Asia-Pacific Tech Monitor

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Leveraging intellectual property for technology commercialization and diffusion

ESCAP
APCTT
Asian and Pacific Centre for Transfer of Technology

*The shaded areas of the map indicate ESCAP members and associate members.**

The Economic and Social Commission for Asia and the Pacific (ESCAP) is the most inclusive intergovernmental platform in the Asia-Pacific region. The Commission promotes cooperation among its 53 member States and 9 associate members in pursuit of solutions to sustainable development challenges. ESCAP is one of the five regional commissions of the United Nations.

The ESCAP secretariat supports inclusive, resilient and sustainable development in the region by generating action-oriented knowledge, and by providing technical assistance and capacity-building services in support of national development objectives, regional agreements and the implementation of the 2030 Agenda for Sustainable Development.

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Foreword

Effective intellectual property management (IP) is essential for R&D institutes and enterprises to protect their innovations, attract investment, and maintain a competitive edge. By strategically safeguarding inventions, designs and innovative technologies, organizations can ensure that their research outputs translate into tangible economic and societal benefits. IP management also facilitates technology transfer, fosters collaboration, and enables monetization through licensing and commercialization - ultimately driving sustainable growth and innovation.

However, R&D institutes and enterprises often face a range of challenges in the journey from innovation to market. Protecting IP can be complex and costly, particularly in international contexts with diverse legal frameworks. Scaling up technologies from lab to market requires significant investment, infrastructure and technical validation. Technology transfer is frequently hindered by gaps in industry-academia collaboration, limited awareness of IP valuation and lack of capacity and intermediary support. Commercialization efforts are further constrained by market uncertainties, regulatory hurdles, and difficulties in attracting investors or licensees. Addressing these challenges requires a holistic approach that includes policy support, capacity building and strong innovation ecosystems.

The Asia-Pacific region is undergoing significant transformation in IP management, driven by rapid technological advancements and evolving innovation landscapes. Countries across the region are modernizing their IP frameworks to address complexities of emerging technologies such as artificial intelligence and blockchain. However, disparities remain in IP awareness, enforcement capacity and commercialization support. Strengthening institutional capacity, harmonizing legal standards and fostering public-private collaboration remain key priorities.

Recognizing IP as a key enabler of sustainable development, this special issue of *Tech Monitor* is dedicated to the theme: "*Leveraging Intellectual Property for Technology Commercialization and Diffusion.*" This edition features six insightful articles covering a wide range of topics, including university strategies for IP commercialization, institutional support mechanisms, policy and legal frameworks, use of IP portfolios as business strategies by innovative firms and emerging commercialization trends across the Asia-Pacific region. The articles are enriched with case studies and examples offering practical experiences and regional insights.

We hope this edition of *Tech Monitor* serves as a valuable resource for policymakers, innovators, academia and enterprises. It aims to enhance understanding and capacity to address the critical challenges of IP commercialization, supporting informed decision-making and the development of effective strategies for bringing innovations and technologies to market.

Preeti Soni
Head, APCTT

Technology Market Scan

ASIA-PACIFIC

CHINA

Guidelines to promote AI education

China's Ministry of Education has recently issued two guidelines to promote artificial intelligence (AI) education in primary and secondary schools by building a tiered, progressive, and spiraling general AI education system, prohibiting students from independently using open-ended content generation at primary schools and banning teachers from using generative AI as a substitute for their core teaching responsibilities.

The release of the two documents - the guidelines for AI general education in primary and secondary schools (2025) and the guidelines for the use of generative AI in primary and secondary schools (2025) - marks a significant initiative to scientifically and systematically promote AI education across all levels of schooling, further implement the cultivation of innovative talent with AI literacy and offers a Chinese solution to respond to technological transformation in the global education sector, CCTV News reported.

The guidelines for AI general education aim to establish a comprehensive, scientifically grounded AI education system, which centers on AI literacy through the adoption of a spiral curriculum designed to realize the development from cognitive enlightenment to creative practice, CCTV reported. At the primary level, the focus is on sparking interest and building foundational cognitive understanding. During the junior high school period, AI education will reinforce students' understanding of technical principles and foundational AI applications. At the senior high level, emphasis is placed on systems thinking and innovation.

According to the AI general education guidelines, the goal is to cultivate students' core competencies for adapting to an intelligent society, the AI education system will cultivate talent with AI literacy characterized by an integrated development in terms of knowledge, skills, thinking, and values which includes the development of technological innovation thinking, critical thinking, human-AI collaboration skills, AI literacy, and a strong sense of social responsibility, People's Education magazine reported.

By implementing a coordinated mechanism involving "curriculum restructuring, integrated resources, innovative assessment, and empowered teacher training," this initiative aims to transition AI education from localized pilots to nationwide implementation, ultimately establishing a Chinese-style model of AI general education for primary and secondary schools, CCTV reported.

https://www.globaltimes.cn/

Patent applications hit record high

Patent applications from China reached a record high in 2024, according to a report released by the European Patent Office (EPO), showing a strong presence of Chinese companies in the European technology market. The report said Chinese companies and researchers filed 20,081 patent applications last year at the EPO ranking 4th worldwide, accounting for 10.1 percent of total applications there, following the US (47,787 applications), Germany (25,033 applications), and Japan (21,062 applications).

Patent filings from China have grown steadily over the past decade. While growth slowed in 2024, up only 0.5 percent compared to 2023, applications from China have more than doubled since 2018; and more than quadrupled since 2014. China's innovation momentum remains strong. Huawei Technologies led the Chinese rankings, placing second overall at the EPO in 2024 behind Samsung, followed by LG, Qualcomm, and RTX.

In addition to Huawei (4,322 applications), five other Chinese companies ranked in the top 50 applicants at the EPO, showcasing China's robust innovation capabilities and active participation in European patent applications. The list includes CATL at number 14, with 1,163 European patent applications, ZTE at 16, with 999 applications, Xiaomi at number 20, with 763 applications, Vivo Mobile at 28, with 622 applications and finally Tencent at number 49, with 446 European patent applications.

The report also noted a surge in patent filings from China related to battery technologies. Chinese firms saw the strongest growth in electrical machinery, apparatus, and energy, up 32.2 percent in 2024 year-on-year. This was thanks to a surge from China in patent applications for battery-related technologies (+79 percent), with four Chinese companies now among the top 15 applicants in battery technologies (up from two in 2023): CATL, Eve Energy, BYD, and Zhuhai CosMX Battery.

https://www.globaltimes.cn/

INDIA

R&D spending doubles over the last decade

India's Gross Expenditure on Research and Development (GERD) has more than doubled over the past decade, rising from Rs. 60,196 crore in 2013-14 to Rs. 1.27 lakh crore, according to Union Minister Jitendra Singh. Speaking at the DISHA event at the India Habitat Centre on Monday, the Union Minister of State (Independent Charge) for Science and Technology highlighted the significant growth in India's R&D investments under Prime Minister Narendra Modi's leadership. He attributed this increase to the government's commitment to fostering innovation in key sectors like artificial intelligence, biotechnology, and quantum computing.

"The future economy of India will be shaped by home-grown innovations in deep-tech areas such as AI, biotechnology, and quantum computing," Dr. Singh said. He emphasised that government-backed initiatives have been instrumental in driving scientific advancements and positioning India as a global leader in technological innovation.

Dr. Singh also highlighted India's evolving intellectual property (IP)-driven innovation ecosystem, which is supported by academia, industry, and startups. He credited the government's push for research and development (R&D) as a key factor in this progress, stressing the importance of transitioning innovations from labs to industries in the pursuit of self-reliance, or 'Atmanirbhar Bharat.'

Dr. Singh lauded the DISHA Program—an initiative aimed at Developing Innovations, Successful Harnessing, and Adoption—as a vital step toward creating a knowledge-based economy. The program supports faculty members and students working on disruptive technologies, ensuring India stays at the forefront of global innovation.

https://ddnews.gov.in/

6G patent filings

India entered amongst the top six countries globally in 6G patent filing, said Chandra Sekhar Pemmasani, the Minister of State for Communications at the BHARAT 6G 2025 conference. The country has sanctioned over Rs 300 crore (USD 35.14 million) for over 111 research projects, marking a significant milestone in pursuing 6G technology. "6G will operate on TeraHertz frequency bands, enabling data rates up to one terabit per second, 100 times faster than 5G," the minister added.

According to a release by the India Brand Equity Foundation (IBEF), the adoption of 6G technology will "create entirely new industries and revolutionise existing ones" and is expected to contribute Rs 85,37,000 crore (USD 1 trillion) to India's economy by 2035.

https://economictimes.indiatimes.com/

MALAYSIA

National blockchain infrastructure launched

Malaysia has launched its national Malaysian Blockchain Infrastructure (MBI), which is a core component of Malaysia's National Blockchain Roadmap. MBI is a partnership between MIMOS Berhad (Malaysian Institute of Microelectronic Systems), the national applied research and development (R&D) centre under the Ministry of Science, Technology, and Innovation (MOSTI), as well as Malaysian e-government solutions provider MY E.G. Services Berhad (MYEG). The infrastructure has been built on blockchain technology by Malaysia-based company Zetrix, which has developed blockchain applications that have been deployed by governments and enterprises around Asia.

In a joint release, MIMOS and MYEG said MBI was the foundation layer that would allow developers and businesses to build secure, scalable blockchain-based services without needing to navigate the technical complexity of individual blockchain platforms like Ethereum, Solana , and enterprise networks. This would simplify the creation of blockchain applications, and MBI was expected to cater to a broad range of use cases, such as supply chain traceability and digital identity. Both the public and private sectors could also build applications catering to decentralised finance and tokenisation of digital assets, the statement said.

https://govinsider.asia/

Funding for R&D, commercialisation, and innovation ecosystem

The government, through funding agencies under the Ministry of Science, Technology, and Innovation (Mosti), has channelled RM1.37 billion in financing or investment to startups and Small and Medium Enterprises (SMEs) from 2016 to 2024. According to the ministry, it aims to strengthen the financing ecosystem of Malaysia's research and development (R&D) as well as commercialisation and innovation (C&I), which contributed to an increase in RM1.76 billion in funding, generating a return of up to 4.9 times for every ringgit invested.

Mosti, in a statement, said the financing programme had a major impact on the country through the creation of 17,282 highly skilled job opportunities, contributing RM12.99 billion to the country's GDP, with 360 intellectual properties marketed and the production of 170 products or services of disruptive technology. "As of Dec 31, 2024, a total of 4,319 startups were registered on the MyStartup portal operated by Cradle Fund Sdn Bhd (Cradle)," said Mosti.

The funding agencies under MOSTI are Cradle, Kumpulan Modal Perdana (KMP), Malaysian Technology Development Corporation (MTDC), Malaysia Debt Ventures Berhad (MDV), VentureTECH (VT), NanoMalaysia Berhad (NMB) and Malaysian Bioeconomy Development Corporation Sdn Bhd (BEC).

https://theedgemalaysia.com/

Community-based rooftop solar aggregation scheme

In a landmark move to boost decentralized renewable energy adoption, Malaysia's Ministry of Energy Transition and Water Transformation (PETRA) has launched the Community Renewable Energy Aggregation Mechanism (CREAM) — the nation's first structured rooftop solar aggregation program.

The initiative enables homeowners to lease or rent out their rooftop spaces to third-party developers, who will then install solar photovoltaic (PV) systems to generate green electricity for nearby users. The electricity generated will be supplied to local commercial and domestic consumers located within a 5-kilometer radius, as specified in the program's framework published by the Energy Commission.

These localized energy clusters will be facilitated by registered Local Energy Generators and Aggregators (LEGA), who are tasked with both developing the rooftop solar infrastructure and managing the contractual agreements with homeowners. This model is designed to create community-scale energy ecosystems while minimizing the complexity typically associated with individual installations.

https://solarquarter.com/

PHILIPPINES

National AI strategy to boost inclusive innovation

The Department of Science and Technology (DOST) is moving forward with a proposed National Artificial Intelligence Strategy aimed at promoting ethical, inclusive, and accessible innovation across the Philippines. Speaking during the 2025 National Innovation Day celebration on April 30 at Novotel Manila, DOST Secretary Renato Solidum Jr. emphasized the need for a unified approach to AI development that serves real societal needs.

The strategy outlines a national framework for developing and deploying AI technologies through 2028. It centers on five pillars: infrastructure, workforce, innovation, ethics and policy, and deployment. These efforts are meant to support AI applications in areas such as agriculture, education, smart cities, creative industries, and national security.

https://www.manilatimes.net/

REPUBLIC OF KOREA

International patent applications in 2024

For the fifth consecutive year, the Republic of Korea ranks fourth in the number of international patent applications under the Patent Cooperation Treaty (PCT), with the figure rising 7.1%. The Korean Intellectual Property Office (KIPO) on March 17 said the Republic of Korea filed 23,851 applications last year to rank behind the top three in China, the U.S., and Japan in that order. Among the top five, the U.S. (minus 2.8%), Japan (minus 1.2%), and Germany (minus 1.3%) saw negative performance in the category, while the Republic of Korea showed strong growth.

By company, Samsung Electronics ranked second with 4,640 PCT applications, and LG Electronics fourth with 2,083. The former's increase of 18.2% was the highest among those in the top 10. The nation also had four universities ranked in the top 20: Seoul National (fifth), Hanyang (15th), Korea (18th), and Yonsei (20th).

https://www.korea.net/

Global R&D investment

The Republic of Korea ranked No. 5 in terms of the amount of research and development (R&D) investments by the country's businesses in 2023, with Samsung Electronics standing as the world's top R&D investor in the chip industry, a report on the world's top 2,000 investors showed. According to the Korea Chamber of Commerce and Industry's (KCCI) analysis of the European Union's Industrial R&D Investment Scoreboard, the Republic of Korean companies included in the list invested 42.5 billion euros ($44.1 billion) in 2023, trailing behind the United States, China, Germany and Japan.

Compared to that of 2013, the country's R&D investment grew 2.2 times from 19.3 billion euros, pushing up the rankings two spots from No. 7 to No. 5. During the same period, however, the number of the Republic of Korean companies included in the top 2,000 R&D investor list declined from 54 to 40, as 405 Chinese firms made their entry into the list over the past decade.

https://www.koreatimes.co.kr/

Fund to boost private investment in innovation

The Ministry of SMEs and Startups announced on April 24 the establishment of the Startup Korea Fund (SkoFund) for 2025, with a projected scale of 600 billion won. This venture fund, primarily driven by the private sector, marks a significant shift in the Republic of Korea's approach to fostering innovation and entrepreneurship. Unlike traditional parent fund investment projects where the parent fund is the main contributor, SkoFund incentivizes private sector participation by offering priority loss compensation, making them the primary contributors at 70%.

This year, SkoFund will see participation from 30 private contributors, investing over 250 billion won. The parent fund will match this with an investment of 170 billion won, creating an initial parent fund of 420 billion won. The Ministry plans to select an operator (GP) by May to establish a sub-fund with a total scale of 600 billion won. Notable participants include major corporations such as POSCO Holdings, LX Semicon, and GS Engineering & Construction, as well as overseas institutions like CMIC and Tokyo Seikyo Center.

https://www.businesskorea.co.kr/

Corporations with IP report higher revenue per employee

Corporations with intellectual property (IP) recorded an average revenue per employee that is 20.9% higher than those without. The Korea Institute of Intellectual Property and the Korea Development Institute (KDI) published a report on the 21st titled 'Analysis of corporate revenue performance based on intellectual property rights.' This report is based on research commissioned by the National Intellectual Property Commission, which is led by the president, and the Korean Intellectual Property Office. It analyzed the big data of operational information from 228,617 domestic corporations from 2010 to 2023 to assess the impact of intellectual property rights on corporate revenue.

