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RECONCILING OPEN INNOVATION AND PATENT RIGHTS UNDER INDIAN PATENT LAW: IMPLICATIONS FOR SUSTAINABLE MOBILITY TECHNOLOGIES

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Abstract

The growing reach of environmentally friendly mobility technologies throughout India—including electric vehicles, advanced battery technologies, and hydrogen mobility—requires creation of new technologies within collaborative and competitive framework. Shared technology, partnership across sectors, and collaboration within the triangle of academia, start-ups, and industry are signs of Open Innovation within the economic system. Facilitating technologies of clean mobility fits the purpose of Open Innovation. However, without patent protection, investors cannot be attracted, commercialisation is unlikely, and technology protection is forfeited. Therefore, this paper aims to assess the Indian Patent Law and its attempts to address this dichotomy and assist the diffusion of mobility technologies. Using doctrinal and policy analytical approaches, the Indian Patent Act is assessed along the lines of Open Innovation, namely, patentable subject matter, compulsory licensing, research exemptions, disclosure provisions, Section 8 and the absence of patent. The paper also attempts to understand the global contexts within which India operates. Tesla's case on open patents and licensing of hydrogen technology by Toyota are examples. The Indian context of FAME-II and battery swapping benefited from the collaboration. The paper informs policy formulation by identifying the policy gaps of no clear open licensing rules, absence of economic incentives to contribute, poor enforcement, and weak IP education within start-ups.The text finishes by suggesting a model that merges exclusivity and tactical openness using patent pools, FRAND licencing, open patent repositories, and advanced collaborative IP frameworks as a hybrid IP system. The model proposed will bolster India's S\&T innovative capacity, enhance localisation, improve the country's reduction of import dependency, and help expedite the country's transition toward eco-friendly mobility.

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Keywords: Open innovation; Indian Patent Law; sustainable mobility; electric vehicles; battery technologies.

1. Introduction

As the country seeks to mitigate the challenges associated with increased urban pollution, energy security, and commitments to global climate change, the importance of sustainable mobility technologies in India is increasing strategically. Over the last ten years, India has transitioned to a low-carbon economy, promoting electric mobility, hydrogen-based transport, and smart mobility systems. From the FAME (Faster Adoption and Manufacturing of Electric Vehicles) programme to the PLI (Production-Linked Incentive) programmes for Advanced Chemistry Cell (ACC) Batteries and the growing hydrogen mobility initiatives, there is a clear policy focus on clean mobility[3]. However, strong innovation ecosystems, with collaboration among the public sector, the private sector, emerging technology start-ups, and global technology firms, are essential to the growing diffusion and development of these systems and technologies. Within this framework, open innovation, defined by knowledge transfer, collaborative development, and inter-organisation partnerships, has been a fundamental driver of the mobility systems.

The principles of open innovation are critical for the acceleration of advancements in the innovation of battery chemistry, battery management algorithms, hydrogen fuel cell stacks, charging infrastructure, and vehicle telematics, and also in the alteration of the innovation of battery chemistry management and the fuel cell stacks of the hydrogen batteries. The co-innovation of several technologies has resulted in the increased dependence of the mobility sector on the co-creation of technologies, shared test facilities, open-source software platforms, and collaborative research partnerships[4]. At the same time, patent rights are necessary for the attraction of investments, the maintenance of competitive edge, and the ease of commercializing technology. Patents provide the incentive for firms to spend more on research and development by offering them exclusive rights for a particular time. It is the development of new products for research and development, which would otherwise be lost, that is obtained through this patent more than the funds to restrict. The result is exclusive rights in the realm of

[3] Bhardwaj A, Parveen H. Intellectual Property in the Age of Climate Change: Balancing Innovation and Sustainability through Green Technology.
[4] Sidhu VT. GREEN IP-A MUCH NEEDED INTERPLAY BETWEEN THE INTELLECTUAL PROPERTY AND STABILITY. InObstetrics & Gynaecology Forum 2024 Apr 1 (Vol. 34, No. 2).

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research and development. The paradox is that open innovation is based on the flow of ideas through open access and shared intellectual resources, whereas patents are fundamentally based on both the exclusivity and exclusion of ideas, and the controlled dissemination of knowledge.

