

**A STUDY OF INTELLECTUAL PROPERTY RIGHTS IN
RELATION TO INDUSTRY STANDARDS IN INDIA**

YASHAWANT DEV PANWAR



**DEPARTMENT OF MANAGEMENT STUDIES
INDIAN INSTITUTE OF TECHNOLOGY DELHI
NEW DELHI - 110016, INDIA**

OCTOBER 2019

© Indian Institute of Technology Delhi (IITD), New Delhi, 2019

A STUDY OF INTELLECTUAL PROPERTY RIGHTS IN RELATION TO INDUSTRY STANDARDS IN INDIA

by

YASHAWANT DEV PANWAR

Department of Management Studies

Submitted

**in fulfillment of the requirements of the degree of Doctor of Philosophy
to the**



INDIAN INSTITUTE OF TECHNOLOGY DELHI

NEW DELHI - 110016, INDIA

OCTOBER 2019

CERTIFICATE

The thesis entitled “**A Study of Intellectual Property Rights in Relation to Industry Standards in India**”, being submitted by Mr. Yashawant Dev Panwar to the Indian Institute of Technology Delhi for the award of the degree of DOCTOR OF PHILOSOPHY (Ph.D.) is a record of bonafide research work carried out by him under our guidance and supervision. He has fulfilled the requirements for the submission of the thesis which has attained the standard as required for a Ph.D. degree of the Institute. The results presented in this thesis have not been submitted elsewhere for award of any other degree or diploma.

(Dr. P. Vigneswara Ilavarasan)

Associate Professor

Department of Management Studies

Indian Institute of Technology Delhi

(Dr. Sudhir K. Jain)

Adjunct Professor

Department of Management Studies

Indian Institute of Technology Delhi

ACKNOWLEDGEMENTS

I express my gratitude and deep reverence for my supervisor Prof. Sudhir K. Jain, who attracted me towards the academics and followed by induction into IITD. I am grateful to Dr. P. Vigneswara Ilavarasan for joining this journey and supporting this research work. Their guidance to mould my IP experience in to formal and systematic reasoning and questioning the system enabled me to conceive and conduct academic research to address practical problems. I am blessed enough to get Prof. Jain's time and guidance despite his busy academic and administrative responsibilities earlier as Head of the Department of Management Studies, IIT Delhi and later as Vice-Chancellor, Shri Mata Vaishno Devi University, Katra (J&K) for over 3 years. I am also thankful to my Co-supervisor Prof. Vigneswara Ilavarasan who always supported and facilitated all my endeavours towards this research work. I am rare fortunate to have third co-supervisor for short stint Dr Ruchi Sharma, who left IIT Delhi to rejoin IIT Indore. I thankfully acknowledge her contribution in making me understand some critical concepts of economics very pertinent to this research work during detailed discussion on research problems. I extend my regards and thank the Student Research Committee (SRC) Chairperson Prof. Surendra S. Yadav and Members Prof Archana Chug and Prof Mahim Sagar for helping me in improving my work by giving valuable suggestions at various stages of my thesis work.

My journey of doctoral research has been a mixed sense of joy, excitement, deep thinking, directed application of mind and leveraging experience. It also resulted in periodic cycle of inflicting pain to family and self which resulted in producing glue from those cuts to keep glued us together and finding time to pursue their interest due to time vacuum created by my engagement in this activity.

I express my owings to Shri R Saha former Director Patent Facilitating Centre (PFC), TIFAC and Former Adviser, Department of Science & Technology, Government of India; who infused IP thinking in my mind and provided opportunity to gain enough fuel to take such flight on IP furtherance. I also thankfully acknowledge the ever encouraging support from Prof Prabhat Ranjan who was most of the time of this journey was my boss and mentor who pushed me to this work and stretched away from this to take care of my work at TIFAC in very balanced manner. My introduction and indulgence in IP started as long as 23 years back and has traversed through various

phases and got a chance to acquire knowledge and ability to think IP but at IIT Delhi, with the chance to pursue doctoral studies, I learnt how to apply that knowledge in furtherance of knowledge. I am deeply humbled and really feel privileged to be a part of the prestigious institute IIT Delhi and its Department of Management Studies, where I got the opportunity to enroll and pursue higher studies. I enjoyed the academic freedom which gave me the opportunity for self-learning through challenges faced at the time of data procurement and response generation. I also extend my due regards to all the respected professors of DMS notably Prof M P Gupta, Prof. Mahim Sagar, Prof. Kanika T. Bhal, Prof. Seema Sharma, for the enrichment through the coursework and other interaction. I also put on record forthcoming support from all staff members at DMS at all stages including class work, lab work, library reading and administrative work. I would like to thank each person who was a part of this journey and whom I might miss inadvertently.