According to the report, corporations holding intellectual property rights such as patents, trademarks, and designs had higher revenues. Corporations that held only one type of intellectual property reported 18.9% higher revenue per employee, those with two types had 27.1%, and those with all three types had 32.7% more. On average, they had 20.9% higher revenue than corporations without intellectual property rights.

The scope of intellectual property rights also influenced revenue. Corporations holding only one intellectual property right had 15.4% higher revenue per employee compared to those without any. In contrast, those holding between 2 and 19 rights reported 24.1% higher, and those with over 100 rights had 50.3% higher revenue. The report explained that 'the quantitative expansion of intellectual property rights significantly contributes to corporate growth.' It also noted that corporations that filed overseas applications had 27.3% higher revenue than those without.

https://biz.chosun.com/

THAILAND

AI strategy to become a regional hub

The National AI Committee has outlined its strategic direction to position Thailand as a regional hub for AI development and to drive national economic growth. Digital Economy and Society Minister Prasert Jantararuangtong, who also serves as deputy chairman of the committee, said that the committee has developed a comprehensive plan to prepare Thailand across various dimensions—particularly focusing on the development of a skilled AI workforce.

The government aims to train no fewer than 10 million individuals as AI users, 90,000 as AI professionals, and 50,000 as AI developers within the next two years. In addition, the committee will promote investment in digital infrastructure, including cloud systems, data centres, GPU-based computing systems, and the development of an open-source AI platform.

https://www.nationthailand.com/

Direct PPAs for renewable energy procurement

Thailand is set to introduce a direct power purchase agreement (PPA) framework, allowing businesses to buy renewable energy directly from producers, such as solar farms. The move aims to accelerate the country's transition to clean energy and create a more competitive energy market.

Prime Minister Srettha Thavisin has directed authorities to develop the PPA framework with a completion target set for the end of the year. The announcement was made during a mobile Cabinet meeting in Phayao, where the government reiterated its commitment to advancing clean energy initiatives.

The decision follows discussions between U.S. Commerce Secretary Gina Raimondo and Thai officials during her recent visit. Raimondo underscored the importance of direct PPAs in enabling businesses to lower their carbon footprint and access renewable energy more efficiently. In response, Srettha assured that a clear PPA policy would soon be in place to support both international and domestic enterprises in their sustainability efforts.

https://solarquarter.com/

Draft law to promote solar power usage

Thailand's Department of Alternative Energy Development and Efficiency (DEDE) has announced a public hearing on the Draft Act on Promotion of Solar Power Usage, aimed at simplifying regulatory procedures and accelerating solar PV adoption across the country.

The proposed legislation seeks to eliminate bureaucratic bottlenecks and reduce costs associated with installing solar photovoltaic systems, particularly for commercial and industrial consumers. If enacted, the law is expected to benefit building owners opting for solar installations for self-consumption, as well as developers operating under build-transfer-operate models, such as EPC and O&M arrangements.

In a significant regulatory shift, the Draft Act builds on recent reforms introduced through a Ministerial Regulation that removed the requirement to obtain a Ror. Ngor. 4 factory license for solar rooftop installations outside industrial estates—regardless of capacity. The new legislation expands this approach beyond rooftop systems, offering a broader regulatory overhaul for solar projects.

https://solarquarter.com/

VIET NAM

National semiconductor strategy

The Vietnamese government has approved a 12.8 trillion VND ($500 million) investment to establish a high-tech semiconductor fabrication plant, marking a major step in developing a domestic chip industry and securing supply chain resilience. Aiming to strengthen its position in the global semiconductor supply chain, Viet Nam has announced its first government-backed chip manufacturing plant and incentives to boost domestic R&D, innovation, and production capabilities.

With government funding of up to 12.8 trillion VND ($500 million), Viet Nam is taking concrete steps toward establishing a small-scale semiconductor fabrication plant to support national defence, high-tech industries, and research needs. To accelerate semiconductor research, design, and production, Viet Nam will invest in a state-supported semiconductor fabrication facility, reinforcing its long-term vision for technological self-sufficiency by 2050. Recognizing the strategic importance of semiconductors, Viet Nam is launching its first government-backed chip fabrication plant, setting the stage for future growth in advanced electronics and AI-driven technologies.

https://vietnamnet.vn/

Solar Feed-in Tariffs in 2025

On April 10, 2025, the Ministry of Industry and Trade (MOIT) issued Decision 988/QD-BCT ("Decision"), updating Viet Nam's feed-in tariff (FiT) rates for solar power projects. These tariffs, effective under the framework of Circular 09/2025/TT-BCT issued on February 1, 2025 ("Circular"), will apply throughout 2025. While FiTs have been part of Vietnam's renewable energy policy toolkit for several years, the latest update introduces some notable changes to how tariffs are structured and calculated.

Most significantly, the Decision introduces separate tariffs for solar power projects that incorporate battery energy storage systems (BESS). This development reflects a growing policy emphasis on grid flexibility and energy reliability. The tariff rates also vary depending on the geographic location—North, Central, and South Vietnam—to reflect the differing solar radiation levels. Power purchase agreements (PPAs) under the new FiTs will be signed between project developers and the state utility, Vietnam Electricity Group (EVN), as per existing regulatory procedures.

Viet Nam's FiT program has evolved significantly over the past decade. The country first introduced feed-in tariffs to stimulate investment in solar and wind energy, offering stable, long-term returns for private investors. As of December 2023, the **introduction of Decree No. 19/2023/TT-BCT** revised this mechanism, laying the foundation for the current approach.

Under this decree, FiTs now cover a wide array of renewable projects, including ground-mounted and floating solar, as well as onshore and offshore wind. The decree exempts legacy projects that began commercial operations before January 1, 2021 (for solar) and November 1, 2021 (for wind), from the new pricing framework.

https://www.vietnam-briefing.com/

Technology Scan

Focus: Artificial Intelligence technologies for climate resilience

INTERNATIONAL

Generative AI model for Earth observation

The new foundation model from IBM and the European Space Agency (ESA) combines insights from nine types of Earth observation data to provide an intuitive understanding of our planet. IBM and ESA have released TerraMind, a new earth-observation model that the group has open-sourced on Hugging Face. It was pre-trained on TerraMesh, the largest geospatial data set available, built by researchers as part of the TerraMind project.

TerraMind has a unique symmetric transformer-based encoder-decoder architecture, which is designed to work with pixel-base, token-base, and sequence-base inputs and learn correlations across modalities. Despite being trained across 500 billion tokens, TerraMind is a small, lightweight model, using 10 times less compute than standard models for each modality. This means users can deploy it at scale at a lower cost while reducing the overall energy consumption at inference time.

In an ESA evaluation, TerraMind was compared against 12 popular Earth observation foundation models on PANGAEA, a community-standard benchmark, to measure the model's performance on real-world tasks, like land cover classification, change detection, environmental monitoring, and multi-sensor and multi-temporal analysis. The benchmark showed TerraMind outperformed other models on these tasks by 8% or more.

https://research.ibm.com/

ASIA-PACIFIC

CHINA

AI to revolutionize smart breeding, crop development

The fusion of artificial intelligence (AI) and agriculture is transforming the future of food. Smart breeding, powered by AI, is unlocking the potential to develop high-yield, climate-resilient "super crops" that could redefine global food security in an era of environmental uncertainty.

At the 2025 Seed Congress held from March 20 to 23 in the city of Sanya, south China's Hainan Province, smart breeding took center stage. Over 40 exhibitors showcased cutting-edge technologies and flagship crop varieties, highlighting how AI-driven breeding is transitioning from theory to practice. Digital displays at the event illustrated the latest breakthroughs, from AI-powered genomic analysis to cloud-based farm monitoring systems.

Qian Qian, another CAS academician, highlighted the complexity of crop traits. "Understanding the relationship between genes and traits requires computational power and advanced algorithms," he said. Unlike traditional small-scale breeding, smart breeding adopts an industrialized approach, pooling vast resources to integrate superior traits efficiently.

https://www.globaltimes.cn/

INDIA

AI in hunt for curious corals

Researchers at the National Institute of Ocean Technology (NIOT), Chennai have created an AI algorithm capable of tracking "curious" corals using autonomous underwater vehicles (AUVs). Curious corals are new species of coral reefs found in deep-sea expeditions or coral reefs that appear to be resistant to climate change.

This new technology, developed from images collected by the PROVe500 in the Andaman and Nicobar Islands, promises to significantly enhance our understanding of coral reef ecosystems and the impact of climate change on these vital marine habitats. The AI algorithm, trained on six distinct families of coral images, uses advanced computer vision and deep learning techniques. It utilises the YOLOv8 model for coral detection and classification, combined with ByteTrack for tracking, achieving impressive mean average precision and recall rates of 97.4% and 96.8%, respectively.

This high accuracy allows AUVs to identify and monitor corals in real-time across large spatial domains, reducing the need for manual intervention by divers and minimizing subjective decisions. By deploying AUVs equipped with AI-enabled image processing, researchers can gather comprehensive data on coral health and dynamics over extensive areas.

https://www.indiatoday.in/

'Smart Model' to predict flooding in deltaic regions

Researchers from the University of Notre Dame, USA, Indian Institute of Technology (IIT) Kharagpur, India Meteorological Department (IMD), and the National Institute of Hydrology (India) have developed an innovative computer model for predicting floods in deltaic regions.

Their study centres around the Brahmani-Baitarani River delta in Odisha, India, where the two rivers meet to form a delta before pouring out into the Bay of Bengal. The region is notoriously susceptible to floods and cyclones. The team developed an integrated method, where, instead of relying on separate models that only look at the river or the ocean separately, they've linked them together. This allows the models to talk to each other and understand how a storm surge in the Bay of Bengal pushes water up the rivers while heavy rainfall inland swells the rivers at the same time.

The team used three computer models: ADCIRC, SWAN, and HEC-RAS 2D. ADCIRC (Advanced Circulation Model) takes on the task of simulating how water moves in the ocean, accounting for tides and storm surges. SWAN (Simulating Waves Nearshore) focuses on the waves and calculates their height and direction. These two work together, with ADCIRC sending information on water levels to SWAN and SWAN returning data on wave forces. Finally, HEC-RAS 2D (Hydrologic Engineering Center's River Analysis System) simulates river flooding, taking into account rainfall and the flow of water downstream. The key to the new model is in the way these three models are connected. The ocean surge data from ADCIRC+SWAN becomes the coastal boundary condition for the HEC-RAS model, informing it how much the ocean is pushing into the rivers.

https://researchmatters.in/

AI model to offer heat-stress predictions

An AI-powered model that provides taluk level heat-stress predictions in Karnataka is being developed by Bengaluru's IISc, which could be a game-changer in predicting high-temperature events that pose major health risks. Researchers from the Indian Institute of Science's (IISc) AI & Robotics Technology Park (ARTPARK) are the brains behind the model that provides heat predictions for up to 10 days. AI-based models generate weather forecasts faster and with significantly lower computational resources, unlike current forecasting systems that require large supercomputers. ARTPARK researchers, who are testing the model, in the next couple of weeks, will hand it over to the Karnataka State Natural Disaster Monitoring Centre (KSNDMC), one of the key stakeholders along with the IMD and state health and family welfare department. As of now, researchers are sharing heat maps with the KSNDMC. In the IISc model, people can understand maximum temperature distribution, anomalies, and daily temperature variations. They can also calculate thermal comfort and a heat risk index, apart from getting a 10-day forecast, which will show how the temperature feels (human perception) by combining humidity levels, geographical conditions, and wind speeds.

https://www.deccanherald.com/

ISRAEL

AI model to predict lightning-induced wildfires

A new artificial intelligence (AI) model developed by researchers at Bar-Ilan University (BIU) in Ramat Gan promises to revolutionize wildfire prediction, with a particular focus on lightning-induced blazes that are growing increasingly common due to climate change. The new AI model can predict where and when lightning strikes are most likely to cause wildfires, achieving over 90% accuracy – a first in wildfire forecasting that could transform emergency response and disaster management worldwide.

Dr. Oren Glickman and Dr. Assaf Shmuel from the computer science department, in collaboration with experts from Ariel University and Tel Aviv University (TAU), worked with seven years of high-resolution global satellite data, alongside detailed environmental factors like vegetation, weather patterns, and topography, to map and predict lightning-induced wildfire risks on a global scale. Their research was recently published in Nature Publishing's *Scientific Reports* under the title "Global lightning-ignited wildfires prediction and climate change projections based on explainable machine learning models."

What makes this so significant is the ability to predict lightning-induced wildfires with remarkable precision. The AI model outperforms traditional fire danger indices by taking a global, data-driven approach. It integrates environmental factors, data from satellites, and weather systems to assess the likelihood of lightning-induced fires, overcoming the limitations of regional and data-restricted models.

https://www.jpost.com/

PHILIPPINES

AI-powered platform for hybrid rice breeding

The International Rice Research Institute (IRRI) has launched a new AI-powered digital platform that can significantly advance and accelerate hybrid rice breeding and parental selection around the world, contributing to improved food security and sustainable agriculture through the propagation of high-yielding and climate-smart rice hybrids.

Called the Global AI-Hybrid Rice Platform (GAI-HRP), the platform was developed by the IRRI Hybrid Rice Unit with the Hybrid Rice Development Consortium (HRDC). The system utilizes advanced artificial intelligence and machine learning models to interrogate datasets across decades of research and trials and to provide swift and precise identification of optimal hybrid rice combinations based on specific parameters.

With the GAI-HRP system, the AI will be able to quickly and accurately predict the highest-yielding F1 rice hybrid combinations using SNP genotypic data of the male and female parental lines, while also considering the various market segments and available historical hybrid datasets. This can significantly help breeders, researchers, and seed companies to determine the best combinations for hybrid rice development by specific traits, environments, and markets.

In addition to optimizing yield potential, GAI-HRP also indirectly contributes to sustainable agriculture by identifying low-carbon footprint rice hybrids. This is achieved by considering high-yielding and early-maturing hybrid rice varieties, which require fewer resources and reduce greenhouse gas emissions. Furthermore, the platform is being developed and enhanced to predict the most significant gene panels for targeted hybrid rice traits, helping to improve breeding efficiency and precision.

https://www.irri.org/

EUROPE

AI tool to help detect growing climate hazards

A JRC-developed expert-driven explainable AI (xAI) model can detect multiple climate hazards impacting agriculture in Europe. It enables probabilistic detection and uncertainty estimation of areas of concern, hence improving risk management. By integrating decades of expert knowledge with advanced explainable AI (xAI) techniques, a team of researchers led by the European Commission's Joint Research Centre (JRC) has developed an expert-driven model that can detect multiple climate hazards affecting agriculture in Europe.