How Indian Patent Law can maintain the paradox of open innovation of the patent rights of sustainable mobility Technologies is the key question India faces in the sustainable mobility sector to achieve the vision of being a world center in EV and hydrogen Mobility. The aim of this paper is to provide arguments for this question through the interdisciplinary conceptualization of Open Innovation and the Indian Patent System.

This paper sought to accomplish the following objectives: (1) to assess the potential for emerging models of sustainable mobility, open innovation and patent law to intersect; (2) to analyze relevant reserved provisions of the Indian Patent Act to influence an open-and-sharing paradigm; (3) to identify conflicts and synergies between the practices of open innovation and patent exclusivity; (4) to survey and compare/select open-patent files, and other examples of restrictive patenting, both nationally and internationally; and (5) to provide balanced insights for the integration of open innovation and the patent system in India. The objectives of the paper were fulfilled in a sequential manner, and for each objective a component of the framework, a layer of legal analysis, an industry case study and a set of policy recommendations were structured.

2. Conceptual Framework

2.1 Open Innovation

Henry Chesbrough's open innovation is a management model that asserts that firms should employ a mix of internal and external avenues for technological advancement. Rather than focus on internal R&D, companies work with and license technologies from and to external parties, such as universities, start-ups, and even competitors, in addition to forming collaborative partnerships. There are three models of open innovation. Inbound open innovation is the procurement of external ideas, technologies, or knowledge[5]. With outbound open innovation, internal technologies are made available for external development and commercialization. Coupled innovation features both end, and is commonly structured as partnerships, joint ventures, or co-development.

[5] Nath A, Chakravarty G, Goel S, Sen A. Unlocking Innovation in Renewable Energy: The Role of Intellectual Property in Advancing Solar, Wind, and Bioenergy Technologies. NUJS J. Regul. Stud.. 2025;10:107.

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Within the domain of mobility, the proliferation of Tesla's Open Patent Pledge indicates the growing influence of open innovation within the industry. Under Open Patent Pledges, companies agree not to sue individuals for infringing their patents as long as the lawsuits are in good faith. A parallel example includes India's FAME program along with its battery swapping policy and standardization of EVs which, as other practitioners, advocate for innovation to be ecosystem-based. Such innovation requires protocols for shared knowledge access in charging infrastructure, batteries, telematics, and other standards. The installed open innovation from sustainable mobility is illustrated by technologies for interoperable charging, open-source battery management systems (BMSs), and collective standards for battery recycling.

4.2 Patent Rights

The exclusive patent rights on an invention remain with the inventor for a specific term, generally 20 years. The policy objectives of patents are the promotion of: 1) investments regarding innovations, 2) an unobstructed innovation environment, and 3) an open access to knowledge. In the high mobility sectors, patents serve as a critical enabler to sustain investments in innovation and R&D within the firm[6]. Consequently, the EV battery design, power electronics, hydrogen fuel cell membranes, and autonomous vehicle software are some of the sectors within high mobility that are heavily patented. The need for strong protection within IP is dire due to intense competition within high technology for multinational companies and even for Indian start-ups.

4.3 Sustainable Mobility Technologies

Sustainable mobility technologies have a multitude of environmentally conscious innovations and enhancements with regards to the effectiveness of the transport systems. This includes:

- Electric Vehicles (EVS): Electric motor technologies, battery packs, and the thermal management and regenerative systems.
- Battery Management Systems (BMS): Algorithms for state-of-charge and thermal control, safety management, and battery lifespan optimisation.
- Hydrogen Mobility: Hydrogen fuel cells, stack architecture, storage tanks, and refueling systems.

[6] Singh A, Srivastava Y. Patent Law, Green Technology and Innovation. Routledge; 2022 Sep 19.

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- Autonomous and Smart Mobility: AI navigation, various sensors, vehicle-to-infrastructure communication, and smart transport systems.
- Circular Economy Systems: System of battery recycling, second-life, and resource recovery.

There needs to be a distinctly balanced combination of proprietary R&D and ecosystem-wide collaboration for these technologies, making open innovation and patent rights both necessary.

3. Indian Patent Law: Provisions Relevant to Open Innovation

The Indian Patent Act stipulates criteria concerning invention novelty, industrial applicability, and inventive step to secure a patent. Within sustainable mobility technology, battery chemistry, hydrogen fuel cells, electronic components, and EVs patentable technologies. However, there are exclusions provided in Section 3, which are especially pertinent. For instance, there is a limitation in Section 3(d) concerning patents relative to incremental changes which would have a bearing on battery technology incremental innovations[7]. Section 3(k) also excludes patenting algorithms and software per se which would also have bearing on a BMS software, autonomous driving, and telematics patents unless there is some technical application involved.

