (accessed on 19 June 2018)

27 Source: http://pib.nic.in/newsite/PrintRelease.aspx?relid=176883 (accessed on 4 June 2018)

28 Source: http://dot.gov.in/sites/default/files/pn6_2013.pdf (accessed on 2 February 2018)

29 Source: http://meity.gov.in/writereaddata/files/policy_on_adoption_of_oss.pdf (accessed on 30 January 2018)

30 Source: http://meity.gov.in/content/national-cyber-security-policy-2013-0 (accessed on 30 January 2018)

31 Source: http://meity.gov.in/content/internet-things (accessed on 4 June 2018)

32 Source: http://164.100.47.4/BillsTexts/RSBillTexts/asintroduced/data%20-E.pdf (accessed on 4 June 2018)

Besides the importance of ICT to help India become an **Innovation Economy**, the domestic creation of IP is necessary as it promotes research and innovation and helps to retrieve the cost of technology effectively through viable IP commercialisation. When a country moves towards invention and design of high-end technologies, it becomes necessary to protect the IP rights to own and use the technologies, and to prevent infringement. The government has actively taken steps by introducing IP protection schemes to ease patent filing and promote awareness and adoption of IP rights. While much of these are discussed in Chapter 5, one of the schemes that have been initiated is the Support for International Patent Protection in Electronics & Information Technology (SIP-EIT). Under this scheme, the fees for the facilitators for patents, trademarks or designs, that a startup may file, are borne by the Government to provide financial support to Micro, Small, and Medium-sized Enterprises (MSMEs) and startups.[33] Moreover, in May 2016, the Union Cabinet approved the National Intellectual Property Rights Policy, which aims to present a holistic and predictable IPR regime that stimulates creativity and innovation across sectors, and facilitates a stable, transparent and service-oriented IPR administration in the country.

Thus, the Government of India has taken various steps to help India become an **Innovation Economy**. The next section examines how ICT has been used as a socio-economic driver in India in a range of sectors including health, education, and financial services, among others.

4.4 ICT - Its Socio-Economic Impact

While a number of studies have shown how the growth of the software industry has led to job creation in India (see Sen et al., 2018; NASSCOM, 2018) and how the mobile penetration and reduction in cost has benefited the farmers, small businesses etc. (Kathuria et al., 2009), in recent years, there have been concerns about the impact of ICT and innovation on future of jobs. For these reasons, the government, industry and academic institutes have come together to develop skills in areas such as AI, robotics and machine learning. As technology progresses, there will be demand for specialized skills both in India and abroad and India has the potential of becoming a global supplier of talent in the ICT segment. However, certain skills such as telemarketing or customer support can now be automated. Thus, there is a shift in requirements from low-technology routine jobs to high-technology jobs. Overall, as businesses will adopt digital transformation for improved efficiency and productivity, well paid jobs will be created in this segment.

ICT can be used by businesses to increase efficiency, productivity and global reach. A number of small businesses in India are now selling their products through global e-commerce companies. It can help manufacturers to reduce cost through better processes. ICT can be used to reduce wastage in agriculture supply chain and share information with farmers on inputs. It can help to address a number of socio-economic problems across a wide range of sectors including health, education and sanitation, which in turn can improve the quality of life. It can help government to implement its programmes more efficiently, especially those related to inclusive growth and moving towards a modern India.

Given these benefits, this section presents some of the examples and cases on how ICT is being used or can be used for across various sectors to facilitate inclusive growth and taking India forward towards an **Innovation Economy**.

a. Supporting Government Policies and Initiatives

The Government of India has come up with a unique identification number (Aadhaar) and is trying to link it to bank accounts and other government approved identification numbers such as the Permanent Account Number (PAN). Such initiatives can be successful and efficient through use of ICT. For example, the UK-based digital identity startup "Yoti" has come up with a consumer app which can be downloaded on one's phone and creates one's own identity based on various government approved identities such as Aadhaar card, passport, PAN card, etc. Partnerships of such businesses with government departments both at the Centre and state levels will help in the process of

[33] Source: http://www.ict-ipr.in/sipeit/downloadFile?fileName=Brochure_SIPEIT.pdf (accessed on 4 June 2018)

digitalisation. Consumers and businesses will also benefit as they will no longer be required to physically produce multiple government approved identifications.

b. Using ICT in Smart Cities

A number of studies have shown how ICT can help cities to become smart cities and improve quality of life by facilitating sustainable environments, offering optimised transportation, e-governance, enabling high quality healthcare, improving security and streamlining crisis management responses (Anthopoulos and Vakali, 2012). One of the examples is Geographic Information Systems (GIS), which allow spatial data management for cities with mapping of utilities, services and resources below the ground as well as infrastructure and land-use above the ground. The GIS data can be used for urban planning and online delivery of targeted public services.

c. Using ICT in Transport and Mobility

Telemetry and satellite data is used for traffic management (rerouting cars from busy routes into alternative routes), services like radio-cabs, online maps to find the most efficient routes, smart parking (displaying available spaces), time signaling on traffic lights, and scheduling information of public transport like buses metro and trains.

An interesting example of combining telematics with eco-mobility comes from the Indian company Mahindra and Mahindra Limited which has developed India's first smartphone-controlled car. Using an app, it allows users to track the general performance of this electric car while controlling features like air conditioning.

d. Blockchain Technology for Efficient Financial Transactions

As government is keen on financial inclusion, it is important to improve the banking processes using ICT such as blockchain technology which can help ensure security and transparency, and address the shortcomings of a traditional banking system, including delays caused due to verification by the banks. A number of Indian banks including ICICI Bank, Axis Bank and Kotak Mahindra Bank are in the process of adopting this technology. The technology can be used for a variety of sectors including digital transformation of logistics services, insurance and manufacturing.

e. Help the Farmers and Increase the Productivity of the Agriculture Sector

Indian farmers are adversely impacted by climate change, water scarcity, land degradation, rising input costs and post-harvest losses, to name a few. A number of studies have shown that ICT can help farmers in various ways including agronomical and market information, farm management and planning, and mobile payments and other financial services (Rathore et al., 2016; Patidar et al., 2018).