The model - described in a scientific article published in *Nature* - can improve risk management and adaptation, helping to boost the resilience of agriculture in Europe. This marks a step towards developing more robust and reliable multi-hazard early warning systems for agriculture. By combining the power of AI with the irreplaceable expertise of domain specialists, this model can help to improve climate resilience and safeguard food security in the face of increasing climate variability in Europe.

The model builds on the expertise of agro-climatic specialists who have operationally identified areas of concern (AOCs) where specific climate hazards may impact agriculture, such as droughts, heatwaves, and extreme precipitation events. By learning from this rich dataset, the model can efficiently digest big agro-meteorological datasets in a timely fashion to provide first guesses of AOCs relevant for agriculture in Europe.

Unlike traditional black-box AI models, this system provides clear explanations for its predictions by showing the key factors driving the detection of AOCs. For instance, the model reveals the critical role of specific atmospheric circulation patterns in driving drought conditions, allowing for more accurate drought impact-based forecasting and preparedness. The transparency and interpretability embedded in the model helps to build trust and allows stakeholders to understand potential underlying causes of risk.

https://joint-research-centre.ec.europa.eu/

AI-powered robots tackle e-waste problem

EU-funded researchers have developed adaptable robots that could transform the way we recycle electronic waste, benefiting both the environment and the economy. Researchers from Slovenia, Germany, and Italy worked together on this issue at the Jožef Stefan Institute, Slovenia's leading research facility, from 2020 to 2024. The team developed adaptable AI-supported robots that are able to remove batteries from smoke detectors and radiator heat metres. These two products can be found in most households and are replaced every five to eight years, creating large amounts of waste.

Working with Electrocycling, Ude's international research team created an adaptable robotic work cell. This is a workspace that consists of at least one robot, its tools and equipment, and its controller.

The novelty here is that this closed system autonomously adapts itself to various tasks, with the help of complex AI-driven software and modular hardware that can be quickly reconfigured. It also uses soft components like SoftHand, a human-like hand that can manipulate objects with great precision. There are also safety features like collaborative robots and emergency stop buttons.

https://projects.research-and-innovation.ec.europa.eu/

UK

AI driven weather prediction system

A new AI weather prediction system, developed by researchers from the University of Cambridge, can deliver accurate forecasts tens of times faster and use thousands of times less computing power than current AI and physics-based forecasting systems. The system, Aardvark Weather, has been supported by the Alan Turing Institute, Microsoft Research, and the European Centre for Medium-Range Weather Forecasts. It provides a blueprint for a new approach to weather forecasting with the potential to transform current practices. The results are reported in the journal *Nature*.

The researchers have replaced the entire weather prediction pipeline with a single, simple machine-learning model. The new model takes in observations from satellites, weather stations, and other sensors and outputs both global and local forecasts. This fully AI-driven approach means predictions that were once produced using many models – each requiring a supercomputer and a large support team to run – can now be produced in minutes on a desktop computer.

https://www.cam.ac.uk/

AI tools help reduce greenhouse gas emissions

Loughborough University computer scientists have developed AI tools that offer insights into how greenhouse gas emissions associated with UK livestock farming and land use can be reduced. The tools – which are hosted on an online digital platform and created as part of research funded by UK Research and Innovation (UKRI) and the Engineering and Physical Sciences Research Council (EPSRC) – aim to provide farmers, farming organizations, and government bodies with valuable data on how changes in livestock practices and land use can help the UK achieve its 2050 net zero goal.

Developed by a team led by Professor Baihua Li and Professor Qinggang Meng, key features of the platform include machine learning models designed to estimate methane emissions from livestock farming, predict milk productivity and ammonia emissions from dairy farms, and analyze how land use and environmental factors influence methane emissions across the UK.

The Loughborough University AI models provide a solution. Trained on diverse livestock and environmental datasets, they analyze how various factors interact to impact emissions, providing farm-level and nation-wide insights that can help shape strategies to support the UK's net zero goal.

The AI tools developed for livestock farms allow farmers to input details about their specific animals and practices to estimate their current annual greenhouse gas emissions. Farmers can easily explore potential changes to their practices – simply by selecting options from drop-down menus or entering variable values. These adjustments provide immediate insights into their potential impact on both emissions and farm productivity.

https://www.lboro.ac.uk/

NORTH AMERICA

USA

AI technique boosts climate change defenses

Researchers from Princeton and Rutgers University have used reinforcement learning, a method frequently deployed to train artificial intelligence, to show how flexible responses can substantially increase the cost-effectiveness of steps to defend cities like New York against climate change.

The research is part of an attempt to grapple with the effort to make expensive, long-term investments to mitigate the impacts of climate change. The substantial uncertainty related to long-term climate change makes it difficult for political leaders to make investments now that are designed to protect citizens for decades or longer. The difficulty is enhanced by the vast number of variables that go into any such decision and by the fact that the variables are likely to shift in unforeseen ways.

In a March 18 article in the *Proceedings of the National Academy of Sciences*, the researchers looked at flooding, which has caused increasing damage along the coastal United States and around the world. Governments are building coastal defenses against flooding, but they cannot rely on past conditions to guide defenses that will be needed in the future.

In the PNAS article, the team describes how they simulated efforts to defend Manhattan against sea level rise through the end of this century. The goal was to determine whether any decision-making process that systematically incorporates observations and updating would prove superior to others over such a long period of time. To do this, the researchers simulated decisions by city planners in 10-year intervals up to the year 2100. The researchers compared their decision-making process with existing methods.

https://engineering.princeton.edu/

Climate modeling with generative AI

Researchers at the University of California, San Diego, and the Allen Institute for Artificial Intelligence (Ai2) have developed a generative AI climate prediction model they call Spherical DYffusion, which is fast and agile enough to be used as a tool not just by scientists, but by anyone whose decisions are affected by climate trends.

In their recently published paper online, the researchers explained the difference between climate modeling and weather forecasting. “Climate models are foundational tools used to understand how the Earth system evolves over long time periods and how it may change as a response to possible greenhouse gas emission scenarios … There are fundamental differences between weather and climate modeling. Climate refers to the average weather over long periods of time. While weather forecasting focuses on short time scales in the order of days or weeks, climate modeling simulates longer periods of decades to centuries.”

“What people have usually been using for climate modeling are physics-based climate models, which solve equations about the atmosphere and oceans and so on,” said Salva Ruhling Cachay, one of the Ph.D. students of UCSD Professor Rose Yu. “These models are run on supercomputers to make predictions for 10s or even 100 years. But running such a physics-based model is very expensive in terms of time and compute and energy,” he added. Where it takes about six months to run a physics-based model, theirs was able to produce equally good results in about two weeks.

https://www.techbriefs.com/

AI model for tornado damage assessments and recovery

Led by Dr. Maria Koliou, associate professor and Zachry Career Development Professor II in the Zachry Department of Civil and Environmental Engineering at Texas A&M University, researchers have developed a new method that combines remote sensing, deep learning, and restoration models to speed up building damage assessments and predict recovery times after a tornado. Once post-event images are available, the model can produce damage assessments and recovery forecasts in less than an hour. The researchers published their model in the journal *Sustainable Cities and Society*.

The model does more than assess damage—it also helps predict repair costs and estimate recovery times. Researchers can assess these timelines and costs in different situations by combining deep learning technology, a type of artificial intelligence, with advanced recovery models.

Researchers combined three tools to create the model: remote sensing, deep learning, and restoration modeling. Remote sensing uses high-resolution satellite or aerial images from sources such as NOAA to show the extent of damage across large areas.

Deep learning automatically analyzes these images to identify the severity of the damage accurately. The AI is trained before disasters by analyzing thousands of images of past events, learning to recognize visible signs of damage such as collapsed roofs, missing walls, and scattered debris. The model then classifies each building into categories such as no damage, moderate damage, major damage, or destroyed.

https://phys.org/

IP trends in the Asia-Pacific and commercialisation framework

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Abstract

The Asia-Pacific (APAC) region accounts for the second-largest share of the global Intellectual Property (IP) market, following North America. In recent years, the region has witnessed a significant increase in IP filings and efforts to leverage IP assets for economic and technological advancement. From China's aggressive patenting to India's IP policy reforms and the digital IP innovations of Pacific Island nations, diverse strategies are shaping commercialisation. However, gaps remain between owning patents and successful market diffusion. This article explores recent IP commercialisation trends across the Asia-Pacific. Data from 150 Indian inventors holding patents demonstrates institutional support, resources, incubator systems, and the role of networks in enabling commercialisation. We outline key challenges, strategies, and opportunities related to innovation, IP, and commercialisation. To illustrate the practical dimensions, the article includes a case study of a Bengaluru-based startup that strategically brought its patented technology to market despite significant challenges.

Introduction

The pace of innovation and intellectual property (IP) activity in the Asia-Pacific is unprecedented. Across the dynamic and diverse economies of the Asia-Pacific region, IP emerges as a foundational pillar in the journey from scientific discovery to scalable technology solutions. The region has shifted from being a consumer of global technologies to becoming a formidable source of innovation. In 2023, Asia accounted for nearly 69% of global filings across patents, trademarks, industrial designs, and most utility model applications, followed by the United States. China alone filed over 1.64 million patents, maintaining the global lead, followed by Japan with over 400,000 filings, while India recorded a 15.7% year-on-year growth, surpassing 64,000 applications (WIPO, 2024) and reflecting strong gains in domestic innovation (Table 1). Countries such as Vietnam, the Philippines, and Türkiye were recognised by the World Intellectual Property Organization (WIPO) as among the fastest risers in innovation capacity. In addition, IP-related exports and technology payments across the region have steadily increased, signalling a stronger focus on translating IP into economic value. As digital transformation accelerates, the region's innovation ecosystem continues to get reshaped by artificial intelligence (AI), advanced manufacturing, and national IP strategies, thus positioning Asia-Pacific as a powerful player in the global knowledge economy (Sharma, 2025). The Vietnamese government has stepped up support for patent registration to increase its presence in the global intellectual property market (Nguyen et al., 2023). The Republic of Korea's top conglomerates are monetising the IP portfolios in order to increase liquidity and fortify their strategic positioning (Korea Times, 2024). The Asian region, therefore, not only reflects a strong domestic innovation drive (evident in resident filings) but also demonstrates growing attractiveness to foreign inventors as well (through non-resident filings). The trend underscores the region's strategic investments in R&D, policy reforms, and evolving IP infrastructure. Among Asia-Pacific countries, China, Japan, the Republic of Korea and India feature prominently in the top six in global patent filings (Figure 1).

While the number of patent filings increases, the proportion of IP leading to actual market deployment remains low. The disconnect highlights what may be called the "commercialisation gap", which continues to be a central concern for policymakers, entrepreneurs, and researchers alike. Countries like China, Japan, the Republic of Korea, and India lead in patent filings (WIPO, 2024). However, the rate at which these innovations are transformed into commercially viable products or services remains relatively low (GII, 2024).

The gap stems from several interrelated issues. Many innovations are developed without clear go-to-market strategies or real-world demand validation. Moreover, research institutions often operate in silos (Carreno, 2024), with limited engagement with the private sector, hindering technology transfer. Inventors and startups frequently lack the business acumen or legal knowledge required to navigate IP protection, licensing, and market scaling (Leon & Donoso, 2017). Additionally, early-stage funding for IP-intensive ventures remains a challenge, particularly outside established ecosystems (WIPO, 2025). The APAC region's diver-

Table 1: Application by origin, 2023 for top 5 Asian and top 3 Pacific countries

Origin of applications	Patent	Utility model	Trademark	Industrial design
China	1,642,507	3,061,371	7,417,394	882,807
Japan	414,413	4319	349685	34589
The Republic of Korea	287,954	3901	334032	60120
India	64,480	547	496293	26966
Indonesia	1,727	4368	120880	4949
Australia	11,199	162	125423	5505
New Zealand	2618	49	29915	1106
Samoa	56	6	436	11

(**Source -** IP Facts and Figures 2024)

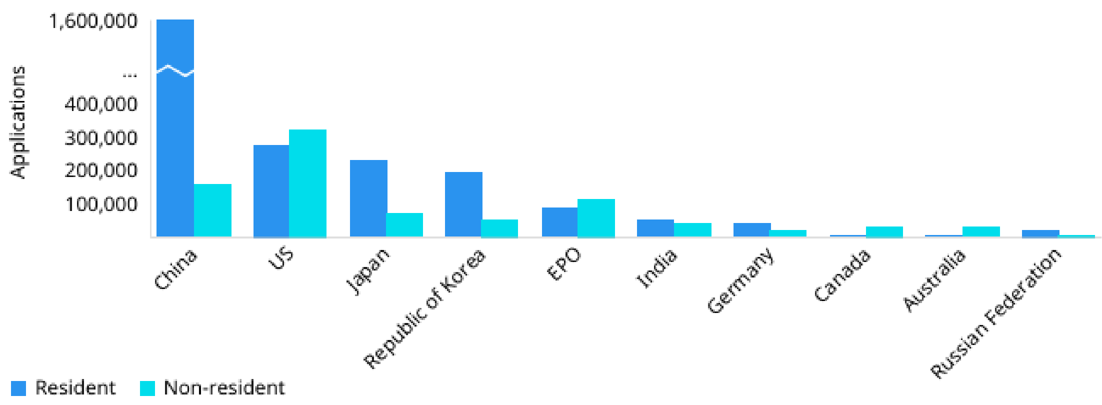

Figure 1: Patent applications at the top 10 offices, 2023

(Source: WIPO, 2024)

sity, ranging from advanced economies like Japan and Australia to emerging nations like Cambodia and Fiji, indicates that commercialisation challenges are uneven. National IP frameworks vary widely, creating inefficiencies and legal uncertainties for innovators operating across borders. Harmonising standards, particularly in patent examination, IP valuation, and dispute resolution, remains a challenge (Fowler, 2021). In countries such as India and Thailand, university Technology Transfer Offices (TTOs) are nascent and under-resourced. India has struggled to convert publiclyfunded research into licences despite policy efforts (Ray & Saha, 2010). Risk aversion among public institutions and bureaucratic delays further stifle innovation diffusion. Even after successful licensing, weak enforcement mechanisms deter commercial investment. In several Southeast Asian nations, counterfeit markets and IP theft remain significant issues as well (Fink et al., 2016).

Despite the challenges, a wave of innovative practices and reforms is reshaping the IP landscape in Asia-Pacific. Countries like India and Viet Nam have launched comprehensive IP policies aimed at strengthening domestic innovation ecosystems. India's National IPR Policy has enhanced patent examination capacity and public awareness campaigns (DPIIT, 2020). Vietnam has reformed the IP law to better support international collaborations (Nguyen et al., 2023). Leading universities and research parks are integrating IP support within incubation systems. For instance, Singapore's BLOCK71 and India's BIRAC BioNEST programs provide startups with IP mentoring, legal services, and connections to industry partners (GII, 2022). The rise of online IP marketplaces, such as WIPO GREEN (WIPO, 2022) and Japan's IP BASE (Japan Times, 2019), further enable exchange and licensing of technology assets.

The Republic of Korea's conglomerates are increasingly treating IP as financial assets. Hyundai and Samsung have used IP-backed securitisation and sale-leaseback models to generate capital while retaining technology access (Korea Times, 2024). Joint ventures between ASEAN countries and innovation hubs in the Republic of Korea, Japan, and China are increasing. These include patent pooling arrangements, co-development grants, and regional IP sharing agreements. These developments suggest some economies in the region are gradually evolving toward a more mature, market-oriented IP environment (ASEAN IP Portal, 2023).