Despite being old timer and part timer, I believe got along well with my fellow research scholars former and current (Dr Koteswar Rao Naik, Dr. Muqbil Burhan, Dr Nalin Jain, Dr. Deepali and Rishi Kant) who actually made me comfortable being a student again without any barrier. I extend my very special thanks to my fellow scholar Dr. Vinita Krishna who was of a great help in shaping up my Ph.D. project, with her regular inputs and feedback. I am thankful to Prof. B S Nagi for his indulgence with me on research methods time to time. I would like to thank for the support from the staff of administrative sections, computer services center and library. Additionally, I would like to thank my team at TIFAC namely Ms Sangeeta Nagar, Dr Aruna, Ms Dipti, Mr Deepak who offered me all possible assistance.

I am indebted to my wife Ms Sangeeta Panwar son Mr. Deepak Dev Panwar and daughter Ms Toshita Panwar for accepting my absence from home in late evenings and holidays many times during the past several years. I would also like to put on record gratefulness to my parents, inlaws and all nitted family members who always encouraged this pursuit of higher academic endeavour.

(Yashawant Dev Panwar)

ABSTRACT

In recent years, a variety of IP issues have emerged globally due to the changing nature of world trade, especially progress of Information and Communication Technologies (ICTs) and other standard driven development of products and services. Industry standard which is protected through IPR has greater economic significance in comparison to not protected under IPR. Both these industry standards and IPR make a deadly combination and influence the economy as doubly protected regime; takes the monopoly to the next level. There has been several disputes in India and worldwide relating infringement patent which are essential to standard. As an Indian we are exposed to various Industry Standards in our life like ISI, Agmark, Woolmark, BS-VI etc which are regulated by agencies responsible. In India there are more than 50 standard monitoring and certification organisations working under various ministries. They partially play a role of standard developing organisation as they need to notify the product standard with specification.

After observing these issues; and exploring literature it was revealed that export-oriented products get more standardised and patents issues are playing important role (Blind 2004). He further defined the Economic Benefits of Standards for Innovation within the framework of three functions; first Incentive Function second Diffusion Function and third Coordination Function, and a case of dispute in India with regards to Gas Cylinder further attracted towards exploring and pursuing the research in the area.

The objective of the study is to analyze process of standard setting in view of protected or to be protected IPR/patents in India and to assess the extent of patent protection with respect to allowing standards set by foreign organization to become part of Indian standards system through various international instruments and obligations. Briefly, the main objectives of the present study are. (i) To study the landscape of standards, patents and other IPRs in India along with IPR policies of standard setting organizations in India, (ii) To study the declaration of Standard Essential Patents (SEP) at select SSO worldwide and inflow of those standards and patents in India, (iii) To study the perception of Indian IP professionals with respect to IPRs vis-à-vis standards

and (iv) Case studies of how IP issues are addressed in standard development in India on (a) India specific 5G standard (b) Gas cylinder.

The research framework is designed around the area of Industry Standards and IPR. It examines various aspects of patents and their interplay with standards. Study analyses industry specific role of patents in standards, possible interplay of other IPRs with standards, IP policy role, standard policy and implementation, Indian scenario and strategies to manage patents in standards and perception of IPR experts in India with regards to subject of research. Further, the central issue of investigation for the purpose of this research is to make a landscape of prevailing scenario in India vis-a-vis outside the country with regards to setting standards and handling IP issues emerging from setting up the mechanism for implementation of those standards. Additionally, to map the perception of main support pillar, IPR professionals, who assist industry and patent holders in India on IPR, patents and standards a survey was conducted. Survey instruments was designed for IP professionals in India. Respondents were IP experts from all sectors viz; Patent Agents and Patent Attorneys, IPR Cell In-charge at academics, R&D Institutions and Industry, officials at Patent Offices and state Patent Information Centres.