Farmers need information on inputs, prices, pest control, risk-management, and quality and certification standards. A number of companies are working with farmers in this regard. For example, the German startup, Progressive Environmental and Agricultural Technologies (PEAT), founded in 2015,[34] along with International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad has developed a mobile app called Plantix which contains a large database of pictures of plant diseases which can be used for comparison and diagnosis.[35]

A number of companies are leveraging technology in the area of market linkages such as retail, Business-to-Consumer and Business-to-Business marketplaces and for reducing wastage.

f. Use of ICT in the Social Sector

The Indian government has taken initiatives to promote the use of ICT in social sectors such as health and education. The private sector has partnered in many such initiatives. For example, in 2013, Samsung India Electronics launched a Smart Class initiative in collaboration with Navodaya Vidyalaya Samiti. The initiative is available across 500 Jawahar Navodaya Vidyalaya Schools, benefitting over 2.5 lakh students. The brand has imparted training to over 8,000 teachers on interacting technology.[36]

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[34] Also see http://peat.technology/#aboutus (accessed on 13 April 2018)

[35] Also see https://plantix.net/ (accessed on 13 April 2018)

[36] Source: https://news.samsung.com/in/samsung-india-electronics-expands-its-smart-class-initiative (accessed on 4 June 2018)

In the healthcare sector, the use of ICT has multiple benefits including maintaining records of prior illnesses of patients, easy access to information, better communication among healthcare providers, and interventions to improve quality and safety of healthcare.[37] For example, electronic health records can help providers keep track of patient information.

Some companies are using ICT to help government to address water and sanitation issues, such as using big data for studies on air pollution. Smart Water Services Platform by Capgemini - an off-the-shelf software-as-a-service (SaaS) solution – was created to allow utilities to deploy radio water meters and networks elements.[38] This software is being used in India.

g. Create Startups and Quality Jobs

Inception of startups in India (both domestic and foreign) has shown to help India develop the ICT sector and transform into an **Innovation Economy**. They introduce innovative products, services and new technologies to improve business efficiency in India. For example, Lyra Networks[39] India offers secure digital payments and data services to retailers which have helped improve their business performance and increase efficiency and transparency. The startups also offer digital solutions to facilitate India's transition to a digital economy. According to NASSCOM (2018), the startups in India have contributed significantly to high technology job creation in the organised sector, and an estimated 300,000 new jobs will be created by startups in India by the year 2020.

h. Women Empowerment

ICT plays a key role in women empowerment, and through ICT, women are inculcating a sense of security, awareness, knowledge, employability, equality, and confidence (Arrawatia and Meel, 2012; Rathi, 2015). One of the programmes is "Internet Saathi" which is a digital literacy programme launched by Google in collaboration with Tata Trusts in 2015 to educate rural women about Internet, tools to use it and its benefits.

i. Improve Efficiency of Business

ICT can help small and mid-sized businesses in formal and informal sectors to improve efficiency and productivity and thereby become more competitive. To interact better within and across business and with customers, companies have adopted ICT, which will help to improve not only productivity but also profits.

The above discussion shows that ICT in India has contributed significantly as a socio-economic driver in India, bridging the rural-urban divide, enhancing the performance of sectors such as education, healthcare, and financial services, and generating employment. However, it is important to note that the use, accessibility and affordability of ICT services, along with generating the necessary high technology skills and training the labour force are important factors to consider in a country like India. Moreover, as more and more innovations and new technologies are generated, it becomes important to protect their IPRs and to ensure that the owner of the IP is receiving the desired incentives and remunerations for their innovations.

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[37] Source: https://health.economictimes.indiatimes.com/news/health-it/putting-technology-to-work-in-digital-indias-healthcare-system/45822740 (accessed on 4 June 2018)

[38] Also see https://www.capgemini.com/wp-content/uploads/2017/07/1310_sws_platform_technical_brochure_lr.pdf (accessed on 4 June 2018)

[39] Source: https://www.lyra-network.com/en/ (accessed on 13 April 2018)

5

Role of Intellectual Property Rights (IPRs) in an Innovation Economy

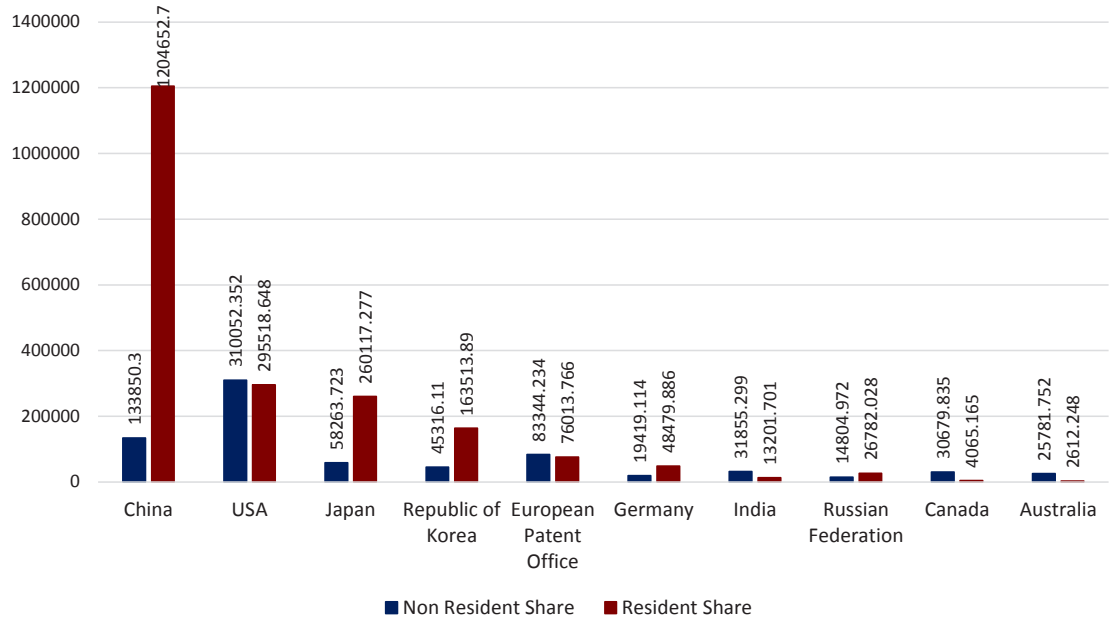
Innovations require a robust IP legal framework. Efficient protection and enforcement of IPRs incentivises the innovators to spend time, money, human resources and infrastructure as they feel confident that their creations will not be copied or illegally used by others. Fortunately, in India, all the IPR laws are in compliance with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the legal framework is well-developed. However, gaps remain as the technology is growing much faster than the legal developments in sectors such as the ICT.

In Chapter 2, it was discussed that IP plays an important role in incentivising industry to create new technology, commercialise their inventions and subsequently increase investment and collaborations. In this chapter, it is discussed how the government support and incentives for creation and commercialisation of inventions in ICT sector and enforcement of IP and IPRs are important prerequisites for India to move towards becoming an **Innovation Economy**.