The Asia-Pacific region remains rich in creativity and technological potential. However, nations must prioritise both the quantity and quality of IP outputs in order to move from an IP-rich environment to an economy driven by innovation. Bridging the commercialisation gap requires more than patents, and demands robust networks, institutional support, and policy coherence. The commercialisation of intellectual property becomes crucial to the region's competitiveness in the future as nations embrace digital ecosystems and implement strategic reforms. Asia-Pacific countries may use IP as legal assets and as engines of equitable and sustainable economic growth, as well as fostering an environment for the free flow of ideas from research labs to international markets. By cultivating an enabling ecosystem where ideas can move fluidly from research labs to global markets, Asia-Pacific nations can harness IP not only as legal assets, but also as drivers of inclusive and sustainable economic growth.

Key factors in IP commercialisation

The successful commercialisation of IP gets shaped by a constellation of interrelated factors spanning individual, organisational, and ecosystem levels as outlined below.

Association with incubators

Incubators significantly enhance the commercialisation potential of IP by providing startups with mentoring, technical infrastructure, access to funding and business development networks (Barbero et al., 2014). The strategic focus of incubators, whether aimed at technology valorisation, regional growth, or commercialisation, can shape commercialisation outcomes (Clarysse et al., 2005; Máté et al., 2024). Notably, incubators embedded within strong innovation ecosystems tend to yield higher success rates by bridging the gap between invention and market readiness.

IP support mechanisms

Evidence from Southeast Asia illustrates the effectiveness of Innovation and Technology Support Offices (ITSOs) in facilitating patenting and technology transfer (Dellosa, 2017). University-level IP support, particularly in emerging economies like Thailand, positively influences faculty decisions to commercialise research outputs (Maneerattanarungrot et al., 2024). IP support structures, including patent guidance and technology transfer offices, enhance the institutional capacity to transition innovations from the lab to the market (Fiedler & Welpe, 2009).

Organisational and managerial support

Organisational support, comprising strategic guidance, consultative leadership, and resource allocation, demonstrates a significant role as a determinant of successful commercialisation. Structured managerial assistance within incubators correlates with higher innovation output and survival rates (Colombo & Delmastro, 2002). Managerial coaching and mentoring bridge the experiential gap for less-experienced innovators, enabling them to navigate early-stage challenges (Al-Mubaraki & Busler, 2017). Additionally, supportive environments, marked by managerial confidence and collaborative leadership, increase the likelihood of successful idea implementation (Grobler, 2018; Zolfaghar Arani et al., 2024).

Difficulty in securing funding

Financial constraints are a widely acknowledged barrier to commercialisation. Traditional financial institutions often fail to recognise the potential of high-tech ventures due to informational asymmetries, resulting in credit rationing (Colombo & Delmastro, 2002). Without access to external funding, inventors may be forced to depend on personal savings, skewing opportunities towards more affluent entrepreneurs (Evans & Jovanovic, 1989; Holtz-Eakin et al., 1994a). Hence, the ease or difficulty of securing funding critically shapes an innovator's ability to invest in prototype development, marketing, and operational scaling.

Diversity of networks

Networks are crucial for facilitating IP commercialisation, especially in knowledge-intensive sectors. Collaborative innovation networks offer access to complementary assets such as market intelligence, regulatory advice, and technical expertise (Misra, 2018). High-performing networks include public agencies, incubators, venture capitalists, and legal support services, which collectively reduce uncertainty and enable smoother transitions from R&D to market application (Yazdimoghaddam et al., 2019; Pellikka & Virtanen, 2009). However, misaligned or ineffective networks can hinder rather than help, thus emphasising the need for the diversity of collaborative networks (Aarikka-Stenroos et al., 2014).

Type of funding source

The source of funding can also influence commercialisation outcomes. While personal savings may be the most readily accessible source, they are inherently limited and socially unequal. In contrast, government grants and private investment provide scalable and often more stable avenues for commercialisation. These sources also typically come with added benefits such as mentorship, regulatory guidance, and enhanced visibility within innovation ecosystems (Colombo & Delmastro, 2002).

Years of experience

Experience, both technical and managerial, significantly predicts commercialisation success. Teams with prior experience in commercialisation or industry are better positioned to manage uncertainty, adapt to market changes, and strategically allocate resources (Yazdimoghaddam et al., 2019). Empirical evidence demonstrates that experienced entrepreneurs are more effective at navigating commercialisation bottlenecks, acquiring capital, and leveraging networks (Pellikka & Virtanen, 2009). Furthermore, incubated firms often led by more experienced founders outperform their counterparts in adopting new technologies and translating research into viable products (Colombo & Delmastro, 2002).

Assessing the commercialisation of intellectual property

The study aims to investigate the key enablers and barriers to the commercialisation of intellectual property among Indian inventors. While India experiences substantial growth in IP filings (over 600,000 as of 2023), translating these into viable commercial products remains inconsistent and underexplored. The framework identifies patterns between commercialisation success and factors such as institutional support, funding access, network association, satisfaction with available resources, and experience (Figure 2). The analysis is grounded in empirical data collected from a diverse sample of Indian IP holders.

The sample comprised 150 Indian inventors who hold at least one patent. Of the total respondents, 98 were male and 52 were female. In terms of educational qualifications, 90% of respondents held a PhD, while the remaining 10% had completed postgraduate degrees.

The dependent variable was the commercialisation status, categorised as a binary outcome, either the IP was commercialised or not. The independent variables included: association with an incubator (yes or no), IP support received (yes or no), satisfaction with organisational support and resources (satisfied or not satisfied), and difficulty in securing funding (yes or no). Additionally, variables capturing external influences were considered, such as network type, classified into none, single-type, or diverse network; funding source, categorised as personal savings, government grants, or private funding; and years of experience, grouped into four categories: 0–4 years, 5–9 years, 10–14 years, and 15 or more years. These variables provided a comprehensive view of the ecosystem and contextual factors enabling or hindering the successful commercialisation of IP among Indian inventors.

Data analysis

Among 150 inventors, commercialisation outcomes varied significantly based on several enabling and constraining factors. Inventors who were associated with an incubator demonstrated notably higher commercialisation success, with 58.3% having commercialised their IP compared to only 37.2% among those without association with an incubator.

Similarly, access to IP-related support services had a strong correlation with commercialisation outcomes; 56.6% of those who received IP support had successfully commercialised their innovation, while only 25% of those without such support had done so.

Network diversity played a critical role. Inventors who reported having diverse collaborative networks achieved a 65.5% commercialisation rate, significantly higher than those in single-type (50%) or no network categories (11.1%). Satisfaction with organisational support also influenced outcomes to a degree; 47.3% of those satisfied with their organisation's support had commercialised their IP, compared to 47.4% among dissatisfied respondents. However, the difference was later found not to be statistically significant.

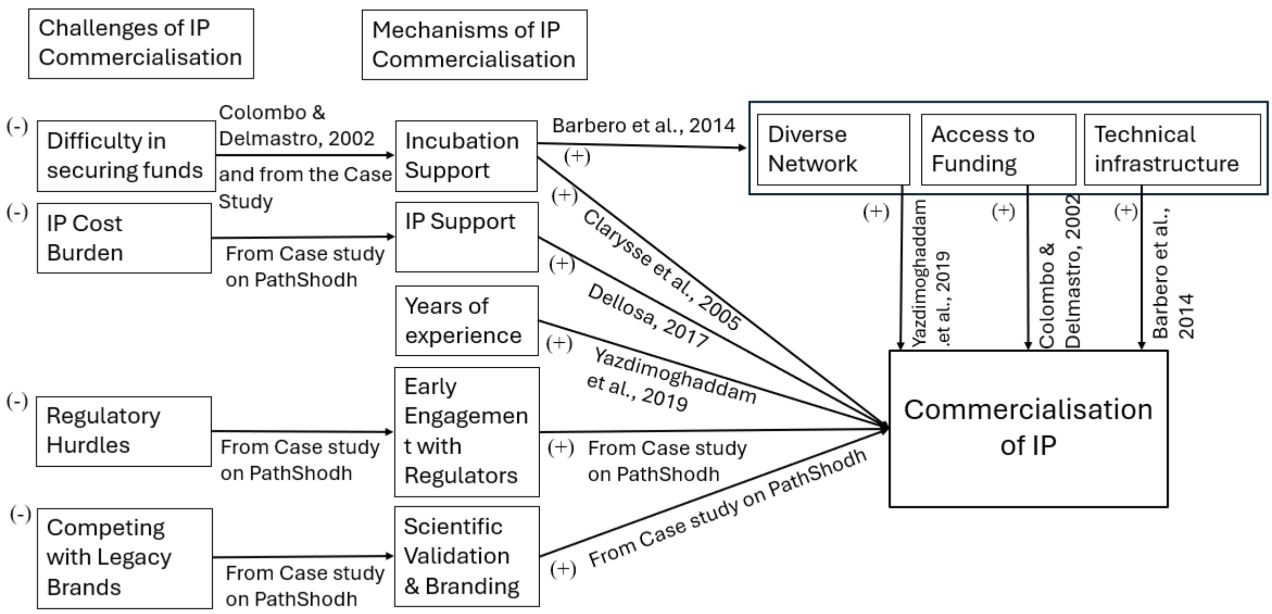

Figure 2: Data and case study driven framework

Funding access emerged as a key differentiator. Inventors who did not face difficulties in securing funding had a much higher success rate (64.4%) than those who faced funding challenges (21.7%). When considering sources of funding, government grants were associated with the highest commercialisation success (56.6%), followed by private funding (47.5%), while personal savings were the least effective (26.5%) (Table 2).

Experience also played a significant reinforcing role (chi-square = 84.04, $p < .05$). Inventors with more than 10 years of experience and who also had access to incubator support or diverse networks showed the highest commercialisation rates, often exceeding 70%. In contrast, those with less experience and minimal support reported significantly lower rates.

Statistical analysis confirmed several of the above trends. Association with an incubator showed a statistically significant relationship with commercialisation (t value = -2.64, $p < .05$), indicating inventors with incubator support were 21 percentage points more likely to commercialise their IP. IP support had an even stronger significance (t value = -4.48, $p < .05$), with a 41-point difference in commercialisation success between those who received support and those who did not.

Table 2: Demographic details of all variables

Factors	Commercialised (in %)	Not commercialised (in %)	No. of respondents
Incubator association			
Yes	58.3	41.7	72
No	37.2	62.8	78
IP support received			
Yes	56.6	43.4	106
No	25.0	75.0	44
Network type			
Diverse	65.5	34.5	87
Single type	50	50	18
None	11.1	88.9	45
Organisational support			
Yes	47.3	52.7	91
No	47.4	52.6	59
Funding difficulty			
Yes	64.4	35.6	90
No	21.7	78.3	60
Funding source			
Government grants	56.6	43.4	76
Private funding	47.5	52.5	40
Personal savings	26.5	73.5	34

The diversity of networks was highly significant (chi-square = 41.3, $p < .05$). Inventors engaged in diverse networks had a linear and positive relationship with commercialisation rates. Funding source was also statistically significant (chi-square = 8.54, $p < .05$), with government grants most strongly associated with commercialisation success. Likewise, the challenge of securing funding showed a substantial effect (t value = 5.626, $p < .05$), with those not facing difficulties being 43 percentage points more likely to succeed in commercialisation. On the other hand, satisfaction with organisational support, while descriptively important, did not reach statistical significance, indicating the factor alone may not directly influence commercialisation outcomes (Table 3).

We applied a binary logistic regression model to examine the impact of various factors on the likelihood of IP commercialisation, as the dependent variable, commercialisation status, is binary (i.e., commercialised vs. not commercialised). The model included key independent variables such as incubator association, IP support, satisfaction with organisational support, difficulty in

Table 3: Statistical analysis

Variables	Tests	Test value	p value
Incubator association X Commercialisation	t-test	-2.64	<0.05*
IP support X Commercialisation	t-test	-4.48	<0.05*
Network type X Commercialisation	Chi-square	41.3	<0.05*
Organisational support X Commercialisation	t-test	.024	>0.05
Experience X Commercialisation	Chi-square	84.04	<0.05*
Funding difficulty X Commercialisation	t-test	5.626	<0.05*
Funding source X Commercialisation	Chi-square	8.54	<0.05*

Table 4: Regression analysis

Variables in the equation							
		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Org support (Yes)	0.001	0.478	0.000	1	0.998	1.001
	Network type			8.897	2	0.012	
	Network type (single type)	-0.684	0.711	0.925	1	0.336	0.505
	Network type (diverse)	2.052	0.682	9.064	1	0.003	7.788
	Incubator (Yes)	0.729	0.509	2.054	1	0.152	2.073
	IP support (Yes)	0.000	0.544	0.000	1	1.000	1.000
	Funding source			6.229	2	0.044	
	Funding source (personal savings)	-0.466	0.562	0.688	1	0.407	0.628
	Funding Source (govt. grants)	1.581	0.634	6.220	1	0.013	4.861
	Difficulty in securing funds (Yes)	-0.288	0.540	0.285	1	0.594	0.750
	Experience	0.115	0.027	17.739	1	0.000	1.122
	Constant	-0.197	0.691	0.081	1	0.776	0.821

securing funding, network type, funding source, and years of experience. The findings indicate experience is a strong and statistically significant predictor ($p < 0.001$), with each additional year increasing the odds of commercialisation by approximately 12% (Exp(B) = 1.122). Network type was also significant ($p = 0.012$), with inventors embedded in diverse networks being substantially more likely to commercialise their IP (Exp(B) = 7.788, $p = 0.003$), compared to those with no networks. Funding source emerged as another significant variable ($p = 0.044$), where reliance on government grants notably increased commercialisation likelihood (Exp(B) = 4.861, $p = 0.013$), whereas personal savings did not yield a significant effect.

Other factors, such as incubator support, IP support, organisational support, and ease in securing funding, while not statistically significant, demonstrated directions consistent with theoretical expectations, suggesting their presence may still play a supportive role in commercialisation outcomes (Table 4).

Leveraging IP for affordable diagnostics: The case of PathShodh Healthcare (India)

PathShodh Healthcare Pvt. Ltd., an Indian health-tech startup incubated at the Indian Institute of Science (IISc), illustrates how IP strategy, institutional support, and strategic networking can enable commercialisation of academic research into socially impactful technologies. Originating from a PhD project, PathShodh has successfully translated biosensor innovations into market-ready products, backed by patents in eight countries and regulatory approvals for use in India. The case study explores the challenges, strategies, and opportunities PathShodh encountered in leveraging IP for technology commercialisation and diffusion, aligning with recent survey data across Asia-Pacific on IP-enabled innovation pathways.

Context and genesis of innovation

PathShodh's journey began as a doctoral proposal by Dr. Vinay Kumar Chauhan, a diabetic himself, at the Centre for Nano Science and Engineering (CeNSE), Indian Institute of Science (IISc). His goal was to develop an electrochemical biosensor capable of detecting diabetic complications, kidney disease, anaemia and liver-related ailments at early stages. While the original intent was academic, repeated clinical engagements with pathologists illuminated the broader healthcare gap and market need.

India has one of the world's highest diabetes burdens, yet over 90% of diagnostic technologies are imported. PathShodh's innovation, therefore, not only addressed a public health issue but also targeted a critical gap in India's diagnostic technology manufacturing capacity.