It was found that Indian Standard developing bodies are staying away from IPR specially patents, thus may result in technology standards of general nature which are based on non-patented technologies. If Indian technologies have to find place in this evolving regime of standard based development, Indian firms and R&D organization will have to take their patents and innovations to standard setting organization. They will have to negotiate a place in standards, else efforts of inventing will not bear any fruit and they will have to stay away from market. This observation is based on the fact that none of Indian firms not finding place in top 20 companies who declared Indian patents as standard essential patents at SSO outside India. It appears very difficult for inventions to traverse through synchronized web of standards and patents to see the market. Whereas foreign firms such as Qualcomm occupies major space in landscape of SEP owners who file patents in India and has largest portfolio of patents in communication technologies 834 patents far ahead of runner-up Samsung 338 patents.

The eco system evolves by constructive efforts of all stakeholders. In India patent and standards system works in isolation. As the government is the main driving force behind any sustainable eco system in any country. The three major role of the government perceived by responded are, (a) To formulate and implement IPR policies for standard bodies under government control such as BIS, FSSAI, BEE etc. (b) Ensuring access to patents part of standards, and (c) Making framework and guidelines for adopting international standards as such.

Patent was found most relevant IP which has interplay with standards in all 18 technical field selected for study. Three other IP namely copyright, design, Trademarks also found reasonable association with standards. However, plant variety found association in some select technical field. Life of Industry Standards for ICT related field perceived was between 6-10 years and in all other 11 field it was 11-15 years. Two business activities importing and assembling components were found to be facing maximum difficulties if they are covered by SEPs.

High to very high impact of patents has been perceived by IP professionals relating to product evolution itself, increasing performance of the product, increases interoperability and making product more globalized. Only two function of patents observed to be affecting each the holder of patents and users of standards negatively. Monopoly rights conferred by grant of patent considered major roadblock for users of standards. On strategy front there is only strategy which faces big no is rejecting portfolio licensing. Two top strategies for success and sustainability of standards for each type of stakeholder as an outcome of survey are identified separately.

The area of concern emerged in the case study of India specific 5G standards was none of the firms irrespective of the origin as Indian or foreign have declared Indian patents at TSDSI. All foreign patents have been declared, so the situation is opaque with regards to the status of protection of those inventions in India through patents. In area of gas cylinder not much of entanglement of patents and standards observed in data analysis. Study in all drawn landscape of IP and standards along with case studies and developed a perspective of plausible IP management specifically patent management in handling standard setting and implementing the standards.

सार

हाल के वर्षों में, विश्व व्यापार की बदलती प्रकृति, विशेष रूप से सूचना और संचार प्रौद्योगिकी (आईसीटी) की प्रगति और उत्पादों और सेवाओं के अन्य मानक संचालित विकास के कारण विभिन्न प्रकार के आईपी मुद्दे विश्व स्तर पर उभरे हैं। आईपीआर के माध्यम से संरक्षित नहीं किए जाने की तुलना में उद्योग मानक जो आईपीआर के माध्यम से संरक्षित हैं, का आर्थिक महत्व अधिक है। ये दोनों उद्योग मानक और आईपीआर एक घातक संयोजन बनाते हैं और अर्थव्यवस्था को दोगुना संरक्षित शासन के रूप में प्रभावित करते हैं; एकाधिकार को अगले स्तर पर ले जाता है। भारत और दुनिया भर में पेटेंट के उल्लंघन से संबंधित कई विवाद हुए हैं। एक भारतीय के रूप में हम अपने जीवन के विभिन्न उद्योग मानकों जैसे कि आईएसआई, एगमार्क, वूलमार्क, बीएस- VI इत्यादि के संपर्क में हैं, जिन्हें जिम्मेदार एजेंसियों द्वारा नियंत्रित किया जाता है। भारत में विभिन्न मंत्रालयों के तहत 50 से अधिक मानक निगरानी और प्रमाणन संगठन काम कर रहे हैं। वे आंशिक रूप से मानक विकासशील संगठन की भूमिका निभाते हैं क्योंकि उन्हें विनिर्देश के साथ उत्पाद मानक को सूचित करने की आवश्यकता होती है।