5.1 Importance of IPR for India

According to the WIPO (2017), global IP filing activity is increasing as the number of patents filed worldwide has augmented by 8.3 per cent from 2015 to 2016. Figure 5.1 provides the number of patent applications at the top 10 offices in 2016 by residents as well as non-residents.

Figure 5.1: Patent Applications Filed at the Top 10 Offices (2016)



Source: Compiled from WIPO (2017)

By looking at the share of specific countries in Figure 5.1, it becomes evident that 42.8 per cent of all patent applications in 2016 were filed at China Patent Office. In the same year, out of these, 96 per cent of the patent applications were filed by Chinese residents, while only 4 per cent were filed by non-residents. However, in India, while the number of patents filed are less than half of those filed in China, at the same time out of the patents filed, around 71 per cent are filed by non-residents. This indicates a lower level of patent filing and a low level of innovation by residents. However, according to the Department for Industrial Policy and Promotion (DIPP, 2018), patent filing increased by 5 per cent in 2017-18 *vis-à-vis* 2016-17.

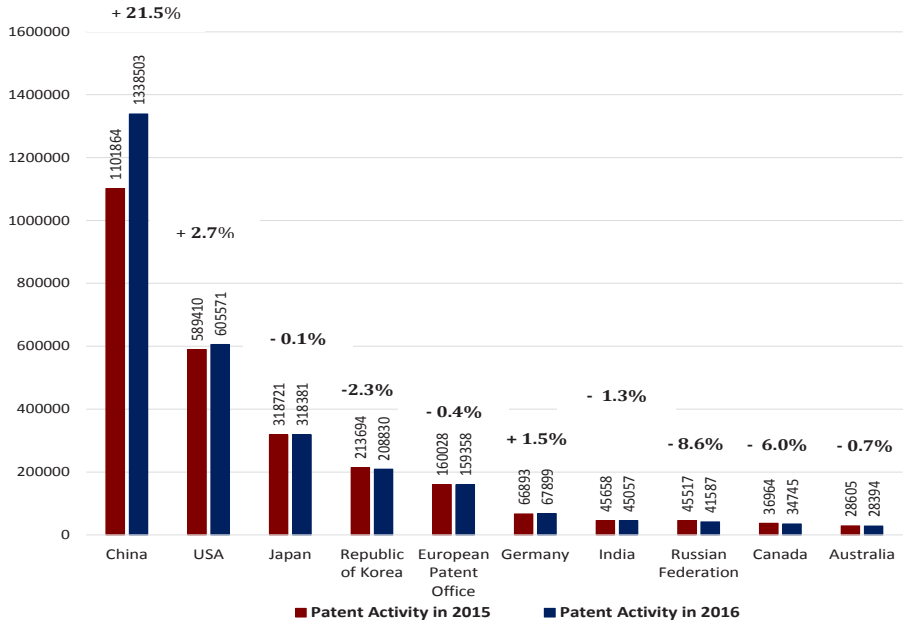
Figure 5.2 shows the growth (or decline) in the patent activity of the top 10 countries' patent offices from 2015 to 2016.

According to WIPO (see Figure 5.2), there has been negative growth of 1.3 per cent in the Indian Patent Office from 2015 to 2016. However, DIPP in 2016-17 recruited 459 technical examiners and the number of examined patents doubled within one year. The recruitment of manpower and the improvement in the infrastructure of Indian Patent Office is expected to reduce the pendency rate and result in higher efficiency.

IPRs are not only a strategic business tool, but also enhance industrial competitiveness (DIPP, 2017). In this regard, IPRs have been acknowledged to be an essential tool to leverage the economic potential that patents hold. A long-term study by Kayalvizhi and Thenmozhi (2017) using panel data from 1996 till 2004 of 22 emerging economies, including India, has shown that the number of patents registered, amongst other factors, can lead to greater FDI inflows. The statistical analysis further revealed that increased technology absorption and innovation capacity increases inward FDI. However, it was pointed out that the effectiveness of the respective legal system and the protection of innovation, i.e. IP, determine the actual flow of FDI into an economy. Another study by OECD (2003) concluded that patent rights have a positive relation with FDI and with trade, though with trade the effect is moderate.

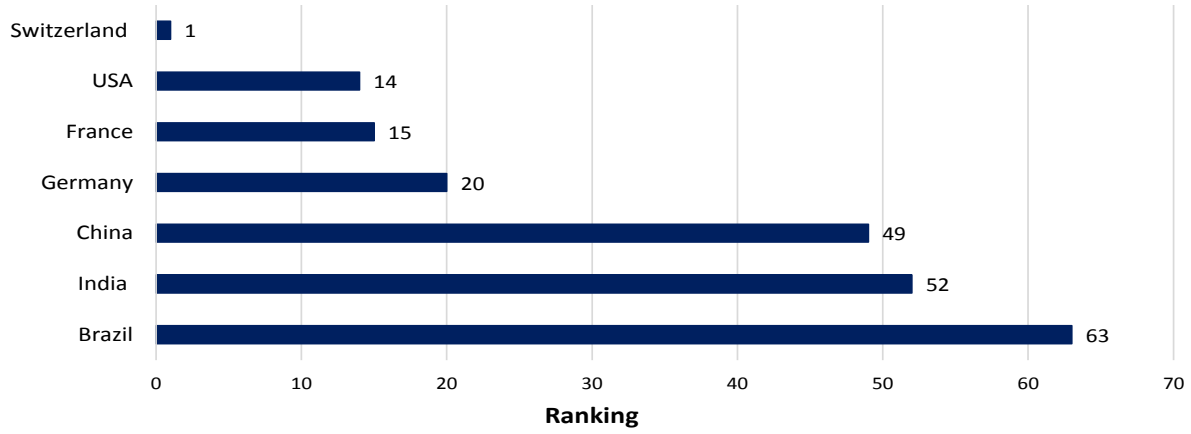
As per the Global Competitiveness Report by the World Economic Forum (2017), in 2017, India ranked 52nd out of 137 countries in the 'Intellectual Property Protection' sub-indicator of the Global Competitiveness Index (see Figure 5.3). This is a matter of concern and the Indian government is taking steps towards improving India's global positioning in IP.