Challenges in leveraging IP for commercialisation

1. Financial constraints and high risk

Securing funding in the initial ideation and development phases forms a significant barrier for research-led startups. In PathShodh's case, while early support through grants like the Biotechnology Industry Research Assistance Council (BIRAC) Biotechnology Ignition Grant was instrumental in de-risking initial R&D, the financial challenges extend far beyond early prototyping. Operationalising a health-tech device, especially one involving high-precision diagnostics, requires sustained investment across clinical validation, manufacturing scale-up, and regulatory navigation. For a startup emerging from academia without immediate commercial backing, managing these capital-intensive demands involved high financial exposure and constant fundraising pressures. Securing funding remains a persistent challenge. Pathshodh has secured its funds from angel investors and government grants.

2. Patent maintenance and IP cost burden

PathShodh's global patenting strategy, covering eight countries including the US, UK, Germany, China, and Japan, was critical in safeguarding its innovation. However, as Dr. Chauhan emphasised, the cost of maintaining these patents, particularly annual annuity fees, has become a recurring burden. For resource-constrained startups, global IP protection becomes a double-edged sword: necessary for securing market and investor confidence, yet the cost of maintenance can consume valuable financial bandwidth. Without immediate monetisation of the IP, such costs strain liquidity and necessitate strategic decision-making on where and how long to maintain protection.

3. Regulatory hurdles and time delays

Commercialising healthcare technology in India demands stringent regulatory approvals from bodies like the Drugs Controller General of India (DCGI)(. Navigating the process remains time-consuming and complex, particularly for a young team without prior market experience. The complexity multiplies when aiming for global diffusion, as each country or region (e.g., Europe's CE marking, US FDA) has distinct processes, documentation, and validation requirements.

4. Competing with legacy brands in a logic-driven market

PathShodh entered the highly specialised field of diagnostic biosensors, a sector dominated by multinational corporations with decades-long legacies, brand loyalty, and validated supply chains. Unlike consumer tech or lifestyle products, biosensors operate in a space where branding and psychology play a limited role, medical technologies are evaluated almost exclusively on scientific rigor, accuracy, and regulatory trustworthiness. In such a logic-driven market, newcomers like PathShodh must not only demonstrate equivalent or superior product performance but also do so while being price-competitive and uncompromising on quality. Building trust from scratch, especially for a life-critical product, requires overcoming institutional inertia and scepticism.

Strategies for IP commercialisation success

1. Early IP filing as a research strategy

Dr. Chauhan filed initial patents during his PhD itself, before commercialisation was even considered. The early filing, backed by IISc's IP support system, gave PathShodh a head start in protecting core technology and ensured "freedom to operate" when commercial interest eventually emerged.

2. Incubation ecosystem and public funding

Being incubated at IISc's Society for Innovation and Development (SID) provided not just infrastructure but access to mentorship, investors, and grant opportunities. The Biotechnology Ignition Grant was crucial in bridging the early "valley of death." Regular reviews by incubator mentors kept the team aligned with both scientific and business milestones. The role of incubators, enhancing commercialisation by 21 percentage points is validated in the regional data.

3. Building strategic networks

From the early stages, PathShodh invested in building strong networks with clinicians, healthcare professionals, regulatory advisors, academic collaborators, and investors. These networks played a critical role in refining product design through clinical feedback, attracting private funding and partnerships, and creating a customer base. Our findings show startups combining diverse collaborative networks with incubation support demonstrate up to 77.8% commercialisation success, underscoring the impact of this strategy.

4. Technology-first market entry

Rather than relying on emotional branding, PathShodh focused on performance, affordability, and scientific rigor. The strategy was essential to penetrate a logic-driven medical diagnostics market. Clinical studies, peer-reviewed publications, and transparent validation data helped establish credibility in a sector that remains sceptical of new entrants.

5. Hybrid manufacturing model

To balance scalability with intellectual property protection, PathShodh built a hybrid manufacturing approach: core R&D integration is retained in-house, while component production and final assembly are outsourced to vetted EMS (Electronics Manufacturing Services) partners. This model keeps the secrets safe, allows for faster time-to-market, and cost efficiency.

6. Vision-driven IP management

Dr. Chauhan highlighted an important principle: a bold vision drives the value of an IP. For startups looking to exit early or license technology, expansive patent portfolios can become a financial strain. However, PathShodh's long-term vision to scale globally justified their investment in maintaining patents in eight countries. The approach reflects an understanding of IP not as a static asset, but as a strategic enabler of future market access, partnerships, and investor confidence.

7. Addressing the cultural undervaluation of PhD-led innovation

Undervaluation of PhD research forms a unique and systemic challenge in India. Dr. Chauhan highlighted societal pressures, poor research stipends, and limited entrepreneurship exposure often leading PhD scholars to undervalue their innovation potential. By turning a PhD-derived technology into a market-ready product, PathShodh shattered the old story that PhDs only gather dust. The organisation showcased how institutional support, incubation, and IP strategy can transform scholarly research into scalable impact. The strategy emphasises the criticality of redefining doctoral research as a launchpad for high-tech entrepreneurship, rather than a mere academic degree.

PathShodh explores certification for European Conformity (CE)-marking to enter global markets and aims to develop modular diagnostic kits suited for export to markets in Asia and Europe. The startup's success reveals how startups can move from idea to international diffusion by:

- Protecting core IP while keeping manufacturing and R&D agile;
- Designing for local use but validating for global standards;
- Using public funds to de-risk early R&D, while pivoting to private capital for scale.

Conclusion: opportunities and emerging models

The Asia-Pacific region, while already one of the leaders of IP filings, stands at a turning point in its journey towards becoming an innovation-driven economy. Drawing on data from 150 Indian inventors with patents, empirical evidence highlights the key enablers of successful commercialisation. Inventors affiliated with incubators with strong IP cells are more likely to engage in commercialisation. Inventors with years of experience, broader networks, including mentors, legal experts, entrepreneurs and academicians, fare better in bringing innovations to market. However, the conversion of intellectual assets into market offerings is hampered by a continuing commercialisation gap, even in the face of notable advancements in patenting and IP creation. This disconnect is not solely due to lack of innovation, but due to systemic challenges such as limited funding availability, insufficient organisational support, high patent maintenance costs, regulatory hurdles, and market resistance from established legacy brands and underdeveloped IP-industry links.

The case of PathShodh Healthcare vividly illustrates a compelling roadmap for overcoming these barriers. PathShodh successfully navigated commercialisation hurdles by strategically leveraging government grants during its early development phase, building multidisciplinary networks. The startup benefited from incubation support, filed patents early, and actively engaged with regulatory bodies and industry stakeholders. While the journey was fraught with regulatory and funding delays, the firm managed to manufacture its technology through EMS (Electronics Manufacturing Services) firms in India, highlighting how structured support systems can bridge the commercialisation gap.

The integrated framework developed in this study (Figure 2) synthesises both empirical data and lived experience to highlight the interdependence between support mechanisms (such as incubation and IP services), ecosystem-level attributes (like funding access and networks), and individual factors (such as experience). By grounding this framework in quantitative evidence and real-world practice, it offers a robust roadmap for IP stakeholders.

Looking ahead, the Asia-Pacific region must foster an inclusive innovation ecosystem where inventors are empowered not just to protect their ideas but to deploy them meaningfully. By doing so, IP will cease to be a static legal instrument and become a dynamic force driving sustainable development, public health, technological sovereignty, and regional competitiveness.

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Strategic bundling of intellectual property

Theory, evidence, and policy of the IP mix

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Abstract

In today's fast-changing markets, especially in the Asia–Pacific region, protecting innovation requires more than just traditional patents. Many firms now adopt a combined approach—known as the "IP mix"—that uses patents, design rights, and trademarks together to protect how a product works, looks, and is recognised by consumers. This article examines how firms across different sectors use this strategy to reduce imitation and remain competitive, drawing on quantitative analysis and a case from Japan's apparel industry. The findings show that the effectiveness of the IP mix varies by firm size, sector, and institutional context—highlighting differences in private appropriation strategies. At the same time, from a theoretical perspective, the IP mix raises wider concerns about legal complexity, barriers to entry, and fair competition when protections are strategically bundled. These insights suggest that support systems and legal frameworks should reflect both sector-specific innovation patterns and the broader need to balance protection with openness in innovation ecosystems.

Introduction

In the Asia–Pacific region, businesses face growing challenges in protecting their innovations. With fast-paced markets, rising consumer expectations, and increasing competition—especially in industries like electronics, fashion, healthcare, and lifestyle goods—companies must not only come up with new ideas but also defend them quickly and effectively. At the same time, the rules and systems for protecting intellectual property (IP) vary widely from one country to another, making it difficult to apply a one-size-fits-all approach.

In many of these sectors, the way a product looks, feels, and connects with customers is just as important as how it works. But traditional patents often don't cover these aspects well. That's why many companies are now using a combination of protection tools—an "IP mix". This approach combines patents for function, design rights for appearance, and trademarks for brand identity. Together, they offer more complete protection that can help firms stand out, avoid copycats, and build long-term value.

This article explores how companies use the IP mix to protect their innovations—and what that means for business strategy and public policy. Drawing primarily on evidence from Japan, but with broader relevance across the region, the analysis looks at how different industries apply this strategy, what outcomes they achieve, and how governments can better support them. The goal is to offer practical insights for firms seeking to strengthen innovation protection and for policymakers aiming to design smarter IP systems in an increasingly complex and diverse region.

Why companies use the IP mix

Companies don't protect their ideas just to follow the rules. They use IP—such as patents, design registrations, and trademarks—as part of a broader strategy to shape how their innovations succeed in the market. These tools help safeguard different aspects of an idea: how it works, how it looks, and what it means to customers. This combined use of IP helps companies strengthen their position, stand out from competitors, and make their innovations harder to copy.

At the core, patents are used to protect technical features, like how a product functions. This encourages companies to invest in research and development, knowing they can stop others from copying the same technology. However, patents have limits. Many only cover narrow features, and competitors often find ways around them. That's why patents alone may not be enough—especially in markets where copying happens through product design or brand imitation.

Design registrations step in to protect how a product looks—its shape, layout, or decorative features. These are especially important in consumer markets, where first impressions and aesthetics influence buying decisions. Think of smartphones, sportswear, or home appliances—design often plays a big role in attracting customers. In these cases, visual design isn't just about style; it helps redefine how people experience and value a product (Verganti, 2009). Studies in Japan have shown that when companies operate in crowded markets with fast-changing trends, they increasingly use design rights to protect their uniqueness.

In fact, companies often time their use of IP tools strategically. For example, since design rights are granted more quickly than patents, firms may use them to protect a product's appearance early on, while waiting for the patent to be approved. In industries where products evolve rapidly or face high risks of being copied visually, this staggered timing offers a practical way to extend protection.

Trademarks add another layer by protecting brand identity—what a product represents in people's minds. They help customers recognise a brand, build loyalty, and trust the quality behind the name. Unlike patents and design rights, trademarks can be renewed indefinitely, making them powerful for long-term market presence.

Used together, these three tools offer more complete protection. This IP mix not only helps firms prevent imitation but also strengthens their brand and keeps products relevant for longer. It's especially useful for smaller companies and those in sectors like fashion, consumer electronics, or personal healthcare devices, where emotional appeal and aesthetics are just as important as technical features.

However, there's a fine line between protecting innovation and blocking competition. When IP tools are used to stop others from entering the market or to push up competitors' costs, they can have negative effects. In some cases, companies might use a bundle of IP rights not just to defend their ideas, but also to unfairly limit others'. That's why it's important to consider how IP is used—not just whether it exists. Laws and policies need to encourage fair competition while still rewarding creativity.

In short, the value of the IP mix lies in its flexibility. It allows companies to protect their ideas in ways that match how customers see and use their products—whether it's through function, appearance, or brand meaning. But the same strategy can be used either positively or negatively. Understanding this helps businesses, governments, and support agencies design smarter IP policies that promote innovation while keeping markets open and fair.

What the evidence shows

Many companies now use a combination of IP tools to protect their innovations. But does this approach actually improve business performance? The answer isn't always clear. Researchers have looked into this question, and their findings suggest that the results depend heavily on the company's size, the industry it's in, and how the IP is used.

Some early studies in Japan found that using multiple forms of IP together—like combining patents with design protection or trademarks—did not always boost company value. In fact, some firms seemed to choose between design and trademark protection based on what fit their business strategy, rather than using both. This shows that firms might see these tools as substitutes rather than complements.

Other research in Japan focused more narrowly on how combining design rights and trademarks affects profitability. One study looked at companies that already had either design protection or a trademark and asked whether adding the other helped improve their profit margins. The results showed no clear benefit from adding the second form of protection. This suggests that just piling on more types of IP doesn't always lead to better results—especially if the first form is already doing the job well.

However, different findings emerge when looking at how patents and design rights work together. In industries where technical performance matters—like information technology—companies that used both types of protection saw better productivity growth than those using just one. But this effect didn't appear in all sectors. For example, in the textile industry, combining patents and design rights didn't seem to provide much extra value. This tells us that the effectiveness of IP bundling depends heavily on the industry context.

The size of the company also makes a difference. Large companies often deal with many different products and may use a wide range of IP tools across their business. This makes it harder to tell if any one IP combination is responsible for their performance. Smaller companies, on the other hand, tend to focus on fewer products, which makes it easier to see how their IP strategy affects outcomes.

A study in the United kingdom (UK) looked at smaller firms and found mixed results (Helmers & Schautschick, 2013). Companies that combined patents and trademarks grew in terms of staff and assets, suggesting they were expanding internally. However, these same firms didn't necessarily see strong growth in sales. So, the gains from using an IP mix may be more about internal strength than immediate market success.

The most encouraging evidence comes from studies of smaller firms in Japan that are just beginning to use IP tools. One such study found that firms using all three protections—patents, designs, and trademarks—saw much stronger sales growth than firms with no IP at all. It also found that adding a patent to existing design protection had a particularly strong positive effect. This suggests that combining protections can work well when done strategically, especially for newer or smaller companies aiming to grow.

In short, combining different types of IP can help firms—but not always. The results depend on the company's goals, size, industry, and how thoughtfully the IP tools are used. For firms and policymakers alike, this means that IP strategy should be tailored, not one-size-fits-all. A well-considered combination of protections may provide real advantages—but only when matched to a company's specific circumstances and innovation goals.

Case Study: Wacoal's IP mix strategy for CW–X

Wacoal Corporation, headquartered in Kyoto, is a leading manufacturer of innerwear, sportswear, and functional garments. A cornerstone of its innovation strategy is the Wacoal Human Science Research Institute, established in 1964. Drawing on decades of body movement research and anthropometric data, the institute develops clothing that supports both comfort and function. Its current focus includes how the body moves externally (such as posture) and internally (such as muscles and joints), allowing the company to design performance wear backed by scientific research.

From elite athletes to everyday users

One of Wacoal's signature innovations is its CW–X line of performance garments. Originally designed for athletes to support motion and reduce muscle fatigue, CW–X has earned praise from professionals across various sports.

More recently, Wacoal expanded the technology into products for everyday use, such as the Light-Movement Shirt, which helps support common movement areas like shoulder blades, hips, and knees. These garments aim to improve comfort and mobility for a broader audience, including older adults and non-athletes.