इन मुद्दों को देखने के बाद; और यह पता चला है कि निर्यात उन्मुख उत्पाद अधिक मानकीकृत हैं और पेटेंट मुद्दे महत्वपूर्ण भूमिका निभा रहे हैं (ब्लाइंड 2004)। उन्होंने तीन कार्यों के ढांचे के भीतर नवाचार के लिए मानकों के आर्थिक लाभ को परिभाषित किया; पहला इंसेंटिव फंक्शन दूसरा डिफ्यूजन फंक्शन और तीसरा कोऑर्डिनेशन फंक्शन, और गैस सिलिंडर के संबंध में भारत में विवाद का एक मामला जो इस क्षेत्र में अनुसंधान को आगे बढ़ाने की ओर आकर्षित किया।

अध्ययन का उद्देश्य भारत में संरक्षित या नहीं संरक्षित आईपीआर / पेटेंट के मद्देनजर मानक सेटिंग की प्रक्रिया का विश्लेषण करना है और विदेशी संगठन द्वारा भारतीय मानक प्रणाली का हिस्सा बनने के लिए निर्धारित मानकों के संबंध में पेटेंट संरक्षण की सीमा का आकलन करना है। विभिन्न अंतरराष्ट्रीय उपकरणों और दायित्वों। संक्षेप में, वर्तमान अध्ययन के मुख्य उद्देश्य हैं। (i) भारत में मानक सेटिंग संगठनों की आईपीआर नीतियों के साथ-साथ भारत में मानकों, पेटेंट और अन्य आईपीआर के परिदृश्य का अध्ययन करने के लिए, (ii) दुनिया भर के चुनिंदा एसएसओ में मानक आवश्यक पेटेंट (एसईपी) की घोषणा का अध्ययन करने और उन मानकों की आमद और भारत में पेटेंट, (iii) आईपीआर के संबंध में भारतीय आईपी पेशेवरों की धारणा का

अध्ययन करने के लिए एक मानक और (iv) भारत में मानक विकास में आईपी मुद्दों को कैसे संबोधित किया जाता है, इस पर केस अध्ययन मानक (बी) गैस सिलेंडर।

अनुसंधान ढांचा उद्योग मानकों और आईपीआर के क्षेत्र के आसपास बनाया गया है। यह मानकों के साथ पेटेंट और उनके परस्पर क्रिया के विभिन्न पहलुओं की जांच करता है। अध्ययन में मानकों का पेटेंट उद्योग की विशिष्ट भूमिका, मानकों के साथ अन्य आईपीआर के संभावित परस्पर क्रिया, आईपी नीति की भूमिका, मानक नीति और कार्यान्वयन, भारतीय परिदृश्य और रणनीतियों में मानकों का प्रबंधन करने के लिए रणनीति और अनुसंधान के विषय के संबंध में भारत में आईपीआर विशेषज्ञों की धारणा का विश्लेषण किया गया है। इसके अलावा, इस शोध के उद्देश्य के लिए जांच का केंद्रीय मुद्दा भारत में देश के बाहर प्रचलित परिदृश्य का परिदृश्य बनाना है, जिसमें मानकों को स्थापित करने और उन के कार्यान्वयन के लिए तंत्र स्थापित करने से उभरने वाले आईपी मुद्दों को संभालने के संबंध में देश के बाहर परिदृश्य है। मानकों। इसके अतिरिक्त, मुख्य सपोर्ट पिलर, आईपीआर पेशेवरों की धारणा को मानचित्रित करने के लिए, जो आईपीआर पर भारत में उद्योग और पेटेंट धारकों की सहायता करते हैं, पेटेंट और मानकों का सर्वेक्षण किया गया था। सर्वेक्षण उपकरणों को भारत में आईपी पेशेवरों के लिए डिज़ाइन किया गया था। उत्तरदाता सभी क्षेत्रों के आईपी विशेषज्ञ थे; पेटेंट एजेंट और पेटेंट अटॉर्नी, शिक्षाविदों, अनुसंधान एवं विकास संस्थानों और उद्योग, पेटेंट कार्यालयों और राज्य पेटेंट सूचना केंद्रों के अधिकारियों में आईपीआर प्रकोष्ठ प्रभारी।