Figure 5.2: Patent Activity of the Top 10 Patent Offices in 2016



Source: Compiled from WIPO (2017)

Figure 5.3: India's rank *vis-à-vis* Select Countries in the 'Intellectual Property Protection' Sub-Indicator (2017)



Source: Compiled from World Economic Forum (2017)

It is thus evident that patents constitute a crucial indicator for an **Innovation Economy**. It thereby becomes crystal clear that an **Innovation Economy** has a positive impact on the investment confidence, and the effectiveness of its IPR is decisive for actual investments. A study by OECD (2003) found that patent rights have a positive relation with FDI and with trade. The empirical data shows that this relationship is conditional on the level of development and the kind of industry as some industries are less affected by IPRs, whereas industries in which easy-to-imitate technologies can be found such as the ICT sector, are more affected by IPRs.

In light of this and acknowledging IPR to be an essential part of the infrastructure for economic growth through increased trade and FDI, NITI Aayog's report on Innovation and Entrepreneurship (2015) highlights the importance of an adequate regulatory framework to promote innovation. It is therein underlined that despite having a very good legal system in India, there is a lack of capacity and gaps in enforcement, and consequently negative impact on the investment confidence of investors and innovators. As a result, various awareness and sensitising programmes have been designed to empower all the stakeholders, namely, the creators and those involved in enforcing laws, including the police, judiciary and the custom authorities at the border.

Given that the review of patent applications may take up to three years, it may outlive the span during which the invention is still considered to be innovative and useful as the technology is evolving at a fast pace (Frakes and Wasserman, 2017). To overcome this, in some countries there are increasing numbers of utility model patents ("petty patents"), which are similar to patents but are for smaller inventions or minor improvement of existing products and have less stringent requirements.[40] With a global growth rate of 28 per cent annually, the implementation of the utility model patent system is often highlighted to be an appropriate solution for improving the innovation performance, presuming to allow for a higher innovation output.[41] The utility model's inventiveness standard is lower, so it can lead to shorter examination periods and thus allow for faster protection for incremental innovation.[42] This topic has been debated in India but as of date, there is no law to protect petty/utility patents.

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[40] Source: http://www.wipo.int/sme/en/ip_business/utility_models/utility_models.htm (accessed on 8 June 2018)

[41] Source: http://www.wipo.int/edocs/infogdocs/en/ipfactsandfigures2017/ (accessed on 8 June 2018)

[42] Source: http://www.wipo.int/sme/en/ip_business/utility_models/utility_models.htm (accessed on 8 June 2018)

Kumar (2002) in his empirical study showed that certain Asian countries that used to be developing economies, for instance Japan, initially had a weak IPR regime and, therefore, adopted a culture of incremental innovation through the utility model system in order to foster local innovation. Once the domestic industry matured, the IPR regime was strengthened, leading to more invention patents. However, it is important to note that at a certain point, the shift towards stricter assessment criteria for patent applications is needed in order to assure a certain level of quality, and hence value of patents, because a utility model patent system can also lead to misuse by counterfeiters (Suthersanen, 2006).

5.2 Government Support for IPR and Innovation

The previous section highlighted the importance of IP for the growth of FDI and GDP of India, as well as how it would help India to become an **Innovation Economy**. Different government departments such as the DIPP and NITI Aayog have also recognised the crucial importance of a robust IP ecosystem. In this regard, the DIPP, which is the nodal department for IPRs, has designed a National IPR Policy, which was adopted by the Union Cabinet on 12 May 2016. This policy lays down the roadmap for India's future in the realm of IPRs and strives to "*…spur creativity and stimulate innovation…*" by establishing an "*…ecosystem in the country conducive to innovation and creativity not only in terms of IP awareness and creation, but also commercialization and enforcement...*".[43]

According to a recent update by the DIPP in 2018,[44] additional IPR initiatives have been put in place already to foster the know-how on and usage of IP in alignment with the objective of the National IPR Policy, 2016 (see Box 5.1).

The Government of India has also launched several initiatives and programmes such as Make in India, Digital India and Startup India, which are interlinked with the vision of the IPR Policy. Make in India strives to transform India into a global design and manufacturing hub - an objective

Box 5.1: Government Policies and Initiatives to Support IP

1. **Strengthening of Institutional Mechanism:**
   - The transfer of the administration of Copyright Act, 1957 and Semiconductor Integrated Circuits Layout-Design Act, 2000 to DIPP has resulted in an integrated approach between various Acts and IP offices. Moreover, for streamlining and simplifying the IPR process and ensuring focused attention on various issues with respect to IPRs, a professional body, namely, the Cell for IPR Promotion and Management (CIPAM) has been created under DIPP with the mandate to increase IPR awareness and foster capacity in IPR commercialisation and enforcement.
2. **Business Process Re-engineering:**
   - To make the process more user friendly and streamlining it, there was an amendment in the Patent Rules, 2003. This has resulted in expediting the process of examination of patents.
3. **Augmentation of Manpower:**
   - In addition to the existing 130 technically competent Patent Examiners, another 459 technically competent Patent Examiners in various fields of technology have been appointed.
   - 59 regular Trademark Examiners have been engaged in addition to existing 63; 84 Trademark Examiners appointed on contractual basis.
4. **IPRs for Startups:**
   - To encourage creativity and innovation, a scheme named Start-ups Intellectual Property Protection has been launched. In this, rebate amounting to 80 per cent is given on the patent filing fees by startups.

[43] Source: http://dipp.nic.in/sites/default/files/National_IPR_Policy_English.pdf (accessed on 8 June 2018)

[44] Source: http://pib.nic.in/newsite/PrintRelease.aspx?relid=179306 (accessed on 8 June 2018)

5. **Dynamic Utility Facilities available on Website of the Office of Controller General of Patents, Designs & Trade Marks (CGPDTM):**
   - CGPDTM has helped in easing business by introducing issuance of electronic patent certificate automatically. SMS service is initiated for the timely update/information with respect to filing.
6. **Creating IPR Awareness:**
   - IPR subject knowledge is being imparted in the course curriculum of class 12th students in their course books.
   - With the help of satellite programmes, awareness programmes are being conducted for reaching the rural areas.
   - Ministry of Home Affairs has issued advisory to all State Police Academies, for incorporating IPR in the curriculum in training for both in-service and regular police officers. Tie-ups between Universities in Uttar Pradesh, Gujarat, Himachal Pradesh and Punjab have been established, and the workshops have also been conducted for the same.
   - To reach out to rural areas, awareness programmes were conducted using satellite communication EduSat. In one such programme, 46 rural schools with over 2,700 students were reached. Total 101 schools and over 7,500 students have been reached.
   - More focus is being given to develop e-content and disseminate content through online channels.
   - Competitions launched in conjunction with industry for school and college students for developing mobile apps, videos and online games.
   - The CIPAM with the DIPP launched a social media campaign in 2017 to promote Indian GIs to make more people aware about the importance of IPR.
7. **Technology and Innovation Support Centres (TISCs):**
   - Between WIPO and DIPP, a Service Level Agreement has been signed for setting up a network of Technology and Innovation Support Centres (TISCs) pan-India.
   - Three TISCs have been established - the first one at Patent Information Centre, Punjab, the second one at Anna University, Chennai and the third one at National Research Development Corporation, Visakhapatnam.