Protecting innovation through a layered IP strategy

What sets CW–X apart is its strategically designed compression zones—most notably around the thighs—that assist with leg movement. To safeguard this innovation, Wacoal uses a combination of IP tools:

Utility Patent No. 4061336 protects the functional structure of the garment.

Design Patent No. 1324024 covers the visual design, including the layout of compression zones.

Trademark Registration No. 4640682 secures the CW–X brand identity.

Wacoal further strengthens its position by registering partial and related designs, allowing it to protect variations in product appearance across its full line.

Counterfeit challenges and the IP mix in action

In 2013, counterfeit versions of CW–X garments began appearing in Japan, often imported from overseas and sold through online channels. These lookalike products mimicked CW–X's design but used lower-quality materials and lacked the original performance features. Some buyers, unaware they had purchased fakes, contacted Wacoal's customer service—leading to the discovery and investigation of the counterfeit networks.

Wacoal's IP mix proved crucial. Although the fake garments altered some structural features—making it difficult to claim infringement under utility patents—the visual similarities allowed Wacoal to take legal action based on its design rights. This led to sales bans and product takedowns. To reinforce protection, Wacoal also implemented a broader anti-counterfeit campaign: it issued online warnings to consumers, requested customs inspections to block imports, monitored online marketplaces, and asked platforms to remove listings of fake items.

Lessons for the region

The CW–X case shows how a combined IP strategy—using patents, designs, and trademarks together—can offer stronger and more flexible protection than any single tool alone. This is especially important in sectors like fashion, sportswear, and lifestyle tech, where how a product looks and feels matters as much as how it functions. Wacoal's example highlights the importance of registering design variations and being proactive in enforcement, especially in markets where counterfeiting is a risk.

For businesses across the Asia–Pacific region, CW–X offers a practical model for using the IP mix to protect valuable products and build long-term customer trust. Whether for large firms or emerging brands, a well-integrated IP strategy can make the difference between innovation that thrives—and one that's quickly copied.

Policy insights

The evidence suggests that there's no single best way to use IP. Instead, how firms combine patents, design rights, and trademarks depends heavily on the nature of their industry and how innovation happens in that field. Some sectors rely on scientific breakthroughs, others on engineering know-how, and still others on creative expression and brand identity. Each of these calls for a different mix of protection.

For example, in industries like pharmaceuticals, where progress is driven by scientific discovery, patents are the key tool. In these fields, companies often license their technologies and partner with universities or research centers. By contrast, in sectors like machinery, innovation comes more from hands-on problem-solving and engineering improvements. These companies may focus more on protecting trade secrets and building internal expertise than on collecting patents. In creative fields like fashion, what sets products apart is often how they look or what they represent. Here, trademarks and design rights are more important than technical patents. These forms of protection help firms preserve their visual identity, support branding, and stand out in the marketplace.

To support these different needs, public policies and IP support programs must be tailored. Agencies that provide IP guidance—such as patent offices or innovation centres—should offer advice that fits each sector's unique conditions. In fashion, that means helping businesses protect visual design and build strong brands. In pharmaceuticals, the focus should be on improving patent quality and connecting firms with research institutions. In mechanical industries, support should center on building balanced IP portfolios that match gradual innovation processes.

To design effective policy support, it is essential to recognise that innovation takes different forms across industries—and so does the optimal use of IP. Table 1 summarises how various sectors innovate, which IP tools best suit their needs, and what kind of policy support can help firms in each domain make the most of their IP strategy.

Another issue is timing. In some countries, design and trademark rights are approved much faster than patents. While this can be helpful, mismatches in approval timelines may discourage firms from using multiple forms of protection together. Policymakers can address this by streamlining the review process, especially for small and medium-sized enterprises (SMEs), to make it easier for them to combine different IP tools effectively.

Support is especially important for newer and smaller firms that may be using IP for the first time. These businesses often benefit the most from combining different protections, but may lack the knowledge or resources to do so. Governments can help by offering subsidies for multi-IP applications, providing diagnostic tools to identify protection gaps, and offering hands-on guidance tailored to firms' innovation goals.

For industries that rely heavily on design and branding, international expo-

Table 1. Sector-specific IP strategies and recommended policy support

Category	Science-based sector	Engineering-based sector	Creative sector
Examples	Pharmaceuticals, semiconductors	Automotive, machinery	Fashion, consumer electronics, architecture
How Innovation Happens	Scientific research and lab discoveries	Step-by-step improvements and problem-solving	Creativity, aesthetics, and brand identity
Best-Suited IP Tools	Patents	Trade secrets, technical advice	Design rights, trademarks
Helpful Policy Support	Improve patent quality, support licensing, link firms with research institutions	Provide tailored IP advice, support for incremental improvements	Support branding, design registration, and fast-track IP processes for SMEs

Author's elaboration based on Fukugawa (2018).

sure is also vital. Programs that support overseas trademark registration, global branding strategies, or joint product development with foreign partners can help firms expand their reach and strengthen the value of their symbolic assets.

However, while combining IP tools can help protect innovation, it can also be misused. As the findings show, firms that bundle multiple IP rights don't always perform better. Beyond these firm-level issues, using multiple IP rights together can create barriers that make it harder for others to enter the market, especially when companies combine rights over a product's design, function, and brand. This is similar to the idea of "patent thickets," where many overlapping rights—held by different firms—make it costly and complex to innovate. These problems go beyond individual business concerns and raise wider public issues around competition, entrepreneurship, and access to knowledge. To respond, IP policy should not only focus on clarifying the rules between different rights, but also on how the combined use of IP affects markets more broadly. This means better coordination between IP offices and competition regulators, and regular reviews of how IP strategies are shaping innovation—especially in fast-moving, design-led industries.

Conclusion

The key takeaway is that IP strategies should be tailored to each sector's specific needs. Public support systems must recognise these differences and help firms—especially SMEs—choose and manage the right combination of protections. At the same time, regulators must ensure that IP rights are not misused to block fair competition. When companies use too many overlapping rights to keep others out of the market, this can hurt innovation rather than help it.

Policymakers must also address the legal and procedural complexity that arises when IP rights overlap. Without clearer boundaries between rights like copyright, design, and trademarks, firms may unintentionally lose protection—or use the system in ways that reduce openness and discourage new entrants.

In the Asia–Pacific region, where industries and legal systems differ greatly, striking the right balance between protection and openness is especially important. The IP mix is not a fixed recipe—it's a flexible strategy that must be adapted to different business goals and market realities. Understanding both its benefits and its risks is essential for companies and policymakers who want to support innovation while keeping markets fair and dynamic.

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Advancing technology commercialization through IPRs and academic ecosystems

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Abstract

This study explores the commercialization potential of multiple technologies to support carbon neutrality, focusing on early-stage supply chains, startups, and academic ecosystems. Many university-developed innovations struggle to cross the "valley of death" due to limited readiness and weak market alignment. Through stakeholder analysis, case studies, and a review of the literature, the study emphasizes how user behaviour and risk perception affect adoption, especially when it comes to early adopters and the early majority. Based on work from Universitas Sebelas Maret, Indonesia, four strategies are proposed for advancing technology commercialization through Intellectual Property Rights (IPRs) and academic ecosystems: leveraging student/researcher competencies, activating TTOs and TICs, fostering supply chain collaboration, and strengthening academic entrepreneurship to enhance market readiness and innovation outcomes.

Introduction

The United Nations' 17 Sustainable Development Goals (SDGs) aim to ensure decent lives for all while preserving a healthy planet by 2030. Leveraging innovative technologies to reduce CO_2 emissions is essential to achieving the goals, including SDG-7, SDG-9, and SDG-13. However, the transition from technological development to commercialization often faces significant challenges—commonly referred to as the "valley of death." Many intellectual property rights (IPRs) resulting from technological innovations fail to cross the "chasm" between early adopters and the early majority, hindering their widespread adoption (Hindle & Yencken, 2004; Valentin et al., 2016; Sutopo et al., 2022).

This study emphasizes the crucial role of early-stage supply chains, technopreneurs, startups, and academic ecosystems in facilitating the diffusion of emerging technologies. These elements are vital for bridging the gap between innovation and commercialization. Early-stage supply chains are key enablers in overcoming the "valley of death" by supporting the transition of innovations from academic or prototype phases to real-world applications and market readiness (Pisano, 2006; Sutopo et al., 2022).

We assess the market potential of multiple technologies (MTs)—including battery-powered electric vehicles (EVs), hybrid systems, hydrogen solutions, and conversion technologies—in supporting carbon neutrality (CN) and advancing SDG 7: Affordable and Clean Energy. However, challenges such as unprofitable business models, weak supply chains, limited charging infrastructure, and non-renewable electricity sources hinder mass adoption. Addressing these issues requires deeper research on business models, sustainable supply chains, charging technologies, renewable energy, and energy storage. In addition, supportive policy frameworks are essential. Institutions that can serve as research hubs, technology developers, and commercialization enablers play a crucial role in driving this transformation.

A framework for advancing technology commercialization

This study examines the relationship between technology commercialization and the "chasm," illustrated in Fig. 1, by addressing three key questions: (i) how to bridge the "valley of death," (ii) how to align technology with product development, and (iii) how to cross the chasm to wider adoption. Building on previous work by the Industrial Engineering and Techno-Economics Research Group (GR RITE), Faculty of Engineering, Universitas Sebelas Maret, the study follows the group's roadmap and guiding motto: *"Enhancing collaboration and innovating solutions to synthesize market problems into industrial engineering knowledge"* (link). A mixed-methods approach is employed, integrating prior research findings, case studies, and stakeholder analysis conducted by GR RITE.

Despite continuous innovation, many technologies developed by higher education institutions (HEIs) struggle to achieve commercialization due to the *"valley of death"*—the critical gap between research and market adoption. This stage is often marked by limited resources, low technological and business readiness, and weak market alignment (Markham et al., 2010; Stefan, 2022; Flinn, 2019). As a result, innovations frequently lack commercial viability, fail to meet industry standards, and are difficult to scale (Chirazi et al., 2019; Sutopo et al., 2022).

To overcome the challenges posed by the chasm, open innovation and robust intellectual property rights (IPRs) are essential. They enable effective collaboration while protecting technological assets. Equally important is the strengthened integration of the university's core pillars—Education & Teaching, Research & Development, and Community Service

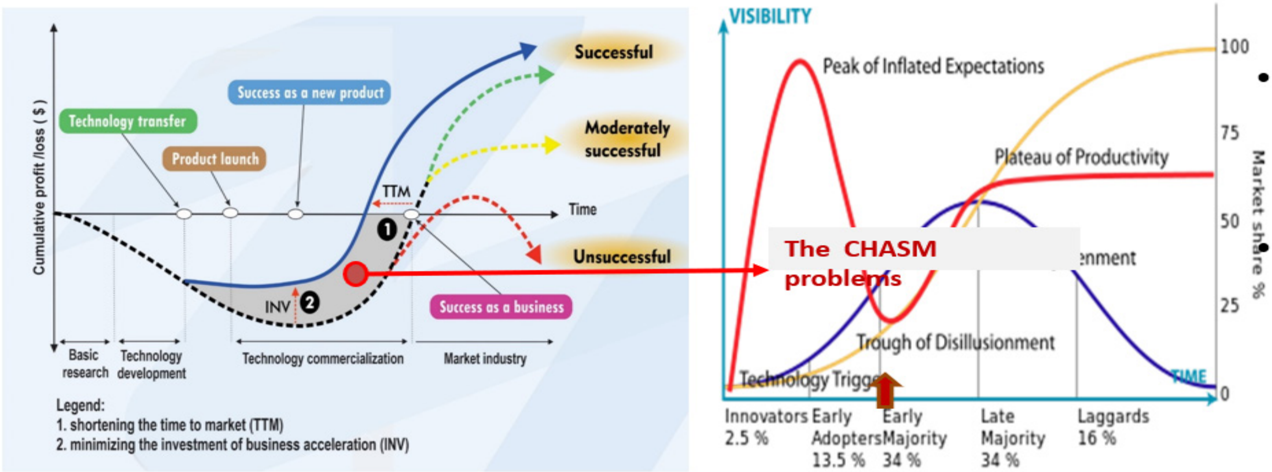


Figure 1: Technology commercialization and the chasm

(Adapted from Sutopo et al., 2022 and Moore's technology adoption life cycle curve, 2014)

(E&T–R&D–CS)—to enhance technology readiness and market alignment.

Case studies advancing technology for carbon neutrality

The Industrial Engineering and Techno-Economics Research Group (GR-RITE) at the Faculty of Engineering, Universitas Sebelas Maret, has consistently aligned its activities with the university's three pillars, E&T–R&D–CS. In doing so, GR-RITE has also adopted an open innovation approach and maintained strong management of intellectual property rights (IPRs) to foster both collaboration and protection of technological outputs.

The group's contributions are reflected in a variety of forms, including peer-reviewed journal publications, conference proceedings, IPR registrations, and community engagement programs. In recent years, GR-RITE has placed a strategic focus on adoption-diffusion, supply chain development, and the commercialization of technologies that support carbon neutrality—particularly in the areas of energy storage systems, electric vehicles (EVs), and EV conversion.

The integration of the university's three pillars

The integration of the university's three pillars—Education & Teaching, Research & Development, and Community Service (**E&T–R&D–CS**) is emphasized to improve market readiness (**Fig.2**).