यह पाया गया कि भारतीय मानक विकासशील निकाय आईपीआर विशेष रूप से पेटेंट से दूर रह रहे हैं, इस प्रकार सामान्य प्रकृति के प्रौद्योगिकी मानकों का परिणाम हो सकता है जो गैर-पेटेंट प्रौद्योगिकियों पर आधारित हैं। अगर भारतीय प्रौद्योगिकियों को मानक आधारित विकास के इस विकसित शासन में जगह मिलनी है, तो भारतीय फर्मों और अनुसंधान एवं विकास संगठन को अपने पेटेंट और नवाचारों को मानक सेटिंग संगठन में ले जाना होगा। उन्हें मानकों में एक स्थान पर बातचीत करनी होगी, और आविष्कार के प्रयास किसी भी फल को सहन नहीं करेंगे और उन्हें बाजार से दूर रहना होगा। यह अवलोकन इस तथ्य पर आधारित है कि भारतीय फर्मों में से कोई भी शीर्ष 20 कंपनियों में जगह नहीं पा रही है जिन्होंने भारतीय पेटेंट को भारत के बाहर एसएसओ में मानक आवश्यक पेटेंट (एसईपी) घोषित किया है। बाजार को देखने के लिए मानकों और पेटेंट की सिंक्रनाइज़ वेब के माध्यम से खोज करना बहुत मुश्किल है। जबकि क्वालकॉम जैसी विदेशी फर्म एसईपी मालिकों के परिदृश्य में प्रमुख स्थान

रखती हैं, जो भारत में पेटेंट फाइल करते हैं और उनके पास रनर-अप सैमसंग 338 पेटेंट के मुकाबले 834 पेटेंट संचार प्रौद्योगिकियों में पेटेंट का सबसे बड़ा पोर्टफोलियो है।

सभी हितधारकों के रचनात्मक प्रयासों से पर्यावरण प्रणाली विकसित होती है। भारत में पेटेंट और मानक प्रणाली अलगाव में काम करती है। जैसा कि सरकार किसी भी देश में स्थायी ईको सिस्टम के पीछे मुख्य प्रेरक शक्ति है। सरकार द्वारा दी गई तीन मुख्य भूमिकाएँ हैं, (क) सरकार के नियंत्रण में मानक निकायों जैसे बीआईएस, एफएसएसआई, बीईई आदि के लिए आईपीआर नीतियां तैयार करना और उन्हें लागू करना (बी) मानकों के हिस्से तक पेटेंट सुनिश्चित करना और अंतरराष्ट्रीय मानकों को अपनाने के लिए रूपरेखा और दिशानिर्देश बनाना।

पेटेंट को सबसे अधिक भरोसेमंद आईपी पाया गया जो कि अध्ययन के लिए चुने गए सभी 18 तकनीकी क्षेत्रों में मानकों के साथ परस्पर क्रिया करता है। तीन अन्य आईपी अर्थात् कॉपीराइट, डिजाइन, ट्रेडमार्क को भी मानकों के साथ उचित सहयोग मिला। हालांकि, कुछ चुनिंदा तकनीकी क्षेत्र में पौधे की विविधता को भी महत्वपूर्ण पाया गया। आईसीटी से संबंधित क्षेत्र के लिए उद्योग मानकों की आयु 6-10 वर्ष के बीच थी और अन्य सभी 11 क्षेत्रों में 11-15 वर्ष थी। एसआईपी द्वारा कवर किए जाने पर घटकों को आयात करने और संयोजन करने वाली दो व्यावसायिक गतिविधियाँ अधिकतम कठिनाइयों का सामना करती पाई गईं।

उत्पाद के विकास से संबंधित आईपी पेशेवरों द्वारा पेटेंट के उच्च से बहुत अधिक प्रभाव को माना गया है, उत्पाद का प्रदर्शन बढ़ रहा है, इंटरऑपरेबिलिटी बढ़ जाती है और उत्पाद को अधिक वैश्विक बनाया जाता है। पेटेंट के केवल दो कार्य पेटेंट के प्रत्येक धारक और मानकों के उपयोगकर्ताओं को नकारात्मक रूप से प्रभावित करते हैं। मानकों के उपयोगकर्ताओं के लिए प्रमुख मार्ग माने जाने वाले पेटेंट के अनुदान द्वारा प्रदत्त एकाधिकार अधिकार। रणनीति के मोर्चे पर केवल रणनीति है जो बड़ी संख्या का सामना करती है, पोर्टफोलियो लाइसेंस को अस्वीकार कर रही है। सफलता और सर्वेक्षण के परिणाम के रूप में प्रत्येक प्रकार के हितधारक के लिए मानकों की स्थिरता के लिए दो शीर्ष रणनीतियों को अलग ढंग से पहचाना जाता है।