Source: Compiled from DIPP (2018)

for which a robust IPR regime is imperative. Likewise, the success of Digital India and Startup India depends on IPR as they are designed to empower India at a global scale by increasing India's conduciveness for doing business and enhance the digital as well as entrepreneurial infrastructure and innovation capabilities pan-India.

5.3 The Role of Standards

India aspires to be a manufacturing hub as is evident from the government's Make in India initiative. As Indian manufacturers and exporters cater to global markets when they export, it becomes necessary for them to adhere to the standards set by the importing countries or by international standard-setting organisations (SSOs). Importance must be given to standards as global trade is enhanced when standards are aligned. SSOs as well as Standards Developing Organisations play a key role in the implementation of standards.

In the context of patents, globally approved standards not only ensure compatibility and interoperability, but also reduce transaction costs, facilitate market entry, and contribute to the dissemination of new technologies.[45] The support of the Government of India in this regard is required for building awareness and knowledge on standards through courses and trainings at higher educational institutes (Contreras, 2017).

[45] Source: https://www.ip.mpg.de/en/projects/details/standard-essential-patents-and-the-role-of-standard-setting-organizations.html (accessed on 8 June 2018)

In the ICT sector, standards have a great impact on the dynamics of the sector since the innovativeness is constituted by the incremental development of pre-existing technologies (Zingales and Kanevskaia, 2016). Therefore, the Ministry of Electronics and Information Technology, coordinates with international SSOs including European Telecommunications Standards Institute (ETSI), International Telecommunication Union, Institute of Electrical and Electronics Engineers (IEEE) and Internet Engineering Task Force in developing telecommunication standards. Moreover, the Indian government's Bureau of Indian Standards actively engages in standardisation in fourteen industry sectors including ICT. However, the number of Standard Essential Patent (SEP)[46] holders in India is low as is the number of patent holders. But, the number of SEPs in the ICT sector is relatively high as compared to other sectors.

There is scope for increased participation in the development of standards, for which a collaborative standard model with industry, including small and medium enterprises (SMEs), is the prerequisite. SMEs need to be incentivised to participate in SEP activities. The market and negotiation power of the IP owner increases once a certain technology has been defined as a standard (Ghidini and Trabucco, 2018).

With a share of 70 per cent of SEPs globally, declared at the ETSI, Europe is the main developer of key standardised technologies.[47] India is already collaborating with Europe on standards and this can be further strengthened.

5.4 IP Commercialisation: SEPs and FRAND

The successful commercialisation of IP is crucial and is one key objective of the National IPR Policy, 2016 since investments in R&D depend on the financial viability of the IP that is created thereby. It is important to acknowledge that the financial viability of the innovation cycle relies on a market-driven IPR regime, which allows to retrieve the cost of technology through patents (for example, licensing of patents) (Bharadwaj et al., 2018).

The licensing of SEP under fair, reasonable and non-discriminatory terms (FRAND) and transparent and predictable conditions helps to spur the innovation cycle[48] as thereby appropriate royalty fees can be derived, which lead to return of investment pertaining to the development of patents that are essential to standards and state-of-the-art technologies, respectively. The fact that investments in SEPs in network-based industries like ICT, are risky, needs to be underlined and considered when deciding on the value method for determination of royalty base. However, it is important to note that determination of royalty base, for example, in the case of mobile industry, is a matter of dispute, because of the two conflicting views on the same, as given in Box 5.2. As there is no standard procedure to determine FRAND, SEP licensing often leads to disputes and litigation, which hamper widespread use of key standardised technologies and thereby the evolvement of an **Innovation Economy** (European Commission, 2017).

To address the bottlenecks in the current scenario of IP enforcement and litigation the sensitisation and capacity building programmes for key stakeholders and the judiciary can be one way to increase the expertise in SEP and FRAND. The other can be to consider the alternative dispute resolution (ADR) mechanisms especially Arbitration. Arbitration is one form of ADR and offers the advantage of confidentiality and more control over the design of the process to be followed for the settlement of disputes. Further, it assures more neutrality and is faster as well as less expensive than court litigation.[49] The European Commission takes the stand that ADR is generally underexploited, though can provide more efficient dispute resolution (European Commission, 2017). It is therefore recommended to integrate a default ADR clause in Non-Disclosure-Agreements.

The next chapter focuses on the challenges and the following chapter presents the way forward.

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[46] Standard Essential Patent (SEP) is a patent that claims an invention that is essential to comply with a standard. The standardisation has gained significant importance in the telecommunication sector which requires standardised worldwide interoperability between networks, devices and network operators.

[47] Source: https://www.eesc.europa.eu/en/documents/factsheet-standard-essential-patents (accessed on 8 June 2018)

[48] Source: https://www.eesc.europa.eu/sites/default/files/files/factsheet_-_standard_essential_patents.pdf (accessed on 8 June 2018)

[49] Source: http://www.wipo.int/amc/en/ (accessed on 19 June 2018)

Box 5.2: Perspectives on the Royalty Base – Case of the Mobile Industry

SEP is a patent that protects technology which is essential for manufacturing standard compliant product.

- The manufacturer (licensee) can use the SEP only on obtaining a license from the SEP holder (licensor).
- The SEP holder and the manufacturer of the SEP have conflicting views on setting the royalty base for licensing on FRAND terms.
- The manufacturer and some SSOs feel that the SEP holders can abuse their dominant position by imposing exorbitant royalties for the licenses for their SEPs. According to them, using the sale price of the downstream product, as the royalty base is unfair (patent hold-up)
- However, in the ICT sector, high-technology devices like smartphones can comprise of several thousand SEPs. Defining the royalty base based on the "smallest saleable component" would lead to multi-tier licensing models which implies that transaction costs would go up drastically (European Commission, 2017) as the quantity and interdependency of licensing agreements would be increased. As a result, the price of the end device would also augment (Teece and Sherry, 2016)
- Royalties can only be compatible with FRAND terms if they reflect the full-value contribution for the end user (Teece et al., 2017) as the full contribution of the IP only becomes evident through complementarity and network effects when interacting with other components within one device (Sidak, 2015).
- A comprehensive study on the global mobile phone industry (2007-2016) by Galetovic et al. (2018) has assessed the claim that patent ownership may lead to the misuse of market power by means of excessive royalty charges. However, their findings show that out of 39 potential licensors worldwide, only 29 charged royalties amounting to only USD 14.2 billion versus USD 425.1 billion in mobile phone sales resulting in a cumulative royalty yield of 3.3 per cent (2016).
- The Delhi High Court's emerging jurisprudence on royalties for standard-essential patents shows that the retail value of the downstream product evolves to be the appropriate royalty base for multi-component products (Galetovic et al., 2018)

6 Challenges Leading to Scope for India-Europe Collaborations

In this chapter, we discuss some of the challenges of the ICT sector and the IP ecosystem in India and how such challenges can also act as opportunities for European companies to invest in India, bring in technology and grow in this market. A number of these challenges can be addressed through partnerships and collaborations at different levels – government-to-government, business-to-business and between associations and institutions. Indian companies are aggressively going for technology adaptation and this can be an opportunity for European companies and experts to contribute in areas such as DevOps, IoT, and digital transformation.