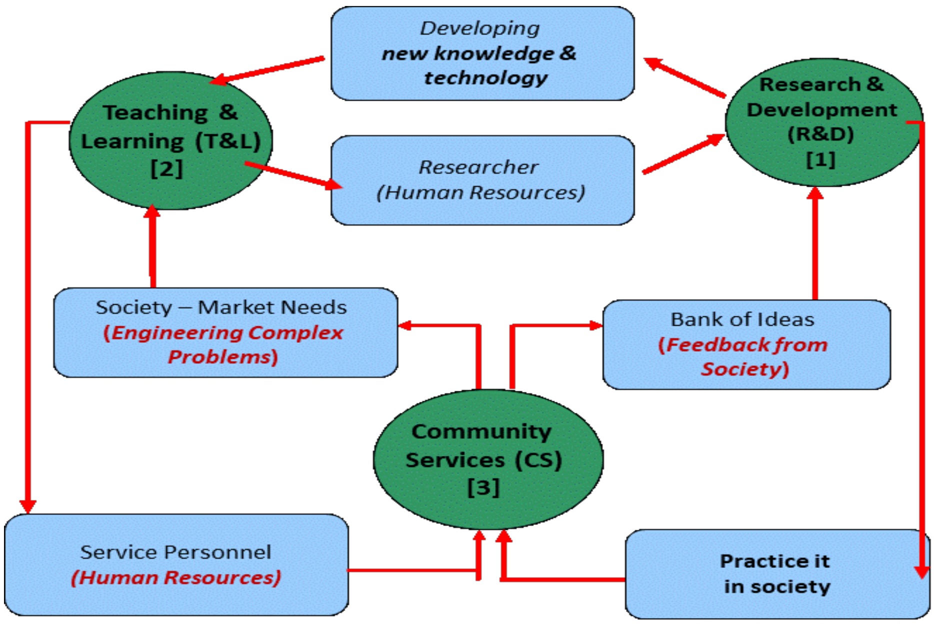


Figure 2: Framework to integrate the university's three pillars

(Source: Author)

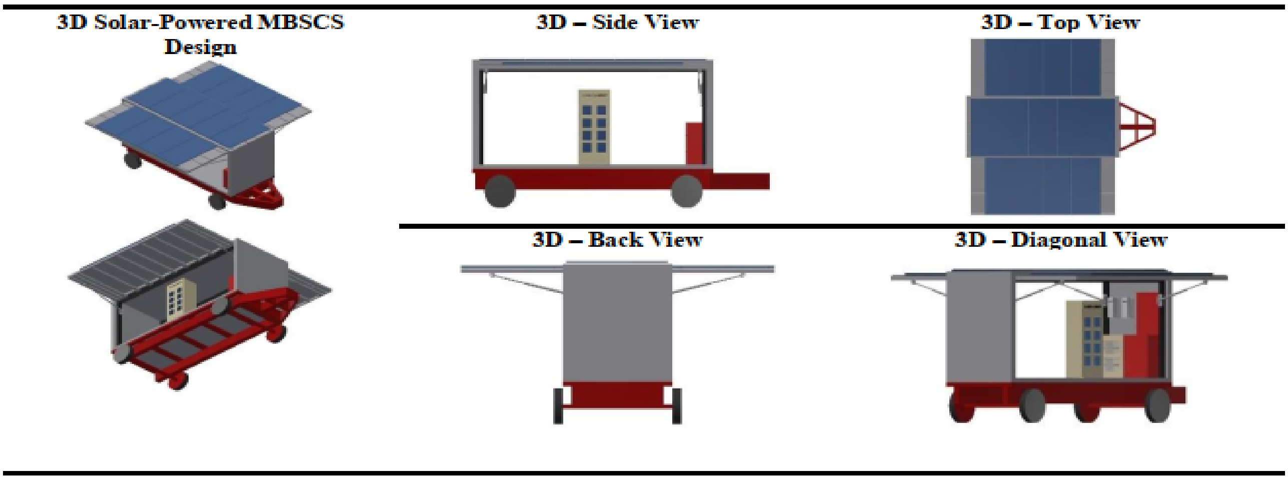


Figure 2: One of GR-RITE's innovations: the Mobile Battery Swap Charging Station (MBSCS)

(Source: Author)

Research & Development (R&D)- [1]

Researchers at GR-RITE conduct R&D guided by a clear roadmap to generate innovations with commercialization potential, protected through intellectual property rights (IPRs). These outputs ranging from technological artifacts and models to systems and policies address real-world challenges and support carbon neutrality. Key research areas include:

- Market validation studies identifying factors influencing EV adoption and diffusion (Aditya et al., 2024; Agustina et al., 2025; Utami et al., 2020; Yuniaristanto et al., 2024).
- Early-stage supply chain organization to support new technologies (Sutopo, 2022; Wardayanti et al., 2018; Zainida et al., 2022).
- EV standardization and infrastructure development, focusing on swappable battery charging systems in Indonesia (Aqidawati et al., 2022; Priyandari et al., 2023; Sutopo et al., 2018; Sutopo, Prianjani, et al., 2022).
- Location and allocation studies for EV charging stations (Istiqomah et al., 2022).
- Life cycle cost and techno-economic analyses of EVs and their infrastructure (Afraah et al., 2021; Chaniago et al., 2025; Hafidza et al., 2022; Kurniyati et al., 2016; Yuniaristanto et al., 2023).
- Research on interoperability of EV charging stations, particularly for swappable batteries on electric motorcycles (Fahma et al., 2023, 2024).
- Studies on EV conversion, especially electric motorcycle conversions (Habibie et al., 2020, 2021; Widiawati et al., 2024).
- Commercialization strategies for electric vehicles (Afraah et al., 2023; Pujotomo et al., 2025; Sutopo, Khofiyah, et al., 2022; Sutopo, 2022).

In addition to academic outputs, GR-RITE has developed technological innovations protected by intellectual property rights (IPRs), including industrial designs and publications (Fig. 2). A notable innovation is the Mobile Battery Swap Charging Station (MBSCS), which integrates renewable energy, battery swapping, and mobile charging technology. GR-RITE's work on MBSCS spans from literature review (Rahmania et al., 2022) to design development (Chaniago et al., 2023; Rochani et al., 2024) and business model formulation (Rochani et al., 2023), covering the full cycle from technology creation to commercialization. The MBSCS industrial design is registered with the Indonesian Intellectual Property Office.

Teaching & Learning (T&L)-[2]

Research findings are integrated into teaching materials, ensuring that students gain industry-relevant knowledge and skills. This enriches teaching and learning (T&L) and prepares graduates to meet evolving market demands. Moreover, GR-RITE has published books in *'Bahasa Indonesia'* focusing on EV-related topics such as early supply chain management, open innovation, and interoperability, further supporting the group's commitment to a clear and focused research roadmap (Fig. 3). This roadmap ensures research efforts are aligned with commercialization goals and the adoption-diffusion of EV technologies in Indonesia and the ASEAN region.

Community Services (CS)-[3]

Through community service (CS), research is applied in practice via consultation, supervision, and support for tech commercialization. GR-RITE collaborates with industry, startups, and government to promote sustainable technology adoption and strengthen academia–society linkages. This stage helps build market confidence and bridge "The Chasm" by validating technologies with real users. Community service also provides valuable feedback for iterative development. Figure 4 shows GR-RITE's outreach activities of Community Services.

Figure 4 presents the GR-RITE community service project conducted throughout 2023 to increase public awareness and acceptance of electric vehicles and renewable energy technologies. This project, which was located in the Refugia Garden in Mage-

(a) (b) (c) (d)

Figure 3: Selected GR-RITE books related to MTs innovation, (a) EV adoption-diffusion; (b) EV market readiness; (c) Technology incubation in HEIs; (d) EV charging station location-allocation

(Source: Author)

(a) Implementation at Public Facilities

(b) Design of Battery Swap Charging Station

Figure 4: Selected GR-RITE's outreach activities of community services.

(Source: Author)

tan, East Java, included an interactive learning tool that was painstakingly designed to mimic the adoption and diffusion of technology. The installed technologies included an IoT-based smart farming system, a rooftop solar power facility, a battery swapping station for electric vehicles, electric and converted motorcycles, and solar-powered public street lighting. By utilizing a Participatory Rural Appraisal approach, the program actively involved community members and partners in the design, training, and evaluation stages, and the results included the installation of educational media, the creation of scientific and popular publications, and the distribution of information via video content. This project not only supports the shift to sustainable energy but also creates local economic opportunities driven by technological innovation.

Open innovation and strong intellectual property rights

An open innovation system—linking supply chain actors, universities, and government—enables faster adoption and diffusion of technologies, such as swappable batteries (Aqidawati et al., 2022). Open innovation fosters knowledge sharing, while IPRs protect ownership, striking a balance between collaboration and security. This synergy is crucial for bridging the "valley of death" and crossing the "chasm," increasing the success rate of technology commercialization and long-term market impact.

Figure 5 presents the open innovation dynamics of swappable batteries. The inbound process encompasses the amalgamation of scientific and technological advancements along with the external expertise of professionals representing diverse stakeholders from multiple organizations. This initiative seeks to collect stakeholder insights to promote shared understanding and fulfil the needs of the interested parties, engaging academia, manufacturers,

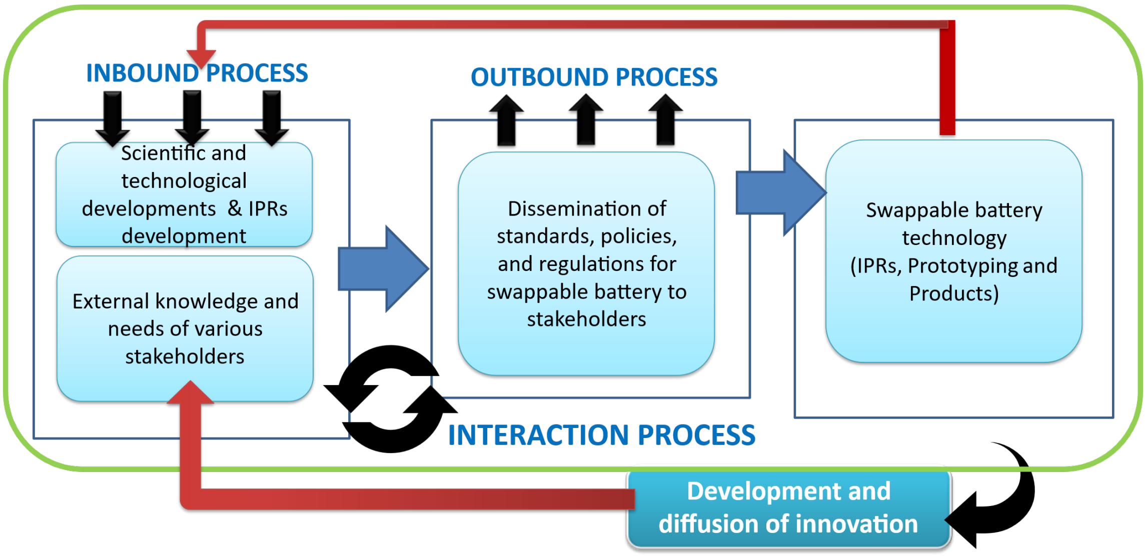


Figure 5: Integrating open innovation with IPR strategies

(Source: Author)

consumers, government entities, and a standardization authority. The outbound process involves delivering standardization results, such as standards, policies, and regulations, that cater to the requirements of pertinent stakeholders. During this phase, standards are launched into the market and business landscape. The standardization agency has executed this step through the dissemination of standards to battery manufacturers, direct engagement by organizing workshops with stakeholders, and promotion and outreach to various involved parties. New standards are developed from previous iterations through the interaction process, which also introduces new players into the standards development framework. As a result, people who use standards may become standards developers. During this stage, the parties involved in developing standards for swappable batteries have learned from the past while combining new developments and experiences to create new standardization results.

Lessons learned from case studies

Since 2014, GR-RITE has focused on system design to enhance productivity and efficiency in technology commercialization. Their contributions include research and IPRs on lithium battery business models, electric motorcycles, EV charging infrastructure, early-stage supply chains, and renewable energy integration. GR-RITE plays a strategic role in research, technology scanning, prototype development, policy briefs, and commercialization efforts. Research groups (RGs) in higher education institutions (HEIs) offer agility and specialization, enabling focused innovation, whether theoretical, technical, or market-oriented. Based on the insights from case studies conducted by the Techno-Economics Research Group (GR RITE) at the Faculty of Engineering, Universitas Sebelas Maret, we propose four strategic actions to advance technology commercialization:

1. **Leverage student and researcher competencies** to drive innovation and accelerate development.

   Product development transforms validated technologies into market-ready innovations, progressing through concept, prototyping, and release stages. Leveraging student and researcher competencies, especially in engineering is key to advancing Technology Readiness Level (TRL) and Market Readiness Level (MRL) across products, processes, and business models (Fig. 6). Students and researchers are encouraged to address key questions across the Product Development Cycle (PDC):

   PDC 1–2 (Ideation & Validation):

   - Q1: What problems will the product solve, and what obstacles exist?
   - Q2: Is the idea validated through market or technology drivers?

   PDC 3–5 (Prototyping & Product):

   - Q3: What is the TRL of the product?

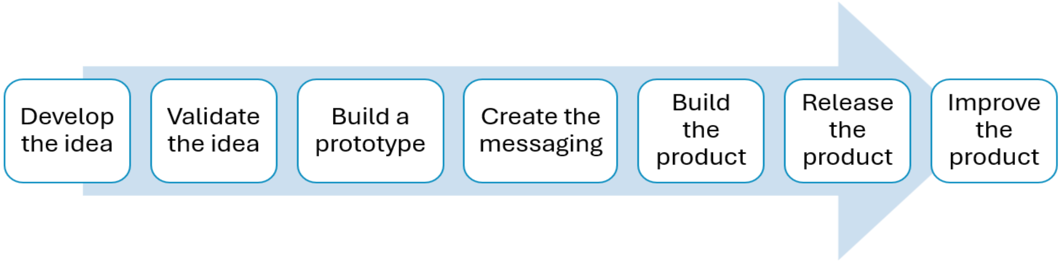
   PDC 6–7 (Release & Scaling):

   - Q4: What is the MRL of the product?
   - Q5: Which engineering competencies can support each stage?

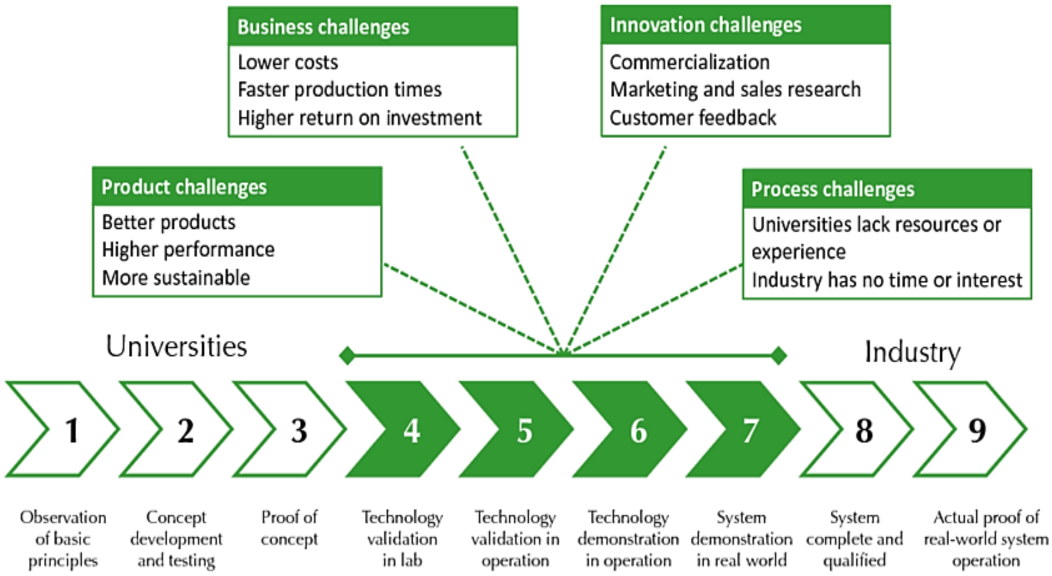
Building industrial networks through internships, collaborative projects, and tech transfer strengthens these competencies. This approach is further enhanced by project-based learning (PBL) and student participation in applied research.

2. **Activate Technology Transfer Offices (TTOs)** and **Technology Innovation Centres (TICs)** to enable effective knowledge transfer and commercialization.

   For different stakeholders in the innovation ecosystem to benefit, TTOs and TICs are crucial in promoting creativity, innovation, and entrepreneurship. Making sure that innovative concepts and scientif-



(a) Stage of product development cycle (PDC)



(b) Technology Readiness Level (TRL)

Source: Hensen et al. (2015)

Level	Market Readiness	Level	Market Readiness
[redacted]			

(c) Market Readiness Level

Figure 6: Leverage engineer's **competencies** to raise tech and market readiness in innovation.