चिंता का क्षेत्र भारत के विशिष्ट 5 जी मानकों के मामले के अध्ययन में उभरा है, चाहे वह कोई भी हो, चाहे वह भारतीय हो या विदेशी, TSDSI में भारतीय पेटेंट की घोषणा कर चुका है। सभी विदेशी पेटेंट घोषित किए गए हैं, इसलिए पेटेंट के माध्यम से भारत में उन आविष्कारों

के संरक्षण की स्थिति के संबंध में स्थिति अपारदर्शी है। गैस सिलेंडर के क्षेत्र में डेटा विश्लेषण में पेटेंट और मानकों के उलझने से ज्यादा नहीं। केस स्टडी के साथ-साथ आईपी और स्टैंडर्ड्स के सभी तैयार परिदृश्यों में अध्ययन और मानक सेटिंग को संभालने और मानकों को लागू करने के लिए विशेष रूप से प्रशंसनीय आईपी प्रबंधन के परिप्रेक्ष्य को विकसित किया।

CONTENTS

	Page
Certificate	i
Acknowledgements	ii-iii
Abstract	iv-vi
संक्षेप	vii-x
Contents	xi-xii
List of Exhibits	xiii
List of Tables	xiv-xvi
List of Abbreviations	xvii-xx
Chapter 1: Introduction	1-24
1.1 Background	2
1.2 IP and Industry Standard System in India	3
1.3 Theoretical Perspective	13
1.4 Purpose and Scope of the Study	21
1.5 Chapterisation Plan	22
Chapter 2: Literature Review, Objectives, Hypotheses and Research Methodology	25-58
2.1 Literature Review	26
2.2 Gaps in the Literature	48
2.3 Research Objectives	48
2.4 Hypotheses	49
2.5 Research Methodology	50
Chapter 3: Patents and Industry Standards Landscape in India	59-86
3.1 Patent Landscape	59
3.2 Industry Standards Landscape	63
3.3 Linkage of Patents and Standards Global Picture	70
3.4 SEP Disclosure at SSO Globally and Their Protection in India	74
3.5 Concluding Remarks	86

	Page
Chapter 4: Interplay of IPRs and Standards in India: Survey Findings	87-109
4.1 Government Role in Standard Setting	88
4.2 Relevance of Type of IP with Standards in Different Technical Field	91
4.3 Life of Industry Standards	100
4.4 Functions of Patents and Their Impact on Patent Holder and User of Standards	103
4.5 Impact of Patents in Standards	106
4.6 Difficulty in Conducting Business Activities due to SEP in India	107
4.7 Concluding Remarks	109
 Chapter 5: Industry Standards and Management Strategies	 110-123
5.1 Management Strategy for Lesser Patent Holders in Standards	111
5.2 Select Strategies for Success and Sustainability of Standards	114
5.3 Concluding Remarks	122
 Chapter 6 : IP Based Industry Standards in India: Case Studies	 124-136
6.1 Case Study 1: 5G Standards for India	124
6.2 Case Study 2: Gas Cylinder Standards and Patent Issue	132
6.3 Concluding Remarks	136
 Chapter 7: Conclusions and Recommendations	 137-143
7.1 Conclusions	137
7.2 Recommendations	141
7.3 Significant Research Contributions	141
7.4 Limitations of the Study	141
7.5 Scope for Further Research	142
 References	 144-163
Glossary	164-169
Appendix	170-179
Annexures	180-195
Brief Bio-data	196

LIST OF EXHIBITS

No.	Title	Page
1.1	Patent Filing Trend Since 1989-2019	6
2.1	Broad Relationship Map of Stakeholder under Study	51
2.2	Flow Diagram of Research Methodology	57
3.1	Patent Applications in Top 10 Countries in 2018	62
3.2	Declared SEPs Worldwide by The Firms and Their Patent Filing and Grant w.r.t. Communication Technologies	83
3.3	Patents Granted in India and Indian Standards (BIS)	85
3.4	Patents Applications Filed in India and Indian Standards (BIS)	85
4.1	Form of IP Relevant to Standards in Different Technical Field	93
4.2	Life Standards by Technical Field	101
4.3	Functions of Patents Impacting Patent Holders and Users of Standard	104
4.4	Impact of Patents on Standard	107
4.5	Impact of SEP on Business Activities based on their Nature	108
5.1	Management Strategy for Lesser Patent Holders in Standards	112
5.2	Management Strategies for Manufacturers	115
5.3	Management Strategies for SEP Holder	116
5.4	Management Strategies for Academic Institutions & Government R&D Labs	118
5.5	Management Strategies for Operators	119
5.6	Management Strategies for Individual Innovators	121
5.7	Management Strategies for Standard Development Organizations	122