The challenges in the ICT sector are given in Section 6.1, followed by the challenges in the IP sector.

6.1 Challenges in the ICT Sector

6.1.1 Access to ICT Infrastructure

According to the Global Innovation Index, 2017, India has a low ranking in the ICT infrastructure sub-indicator, which includes individual access to ICT, use of ICT, e-governance penetration, logistics, and online presence of individuals in India. In India, the penetration of technology has been low and there is a lack of connectivity, especially in the remote areas. Given their own saturated market, the European companies can invest in this sector in the fast-growing Indian market.

6.1.2 Quality of Services

There are issues with broadband connectivity and internet connection speed - networks are congested leading to increased data download time and poor coverage (Masson et al., 2016). In a survey conducted by LocalCircles in 2018 with a sample size of 12,000, 56 per cent citizens said that over 20 per cent of their calls drop or don't connect[50], out of which, 31 per cent said the call drops after 30-60 seconds, and 21 per cent said it drops within 30 seconds.[51] In this there is scope for collaboration with European companies, especially startups, to improve the quality of services.

6.1.3 Gaps in Government Policies

While the Government of India has come up with numerous initiatives to support the ICT sector and have allocated funds for the same, there have been gaps in linking the policies with each other, implementing the policies and fund utilisation. For example, while the Make in India policy aims to attract foreign firms to manufacture in India, the Startup India policy is designed only for Indian firms. Authors' discussions with European companies show that one of the key reasons that Make in India initiative has not taken off is because it is delinked with other initiatives such as Startup India. Unlike a number of the EU Member States, China, Israel, Chile and other countries, India does not have any policy (including startup visa) to attract foreign startups. Foreign startups have potential to bring in investment, technology and create jobs. Herein there is scope for India to learn from the experiences of the EU Member States. Focusing on the fund utilisation, out of the 5,200 startups in India (as on December 2017),[52] only 88 startups were eligible for the tax incentives under Startup India initiative between 1 April 2016 and 31 March 2018. In this case, too, there is scope for learning from the EU Member States on how funds can be allocated and utilised to attract startups in innovative and high technology areas.

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[50] A call drop represents the telecom service provider's inability to keep an incoming or outgoing call going.

[51] Source: https://www.localcircles.com/a/press/page/call-drop-issue-in-vodafone-airtel-idea-jio-survey#.Ww_gw0iFPct (accessed on 30 May 2018)

[52] NASSCOM and Zinnov Management Consulting, 2017

6.1.4 Gaps in Government Interactions

While the multiple ministries and departments and multi-layered regulations and approval processes can be a barrier in a quasi-federal structure, one of the key issues which can be resolved by proper use of ICT is the delay in interaction and communications across different government agencies and the quality of the information on the websites. For example, foreign companies send their queries on the Startup India website through an email, which is unstructured data. A team of around 20 people respond to that query. Due to this, it is not simple to get the data on the number of queries raised by a certain type of firms and by the country of origin. The Income Tax Website by contrast collects queries in a partially structured format. Thus, there are variations within the different agencies as to their method of collecting queries, analysing it and responding to it. It is also important to look at the content in the websites. For example, the discussions with Invest India show that only a few foreign startups are using the Startup India Hub portal. This is because the information in the hub is not often useful. For example, the information related to work permit and visas cover all types of work permits and visas including those for tourism and medical purposes, instead of only covering the information needed by foreign entrepreneurs accessing the Hub.

6.1.5 Skill Shortage

In high technology areas such as AI, machine learning, robotics and big data and scientific research, there are skill shortages in India. This is also evident from India's low ranking (64th) in 2017 in the "Human Capital and Research" [53] sub-indicator of the Global Innovation Index. Under the Skill India initiative, such skills can be developed within the country in collaboration with the EU and its Member States.

6.1.6 Investment Risk in IPR

Many large foreign companies set up R&D centres in India due to the cheap labour costs, though the innovation resulting from it is not necessarily registered and/or commercialised in India. This approach might not only be explained by strategic and global business models which require multinational companies to shorten their development cycles by means of multi-country R&D, but could also be linked to legal, financial and strategic risks due to bottlenecks in the enforcement of IPR.

6.1.7 General Data Protection Regulations

At present, India is in the process of designing a robust law for personal data protection and privacy rights, which has now become critical for IT services and how the service providers handle, store and erase data. In this context, India may look at the EU's General Data Protection Regulation [Regulation (EU) 2016/679][54] and there is scope for collaboration.

6.1.8. Trade Deficit and Low Manufacturing of ICT Goods

One of the key issues faced by India is trade deficit in ICT goods. With the rising domestic demand, India needs to create domestic manufacturing capabilities. In this context, there is need for collaboration in R&D. Bilateral initiatives such as the Indo-French Centre for Advanced Research (IFCAR) that has been fostering collaborative research for more than 30 years[55] can help India to create more innovation. To encourage IP-centric research that results in viable business models, an IP Committee has been put in place by IFCAR in 2017 to strengthen the process of commercialisation of IP.

6.2 Challenges with regard to the IP Ecosystem

6.2.1 Lack of R&D and Innovation in the Private Sector

For the last twenty years, India's expenditure on R&D has been stagnant at 0.63 per cent of its GDP[56]. For India to become an **Innovation Economy**, not only the financial means for R&D have to be increased, but also the way that R&D is done needs to be changed. Developed and innovative economies like Germany and the US are proof that R&D in and by the private sector can catalyse the innovation performance.