The Indian compulsory licensing framework also allows governments to permit third parties, under certain conditions, to manufacture patented technologies without needing to seek permission from the patent owner. Although, normally in the context of medicine, the mobility technologies that benefit the public could also include sustainable mobility technologies, in particular battery technology relating to energy security on a national level. Whilst there is support for the diffusion of knowledge and improved accessibility, it remains procedurally and legally cumbersome.

Section 47 facilitates the limited research exemption concerning the use of patented inventions, and by virtue of this, universities, research and development institutions, and start-ups can legally use and explore patented mobility technologies, for teaching and development work, without violating the restrictions of the patent. Such an exemption is pivotal in the establishment of a synergistic collaborative innovative ecosystem.

[7] Kumar R, Verma V. The Intersection of Unfair Trade Practices and Intellectual Property Rights: A Comprehensive Analysis of Legal Frameworks, Enforcement Mechanisms, and Global Approaches.

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The patenting system in India facilitates the dissemination of technological knowledge through the prescribed requirement of a detailed description of the invention. This, in turn, provides a knowledge spillover effect and enriches information available in the public domain. In the case of mobility technologies, the benefits of full disclosure greatly influence the enhancement of interoperability, benefits of which include the stimulation of incremental innovations and the advancement of unrestricted scientific collaboration. The strong disclosure conditions operate through a different channel in the promotion of open innovations by providing the necessary transparency aimed for.

Section 8 prescribes that patent applicants must disclose the existence of foreign patent applications. Such provisions can have a positive impact with respect to collaborative, international, and R&D activities. This is particularly the case for multinational enterprises that engage in business in India. Although some view Section 8 as an encumbrance, it promotes convergence and transparency with respect to international developments in IP regulation.

4. Intersections & Conflicts Between Open Innovation and Patent Rights

The fundamental tension, in this case, revolves around the fact that open innovation fosters the sharing of knowledge, whereas patents are based on withholding that knowledge through exclusive rights. In the case of sustainable mobility, this tension is evident when legal or financial constraints get in the way of startups and academic institutions needing access to proprietary battery algorithms or designs for hydrogen storages. Likewise, there is tension for companies involved in the charging standardisation. They have to find ways to keep organisational secretiveness while also providing interoperability for the entire system. The potential misappropriation of IP readily explains the lack of fully open collaborative projects.

Patents can, however, support open innovation, which is an issue many people have simply not come to grips with. In fact, patents can support open innovation through something called patent pools[8]. Patent pools can be employed in additional collaborative arrangements, allowing several companies to share ownership and, thereby, share the benefits and risks of the patent, which can reduce the threat of litigation and support greater interoperability (which, for instance, is important in the case of an EV charging network). Cross-licencing arrangements are also very relevant in this case. They are very relevant for the co-innovation of automakers, battery manufacturers, and the organisations supplying the relevant technologies. In addition,

[8] Zhang H, Chen X. Open innovation and sustainable innovation performance: The moderating role of IP strategic planning and IP operation. Sustainability. 2022 Jul 15;14(14):8693.

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where there is FRAND licensing, the monopolistic pricing of patents that cover essential innovations in EVs is eliminated, allowing open access to the innovation while still providing a mechanism for recovery of the costs associated with the patent[9]. This is also evident in the open-patent strategies of corporations such as Tesla and Toyota, where patents have been used to keep ecosystems open rather than restrictive.

That said, there can be detriment from patents. The benefits of a patent system include the availability of enhanced innovations and technologies to the public to a greater extent. The risks that a proprietary system of patents poses include very high royalties, meaning that small entrepreneurial ventures are unable to leverage the benefits, thereby leading to a reduction in competition. Where closed R&D is used, the diffusion of innovations (including, for instance, new battery materials and new catalysts for hydrogen systems) can be reduced. With a closed patent system in place, the failure to meet the relevant standards can lead to a fragmentation of the ecosystem in such a way that large-scale adoption of a technology can be severely hampered.