LIST OF TABLES

No.	Title	Page
1.1	Explanation of Illustration by Mark R Patterson about Possible Impact of IS and IPR	3
1.2	IP Protection Framework in India	4
1.3	Filing of Intellectual Property Applications in India for the Period 2005-19	7
2.1	Economic Effects of Standards	27
2.2	List of Hypotheses	49
2.3	Population and Sample of Data	53
2.4	Demographic Profile of the Respondents	54
2.5	Nature and Extent of Engagement of Respondent in Different Patent Related Activities, Comparison of mean with Respect to Their Gender	55
2.6	Nature and Extent of Engagement of Respondent in Different Patent Related Activities, Comparison of Mean with Respect to Their Affiliation Government and Others	55
2.7	Nature and Extent of Engagement of Respondent in Different Patent Related Activities, Comparison of Mean Between Three Categories Based on Their Educational Qualification	56
3.1	Indian Patents Granted, In-Force and Worked for the Period 1985-2017	60
3.2	Comparison of Annual Growth Rate of Patent Granted and Patents Kept in Force in India by Indian and Foreign Applicants From 1986-2017	61
3.3	Top 10 Non-Resident Patent Applicants in India in 2016-17	63
3.4	BIS Standards on Record as on September 2019	64
3.5	Standard Development/Monitoring Bodies in India at Glance	66
3.6	Major Technical Fields With Maximum Number of SEPS	71

No.	Title	Page
3.7	Region-Wise Holders of Unique Standard Essential Patent	72
3.8	Number of Indian Patents Declared as SEP at SSOs at 13 SSO Alongside Their Raking of Indian Filing in the Year 2016-17	73
3.9	Disclosure of Standard Essential Patents by Top 100 Companies at 11 SSO Worldwide Declaring About 100 and More Patents	77
3.10	Comparative Data of SEP Declared at SSO and Status of Their Patents in India With High Probability of Being The Corresponding Patents	79
4.1	Ranking of Government Roles in Standard and Patents	88
4.2	Comparison of Mean for Level at Which Government Role Perceived by Respondent When Patent Become Part of Standards; Between Respondent from Government Sector and Other	89
4.3	Comparison of Respondent's Perception of Desired Role of Government When Patents Become Part of Industry Standard Between Graduate, Post-Graduate and Ph.D.	90
4.4	Code for 18 Technical Fields	92
4.5	Independence of Technical Qualification of Respondent for Assessment of Relevance of IP with Standards in Different Technical Field	94
4.6	Industry Specific Average Life of Standards	102
4.7	Comparison of Mean for Life of Standards Perceived by Respondent Having Technical Background as Engineering/Physical Sciences and Life Sciences, Drug & Pharma	102
4.8	Code for Functions of Patents	104
4.9	Comparison of Effect of Function of Patent Impacting Patent Holders and Users of Standards	105
4.10	Hypotheses Testing: Impact of SEP on Patent Holders and Users of Standards	105
4.11	Code for Impact of Patents	106
4.12	Code for Nature of Business Activity	108

No.	Title	Page
5.1	Comparison of Respondent's Perception for Advisable Strategy by Firms Having Lesser Patents w.r.t. Industry Standard	112
5.2	Comparison of Mean for Recommended Strategy for Firm Having Lesser Patent w.r.t. Standard Perceived by Respondent from Government Sector	113
5.3	General Scheme of Coding Stakeholders	114
5.4	Code for Strategies for Manufacturers	115
5.5	Code for Strategies for SEP Holder's	116
5.6	Code for Academic Institutions & Government R&D Labs Strategies	117
5.7	Code for Operators Strategies	119
5.8	Code for Individual Innovators Strategies	120
5.9	Code for Standard Developing Organization's Strategies	121
5.10	Top Strategies for Different Type of Stakeholders	123
6.1	Understanding of 1G to 5G Technologies and Evolution of the Same	125
6.2	Test for IPR Requirement Met or Not in Different Situations	128
6.3	IPR Licensing Declaration Forms by Indian Companies	130
6.4	IPR Information Statement and Licensing Declaration (compilation is excluded the information statement)	131