6.2.2 Lack of IP Protection: Computer Related Inventions (CRI)

In India, patents are not awarded to computer programme,

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[53] This sub-indicator compares countries based on their human capital, including tertiary education, and research and development. Source: https://www.globalinnovationindex.org/analysis-indicator (accessed on 7 June 2018)

[54] Source: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0679&from=EN (accessed on 7 June 2018)

[55] Source: http://www.cefipra.org/About_the_Centre.aspx (accessed on 19 June 2018)

[56] Source: https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS (accessed on 19 June 2018)

which is currently protected under copyright. However, any computer software related invention which has a technical implication and is a part of a hardware system is patentable.

Once an entity develops a technology and expands the ICT base, it becomes necessary to protect the IPRs in order to promote innovation and to ensure that the IP owners are provided with fair prices for their technology. Indian industry associations have raised concerns regarding the 2016 CRI guidelines that has put a blanket ban on patenting of CRIs unless a 'novel hardware' is also invented.[57] Non-patentability can also affect innovation by the startups and can hinder investments in the ICT sector.

6.2.3 Low Level of Patent Applications Filed

India's patent filings are less compared to other developed and developing countries (see Chapter 5), especially for domestic innovators. Further there are delays in granting of patents - currently it takes 4 to 6 years from filing of an application to grant of patent.[58] With increase in number of patent applications there is an increase in the number of pending applications. India's volume of pending applications in 2016 was 2.4 times higher than the level recorded in 2010.[59] The application review process might be delayed due to lack of manpower. However, as indicated in Chapter 5, the DIPP has put in place a comprehensive set of IPR initiatives that aim to tackle the lack of efficiency through increased manpower, capacity building and training of examiners, and advanced infrastructure.

A way to increase patent fillings can be through greater collaboration between Indian Patent Office and other leading IP offices of the world such as EPO through sharing of data and information. The inclusion of the Indian patent data in the EPO's patent family service may help India to become a part of the global patent system. Data exchange will lead to the exchange of best practices enabling the assurance of a high global patent standard, foster increased investments especially in innovative technologies, as well as help to reduce pendency times at patent offices.

6.2.4 Bottleneck in IP Commercialisation

As discussed in Chapter 5, the commercialisation of SEPs can cause a bottleneck due to two different approaches towards defining a royalty base at FRAND terms. If the particularities of the ICT sector are not being taken into account adequately when deciding on one approach, incremental innovation and standard development might be hindered. However, the latter are key drivers of the ICT sector. The example of the updated IPR policy (March 2015) by the IEEE, a major US-based SSO, showcases adverse effects of setting the "smallest saleable component" as the royalty base. Most prominently, by this approach the royalty fee excludes any value attributable to the standard which endangers the collaborative standard setting model (Teece and Sherry, 2016). A collaborative model is crucial for a pro-competitive innovation culture that is accessible to a diverse range of innovators, especially smaller players, who depend more on a financially viable technology cost retrieving mechanism. Additionally, value synergies that result from the interaction of the complex array of patents cannot be captured. This, in return, also implies that transaction costs would go up drastically (European Commission, 2017) as the quantity and interdependency of licensing agreements would be increased. As a result, the price of the end device would also augment. This step by the IEEE resulted in an 83 per cent decline in the average supply rate of non-duplicate Letter of Assurances to IEEE standard development activities (Teece and Sherry, 2016) indicating a halt of incremental innovation.

6.2.5 Licensing Disputes Related to SEPs

As outlined in the point above, the commercialisation of IP can cause disputes since the approach towards setting the royalty rate varies. By acknowledging the contribution by a patent to a standard, the value of such patent depends on its interaction with a multitude of other components.

6.2.6 Issues Related to Enforcement and Legal Procedures

Despite several counter measures, for instance putting in place more commercial courts for faster prosecution, the enforcement of the IPR in India remains to constitute a challenge for both domestic and foreign companies. The courts can take years to come to a final decision, and sometimes the payouts received by the IP owner are low (see Branstetter, 2017).

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[57] Source: http://assocham.org/newsdetail.php?id=6279 (accessed on 5 June 2018)

[58] Source: http://www.ipindia.nic.in/faq-patents.htm (accessed on 7 June 2018)

[59] Source: http://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2017.pdf (accessed on 19 June 2018)

7

Way Forward

As India gets ready to become an **Innovation Economy** supported by skilled workforce, adaptation of technology and favourable government policies and initiatives, this white paper highlights the role of ICT and IP in the process. It also identifies how Europe can contribute in India's journey towards an **Innovation Economy**. There are a few roadblocks in India's journey towards an **Innovation Economy**, which can be addressed through right policies and initiatives, a ten-year planned strategy, collaboration with its trading partners such as the EU and its Member States and sharing of knowledge and best practices among institutions and businesses.

7.1 Task Force on Innovation Economy

To begin with, the government may set up a Task Force on **Innovation Economy**, which will include policymakers, investment agencies, non-governmental organisations, academicians, experts, and sectoral committees of Indian and foreign businesses. This Task Force can lay out the short term (5 years) and long term (10 years) plans and strategy for moving towards an **Innovation Economy**. The Task Force will not only provide solution to issues raised in this report but would also address broader issues such as future of work, and how skills have to be developed to meet the future needs.

7.2 Addressing Infrastructural Gaps

7.2.1 Access to Quality ICT Infrastructure

One of the key issues identified in the white paper is that while funds are underutilised, there are infrastructure and access gaps. There are also issues with quality of services. Funds have to be carefully allocated and activities have to be monitored with strict timelines so that projects reach their targets. There has to be more synergies across different government policies and initiatives for which ICT solutions can be considered. For example, the Make in India initiative can be linked with the Startup India initiative and the latter can have provisions/revised guidelines to attract foreign startups.

7.2.2 Building Conducive Environment for Startups

Startups and innovation in ICT will be key drivers of an **Innovation Economy**. The government, therefore, may support the growth of both Indian and foreign startups. A number of EU Member States have come up with policies to attract foreign startups and innovators and India may examine such best practices. Initiatives like Startup Europe India under the Agenda 2020[60] can be instrumental to overcome policy gaps and co-create an ecosystem that helps both Indian and European ICT startups in their growth, investment, market expansion, and innovation strategy.

Participation in government projects will help innovative firms to scale up. The government incentives given to industry should be aligned with its international commitments in the WTO and other bilateral/regional agreements, so that the industry benefits from such incentives.

7.2.3 Promotion of Interdisciplinary Research

Given that ICT is permeating various industries, it is important to fund research studies on ICT and its usage across sectors to improve productivity and efficiency of

[60] Source: https://startupeuropeindia.net/ (accessed on 19 June 2018)

manufacturing, services and agriculture sectors. Usage of technology such as AI, digital transformation and machine learning in sectors such as manufacturing, healthcare and banking can be supported by promoting interdisciplinary research covering subjects such as economics, engineering, sociology and medicines. To support such initiatives, the government and private sector may fund chairs in research institutes working closely with policymakers, businesses, academics, international organisations and foreign governments. Funding may also be given for cross-country research collaborations.