5. Case Studies & Comparative Analysis

Tesla's Open Patent Pledge has been a crucial part of the company's innovation strategy by permitting rivals to use the company's engineering patents without the risk of litigation. Toyota's no-fee cross-licensing of patents pertaining to hydrogen fuel cell technology also demonstrates how benefits from increased competitive strategy market opening. The European Union's battery passport initiative encourages the voluntary disclosure of battery specifications, chemistry, and lifecycle details to enable circularity and interoperability, revealing these to be some of the top tier international collaborations of patent strategy[10]. The Indian mobility sector can glean from these international collaborations how flexibility in patent strategies can promote innovation.

In India, EV startups are increasingly comfortable sharing formal and informal eco-systems of shared intellectuals. These include open-source BMS tool chains, modular interoperable charging systems, and collaborative public-private research. Government programmes like

[9] Ramli N, A. Zainol Z. Malaysian university intellectual property policies in an era of open innovation: time for some uniformity?. Journal of Intellectual Property Law & Practice. 2017 Sep 1;12(9):761-7.
[10] Carayannis EG, Meissner D. Glocal targeted open innovation: Challenges, opportunities and implications for theory, policy and practice. The Journal of Technology Transfer. 2017 Apr;42(2):236-52.

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FAME II and the NITI Aayog Battery Swapping Policy promote the ethos of standard interoperability and collaboration in the entire sector. Unfortunately, many barriers remain in place. Gaps in collaboration between academia and industry are still commonplace owing to issues like disputes around IP ownership, low awareness of alternative licensing models, and a hardliners patent exclusivity stance espoused by the private sector. These challenges emphasise the need to create a more balanced and flexible legal and policy framework to facilitate open collaboration alongside existing robust measures to protect inventions.

6. Implications for Sustainable Mobility Technologies

Open innovation and patent rights are intertwined and can impact the growth and adoption of sustainable mobility technologies in India. Open innovation can accelerate the dispersion of electric vehicles (Evs) and hydrogen mobility technologies by providing wider access to multiple remote tech and technological cooperation[11]. When companies practice patent ovulsions and FRAND licenses, smaller companies and start-ups can experiment with and adapt technologies at lower cost and spend less time on localization. This can accelerate Charged coupled device (CCD) and power electronics and hydrogen fuel cell stacks along with thermal management of the batteries, and other distinguished practices.

On the other hand, patents also have a central barrier to the core. This is the case with battery chemistry, lithium-ion cell structures, and complex battery management system (BMS) algorithms. There are strict patents on these by macro firms, which is then a problem for Indian companies since they have to pay exorbitant royalties on tech and have to submit to tech imports. This is a problem with India's ambition for localization with the PLI coordination. This is a problem too, since there is a lack of innovation on a bimodal basis. These are also the problems with BMS algorithms, which are mostly also Section 3(k) and thus constrain start-ups from experimentation and innovating with other aspects.

Leveraging open innovation would provide As Mobility Technologies Switch to Advanced Foundational Technologies Opportunities for India to Gain Advanced Mobility Technologies. Moreover, the openness would allow for the localization of battery cells, hydrogen storage systems, and powertrain components and would decrease the country’s reliance on imported

[11] Sarango-Lalangui P, Castillo-Vergara M, Carrasco-Carvajal O, Durendez A. Impact of environmental sustainability on open innovation in SMEs: An empirical study considering the moderating effect of gender. Heliyon. 2023 Sep 1;9(9).

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battery cells and components. Additionally, co-developed research and joint prototyping in shared testing facilities would result in lowered operational costs and wider adoption of EVs. Similar to the co-developed research, open platforms and weak IP systems would allow MSMEs, who otherwise would not be able to engage in resource-straining extensive IP litigation or licensing, to participate more in the clean mobility value chain. Therefore, the open innovation not only advances the ecosystem but democratizes the technological advances in India's transitioning to green mobility.

7. Conclusion

India's transition towards the adoption of sustainable mobility will require a careful examination of the restrictive nature of the patent rights' exclusivity, vis-a-vis the collaborative innovation with open systems. The adoption of a hybrid model of IP protection which maintains a core of patented innovation, while allowing for deliberate strategic open systems will pave the most expeditious route for advancements in the mobility ecosystem. The Indian Patent Law provides adequate baseline protection; however, additional targeted reforms, including improvements to the licensing mechanism, research exemptions, enforcement and IP literacy, should be implemented. Through the development of a more systematic, open and collaborative innovation ecosystem, India will be able to further advance toward a low-carbon transportation system, enhance domestic technological prowess and establish a highly competitive global mobility industry.