ABBREVIATIONS

3GPP	3rd Generation Partnership Project
TEC	Telecommunication Engineering Centre
ANSI	American National Standard Institute
ARAI	Automotive Research Association of India
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
BS	Bharat Stage (Standard)
CCSA	China Communications Standards Association
C-DoT	Centre for Development of Telematics
CDSCO	Central Drugs Standard Control Organization
CEN	French: Comité Européen de Normalisation; English: European Committee for Standardization
CENELEC	French: Comité Européen de Normalisation Électrotechnique; English: European Committee for Electrotechnical Standardization
CGPDTM	Controller General of Patents, Designs & Trademarks
CPCB	Central Pollution Control Board
DIPP	Department of Industrial Policy and Promotion
DMI	Directorate of Marketing and Inspection
DoS	Directorate of Standardization
DOSTI	Development Organization of Standards for Telecommunication in India
ECMA	European Computer Manufacturers Association
EPO	European Patent Office
ETNO	European public Telecommunications Network Operators
ETSI	European Telecommunications Standards Institute
EU	European Union

FRAND	Fair, Reasonable, and Non-Discriminatory
FSSAI	Food Safety and Standards Authority of India
GATT	General Agreement on Tariffs and Trade
GERAN	GSM EDGE Radio Access Network
GISFI	Global ICT Standards Forum of India
GLP	Good Laboratory Practice
GMP	Good Manufacturing Practice
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
ICS	International Classification of Standards
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
INPADOC	International Patent Documentation Center
IP	Intellectual Property
IPA	Indian Patent Act (The Patent Act, 1970)
IPAIRS	Indian Patent Information Retrieval System
IPC	International Patent Classification
IPO	Indian Patent Office
IPR	Intellectual Property Right
IPSS	Inter Plant Standardization in Steel Industry
IRC	Indian Roads Congress
IS	Industry Standard
IS	Indian Standard
ISI	Indian Standard Institute
ISO	ISO International Organisation for Standardization

ITU	International Telecommunication Union
JPEG	Joint Photographic Experts Group
LTE	3GPP Long Term Evolution
M&A	Mergers and Acquisitions
MeitY	Ministry of Electronics and Information Technology
MNC	Multi-national Corporation
MoEFCC	Ministry of Environment, Forest and Climate Change
MoRTH	Ministry of Road Transport and Highways
MPEDA	Marine Products Export Development Authority
MPEG	Moving Picture Experts Group
MPEG LA	MPEG Licensing Administration
NMPB	National Medicinal Plants Board
NPE	Non-Producing Entities
OASIS	Organization for the Advancement of Structured Information Standards
OECD	Organization for Economic Cooperation and Development
OISD	Oil Industry Safety Directorate
PATSTAT	EPO Worldwide Patent Statistical Database
PCT	Patent Cooperation Treaty
PDF	Portable Document Format
PESO	Petroleum and Explosives Safety Organization
PNGRB	Petroleum and natural Gas Regulatory Body
QCI	Quality Council of India
R&D	Research and Development
RAND	Reasonable, and Non-Discriminatory
RDSO	Railways Design & Standards Organization
RF	Royalty Free

RFID	Radio-Frequency Identification
SAE	Society of Automotive Engineers
SDO	Standard Developing Organisation
SEP	Standard Essential Patent
SSO	Standard Setting Organisation
STQC	Standardization Testing and Quality Certification
TDD	Time Division Duplex
TETRA	Terrestrial Trunked Radio
TRIPS	Trade Related Aspects of Intellectual Property Rights
TS	Technical Specification
TSDSI	Telecommunications Standards Development Society, India
UICC	Universal Integrated Circuit Card
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USPTO	United States Patent and Trade Mark Office
VESA	Video Electronics Standards Association
VITA	VME bus International Trade Association
WCDMA	Wideband Code Division Multiple Access
WIPO	World Intellectual Property Organization
WPAN	Wireless Personal Area Network
WTO	World Trade Organization