7.3 Strengthening the IP Ecosystem

7.3.1 Monetisation of IP through Market-Driven Approach

Policies consistent with global best practices in areas such as data protection and IP protection will enable the fast-track journey into an **Innovation Economy**. The IPR-related policies of the country should be such that they are attractive to both the SEP holders as well as the SEP implementers. This would also be imperative as it would encourage local investment in developing new technologies and thus in achieving the objectives of the key government initiatives like Make in India. Hence, licensing models may be agreed upon at FRAND terms without any legislative interference. Only when the development of patents that are essential for standards is financially viable, a process of incremental innovation can succeed. The latter needs to be accessible to smaller companies, too, in order to diversify the competitive landscape in fast-growing sector like the ICT sector.

As a result of a public consultation held by the IPO related to issues on working of patents under the Patents Act, 1970, it has been highlighted that the annual submission of Form 27, which also entails a reporting obligation, might be suitable for certain industries, such as pharma or healthcare, though not practical and relevant for the ICT sector as it causes an administrative bottleneck. In this regard, the direct impact of the IPR regime on the ease of doing business and influence on the flourishing of ICT-centric initiatives like Digital India and Startup India has been underlined.[61] In this context, India may look into European best practices and customise it to the need of the ICT sector.

In the telecommunications sector, it is important to monetise IP for increased innovation. As the internet penetration and infrastructure is not capable to assure satisfactory connectivity pan-India, more investments in the mobile network infrastructure are required. The investment of the private sector in innovation in this sector has to be incentivised by following a market-driven commercialisation approach.

7.3.2 Co-Creating Global Standards in ICT

Acknowledging the need for developing and co-creating global standards in ICT, it is of utmost importance to establish financially viable innovation models by recognising the end device's value (downstream approach) as the adequate way to define the royalty base. In case of any dispute, alternate dispute resolution mechanism such as Arbitration may be considered.

The government can work jointly with investment agencies, industries and think-tanks and in partnership with the policymakers and industry to promote IP commercialisation as has been done in Europe. This will incentivise individuals and companies in acquiring patents not as protective measures alone but also as business assets.

The SSOs in India may work in close coordination with SSOs such as ETSI and other international and domestic agencies so that necessary standards are achieved through learning from global best practices.

7.3.3 Increasing the Number of Patent Filings through more R&D

To promote filing of patent applications, Indian government is already focusing on investing more into human capital and R&D activities. Industries can also be encouraged to invest in innovations, open accelerators and incubators. Delays in patent filing due to infrastructure bottlenecks need to be addressed through increased computerisation,

[61] Source: https://www.vantageasia.com/uspto-tell-india-scrap-form-27/ (accessed on 20 June 2018)

electronic payments system and IT-enabled processing. More manpower recruitment is necessary in the position of examiners and controllers in order to process the pending patent applications and clearing the backlogs.

Public bodies at the Centre, state and local levels need to spend more on research and innovation to pave the way for increased cooperation with the private sector. For example, at the city level, municipalities can help to set up incubators and accelerators. Private sectors can be encouraged to invest in research and innovation through lower corporate taxes and incentives for R&D. There is need for research to identify the right incentive models that will encourage private investment in R&D. In this context, India may look at European best practices and design a policy that meets the domestic requirements.

7.3.4 Capacity Building

It is important to do a study on mapping of skill gaps with industry requirements and availability at institutes offering relevant courses. This will enable to design the skill development policy to meet the needs of the technology driven ICT sector. Further, it is also important to identify the infrastructure (accelerator, incubators, etc.) gaps. As companies adopt digital transformation, workforce has to be trained to align to such requirements. Training modules in areas such as blockchains, case studies on use of AI and machine learning will be useful.

Patent-centric innovation has to be encouraged as early as possible. School trainings and programmes at higher educational institutes could be a first step towards a more IP conscious business culture.

7.3.5 IPR Enforcement

The government, judiciary and other administrative bodies should take collective steps in ensuring proper enforcement of the IP laws. The enforcement authorities should take swift and stringent measures against IPR infringement. At the same time, the sensitisation of enforcement agencies such as the judiciary, police, and customs is crucial. More commercial courts with specialised IPR cells could be a useful initiative. There can be more sharing of information and cooperation with the relevant European agencies. The judicial process needs to be accelerated through the formation of fast track courts which can handle the prosecutions related to infringement of IP laws.

If these measures are implemented, it will improve India's ranking in global cross-country comparative indices and enable the country to leapfrog into an **Innovation Economy**.

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Appendix A

Table A1: Select Programmes under Make in India

Programmes	Description
Broadband Highways	Under this programme, high–speed broadband coverage highways will connect 250,000 villages, various government departments, universities, etc. In addition, National Information Infrastructure will ensure the integration of the network and cloud infrastructure within the country to provide high-speed connectivity to various government departments.
Universal Access to Mobile Connectivity	Today, there exist around 55,619 villages in India that have no mobile coverage. To cover remote villages in the northeast, a comprehensive development plan has been initiated that will be carried out in phases
Public Internet Access Programme	The underlying principle of this initiative is to make 250,000 Common Service Centres operational at the gram Panchayat level for delivery of government services. In a similar move, 150,000 post offices will be converted into multi-service centres.
E-governance: Reforming Government through Technology	The idea is to use business process re-engineering to transform government processes and make them simple, automated and efficient. Under this, forms will be simplified and only minimum and necessary information will be collected. Similarly, there will be a tracking process for the status of online applications. To further simplify the process, use of online repositories for certificates, educational degrees, identity documents will be encouraged so that these documents do not have to be submitted in the physical form.
Ekranti - Electronic Delivery of Services	This pillar emphasises on the use of technology for service delivery such as e-education, e-healthcare, technology for planning, final inclusion, etc.
Electronics Manufacturing	Under this programme, the target is to reach net zero imports by 2020 through implementation in areas such as taxation, economies of scale, skill development, government procurement, etc.
IT for Jobs	This step will provide the required skills and training to enable youth to find jobs in the IT/ITes sector. This component also emphasises on the setting up of business process outsourcing to enable ICT-enabled growth.

Source: Extracted from http://www.makeinindia.com/article/-/v/digital-india-transforming-india-into-a-knowledge-economy (accessed on 4 June 2018)

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