(Source: Author)

ic findings can flow naturally from theoretical frameworks to useful goods and services that can be used in the marketplace is essential to maximizing the impact. By bringing creative solutions into line with practical demands, this relationship not only promotes economic growth but also tackles societal issues. TTOs manage intellectual property, licensing, and industry collaboration, while TICs support technology validation and business incubation. Researchers can partner with these offices to navigate funding, legal, regulatory, and market challenges. At GR-RITE, collaboration with TTOs and TICs helps transform innovations into market-ready solutions by aligning research with business and legal frameworks.

3. **Promote early-stage supply chain collaboration** to support the transition from prototype to market.

The creation of an early supply chain is crucial because it provides a solid basis for fostering and promoting prompt and efficient cooperation

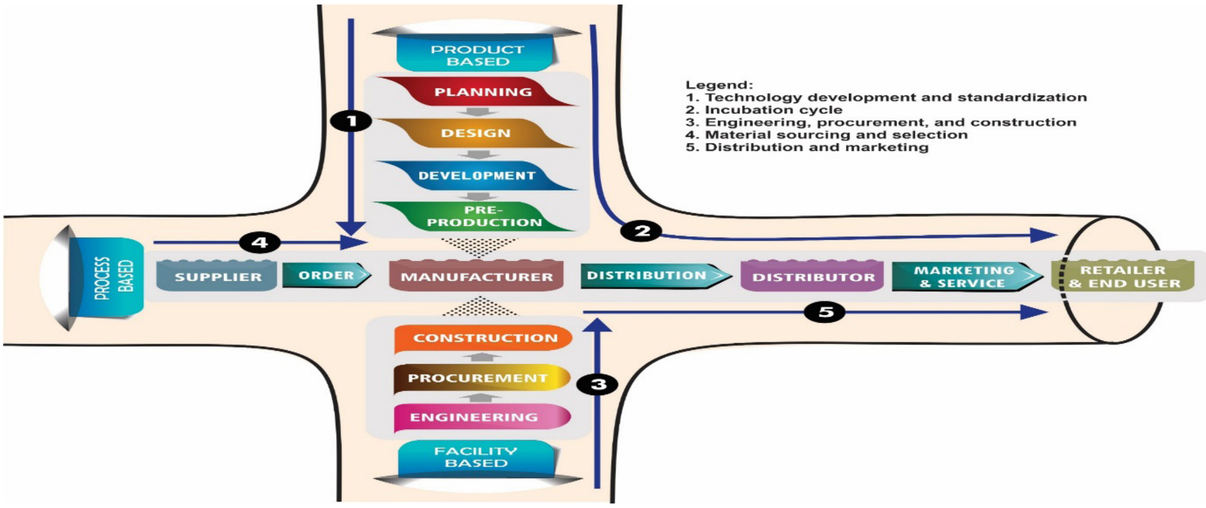


Figure 7: Early supply chain framework for innovation product

(Source: Author)

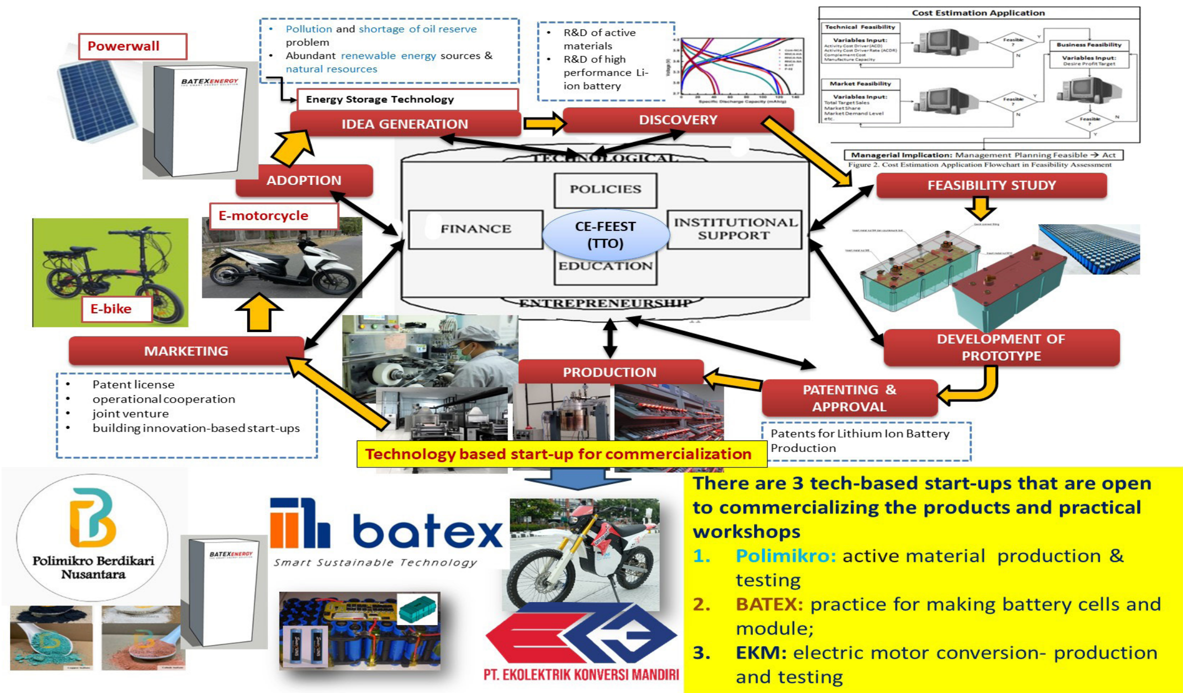


Figure 8 Framework of lessons learned for building entrepreneurial capacity in academia

(Source: Sutopo et al., 2022)

among suppliers, distributors, and end users, among other stakeholders. This, in turn, guarantees that the innovations being developed are effectively in line with the real-world logistics of the real world as well as the constantly changing needs and demands of the market. GR-RITE emphasizes integrating supply chain partners from the start to facilitate a smooth transition from prototype to market. This reduces scaling risks and supports faster adoption of new technologies. GR-RITE identified five key interventions using an early supply chain framework (Fig. 7: (i) tech development and standardization, (ii) incubation cycles, (iii) facility design (EPC/ Engineering, Procurement, Construction), (iv) material sourcing, and (v) distribution and marketing. Open innovation was actively implemented through collaboration among supply chains, universities, and government stakeholders to accelerate the diffusion of technology.

4. **Foster entrepreneurial capacity in academia** to transform research outputs into viable ventures.

GR-RITE drives a culture of technopreneurship by transforming research into viable ventures (Fig. 8). Through frameworks on innovation, technology transfer, and entrepreneurship—such as those developed at the Centre of Excellence for Electrical Energy Storage Technology (CE-FEEST) and the GR-RITE support startup development via training, mentoring, and multidisciplinary teams. Research groups also act as incubators, guiding commercialization strategies to ensure innovations create both economic and societal impact.

Conclusion and future work

This study presents a method for advancing technology commercialization by integrating intellectual property rights (IPRs) and academic ecosystems. This methodology underscores the congruence of the university's three fundamental pillars, including Education & Teaching, Research & Development, and Community Engagement, with the principles of open innovation and intellectual property rights (IPR) frameworks. Utilizing case studies, the execution entails harnessing the capabilities of students and researchers to propel innovation, activating institutional structures such as Technology Transfer Offices (TTOs) and Technology Innovation Centres (TICs) to facilitate commercialization, encouraging collaboration throughout nascent supply chains to bolster market readiness, and nurturing entrepreneurial aptitude within academic environments to foster a more vibrant and adaptive innovation ecosystem. These initiatives contribute to industrial engineering through the development of models, methods, and system designs that enhance productivity, and efficiency, and support carbon-neutral innovation.

Our research roadmap focuses on generating new knowledge and IPRs—such as technological artifacts, know-how, policies, and system models—which are incorporated into teaching and applied through community service. In the future, we plan to implement a structured case study to evaluate the real-world effectiveness of the proposed framework and further refine our approach to support sustainable technology commercialization.

Acknowledgement

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The role of universities in IP-driven technology transfer

Fostering innovation through policy and practice

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Abstract

This article explores how universities increasingly leverage intellectual property rights (IPRs) to foster innovation and enable technology transfer. It discusses the evolving role of academic institutions as commercialisation engines through the creation of robust IP policies, Technology Transfer Offices (TTOs), and university spin-offs. With case studies from India, the article illustrates how institutional mechanisms, policy frameworks, and public-private collaboration contribute to successfully transforming research into market-ready solutions. The article concludes with recommendations to enhance IP-driven technology transfer ecosystems in developing countries.

Introduction

Technology transfer is a collaborative process that facilitates the transfer of scientific knowledge and intellectual property (IP) from the developer, for instance, from universities or a research institute to users in the form of new products and services for the benefit of society[1]. It is a movement of information, materials, inventions, technical knowledge or trade secrets and software from one organisation to another for use with different purposes[2]. In the context of universities, IP-driven technology transfer commercialises the university's intellectual property rights-protected research findings, such as copyrights, patents, or trade secrets. The transfer is often executed through licensing agreements with industry associates.

In the broader context, effective technology transfer is important for promoting economic growth around the world[3]. Technology transfer supports the dissemination of encouraging innovation, new technologies, economic growth, and worldwide collaborations among competent institutes. It fosters the practical applications of newly developed knowledge into practical applications and enhances the productivity and overall well-being of the world[4]. It leads to the creation of new organisations, industries, and employment, and promotes economic activities. Technology transfer allows new technology and knowledge for more users worldwide and involves training and development for skilled human resources. Hence, countries enhance their overall national innovation capacity by adopting new technologies through technology transfer.

Role of universities as innovation hubs

Universities play an important role in the economy, serving as centres for developing and disseminating new knowledge that fosters technological advancement and economic growth (Hsu et al., 2014). Historically, universities primarily emphasised generating new knowledge, making it accessible to all, and leveraging industry with this knowledge for commercial applications (Sattiraju et al., 2022). Universities have become the catalyst for economic growth by actively collaborating in transferring knowledge from their research labs to the industry (Cai et al., 2020; Meléndez et al., 2020). This is possible because the universities have developed innovation strategies and intellectual property rights (IPR) policies that protect and empower them to create and commercialise the innovations they developed (Sattiraju et al., 2022; Bulsara et al., 2013). In recent times, universities have strategically managed their IPR policies to manage technology transfer activities (Urze & Abreu, 2015). Universities adopt various mechanisms to translate the technologies to commercialisation (Phan & Siegel, 2006). It includes patented and non-patent knowledge, such as data, software, and know-how (Marr & Phan, 2020). An effective technological

1 https://www.wipo.int/en/web/technology-transfer

2 https://www.twi-global.com/technical-knowledge/faqs/what-is-technology-transfer#:~:text=Tech%20transfer%20allows%20research%20to,Transfer%20is%20Adapted%20by%20SMEs

3 https://www.wipo.int/en/web/technology-transfer

4 https://thelegalschool.in/blog/advantages-of-technology-transfer

transfer is achieved through a strong innovation ecosystem, collaboration among industry, government, and universities, and the collection of resources and expertise that jointly foster economic development (Bandt, 1999). The successful technology transfer required bridging the gap between academia and industry and resolving areas of concern where universities' knowledge remains as just a publication and uncommercialised, as industry's unawareness of the presence of new know-how (Новородовська et al., 2020).

Collaboration between universities and industry is crucial for technology transfer and promoting innovation by working together. They can fuel the development and commercialisation of new knowledge that fosters innovation in products and services (Hailu, 2024). These collaborations create opportunities for entrepreneurship, employment, and economic growth (Hailu, 2024). However, the relationship between universities and industry faces many challenges, such as conflicts of interest and accountability (Merrill & Mazza, 2010). Despite the challenges, these collaborations are key ecosystems to develop and commercialise university research (Kneller et al., 2014). For successful partnerships with industry and technology transfer, a deep understanding of industry and market needs is important (Benam et al., 2021). Universities need to adapt and customise their curricula to identify the knowledge with practical applications (Sharma & Garg, 2019). The collaboration requires effective leadership and management skills within the universities to become successful centres of technology transfer (Seppo & Roolaht, 2012).

Universities work with their technology transfer offices, incubation centres, and technology or science parks to nurture and create knowledge within the universities (Łobacz, 2018). These catalysts are important in translating academic research into marketable products and services and provide an ecosystem to support university entrepreneurship activities (Hench, 1990). These support structures, therefore, play a pivotal role in helping universities meet their technology transfer objectives and contribute to economic growth. It helps to create new companies based on IPs developed within the universities.

Improving university-based research commercialisation will allow academic researchers to be more active and successful entrepreneurs. Intellectual property will progress more freely in the marketplace to benefit inventors, universities, and society (Vanderford & Marcinkowski, 2015). Startups can focus on technology transfer and eventually become financially independent and self-sustaining in this enabling environment. Academic entrepreneurship and the university model of technology business incubation offer benefits to the country, local community, and university in terms of economic development, diversification, job creation, technology development, viable firms, successful products, and increased university income and prestige (Lyken-Segosebe et al., 2020). However, university and faculty culture and faculty members' knowledge and skills in entrepreneurship and social capital may restrain this potential. Enhancing the commercialisation of university-based research will enable academic researchers to become more active and prosperous businesspeople, facilitating the free flow of intellectual property to the market for the benefit of society, universities, and inventors (Vanderford & Marcinkowski, 2015). In this supportive atmosphere, startups can concentrate on technology transfer and eventually achieve financial independence and self-sufficiency. In terms of economic development, diversification, job creation, technology development, viable firms, successful products, and increased university income and prestige, academic entrepreneurship and the university model of technology business incubation benefit the nation, local community, and the university (Lyken-Segosebe et al., 2020). However, this potential may be limited by the culture of the university and its staff and their expertise in social capital and entrepreneurship.

Government policies and the public's desire for technology-based economic development have propelled universities to become centres of knowledge transfer and entrepreneurship (Ahamat et al., 2021). Government policies significantly contribute to the growth of university knowledge transfer and entrepreneurship by implementing measures like financing programs and tax incentives. By promoting involvement and establishing new businesses, these policy initiatives support the development of entrepreneurial environments within the universities. Governmental initiatives have been developed to boost economic advancement and innovation via university knowledge transfer and entrepreneurship (Duruflé et al., 2018). Nonetheless, it is crucial to create regulations supporting technology transfer initiatives while protecting the integrity and objectivity of scholarly research.

Universities play a crucial role in encouraging innovation through active engagement with industry partners to assist in transferring technology and information. Universities can increase the likelihood of successful technology commercialisation by working with industries to ensure their research meets industry demands. University-business partnerships boost technology transfer's economic impact and speed it up.

Institutional mechanisms supporting technology transfer

Universities are important research centres for innovations and new technologies. Universities facilitate technology transfer through specialised centres called technology transfer offices (TTOs), direct research collaborations, and spin-offs creating start-up companies, technology parks, and industry partnerships. They act as a catalyst for industry collaborations, encouraging entrepreneurial initiatives (Bulsara et al., 2010), developing skilled human resources, and translating research into practical applications[5]. Technology transfer from universities promotes economic growth and improves overall living standards.

5 https://innovation-entrepreneurship.springeropen.com/articles/10.1186/s13731-024-00370-y

The following are the mechanisms that universities use to transfer technology.

Formal licensing agreements: Formal licensing is the most prevalent and structured mechanism for university technology transfer. It involves the university, as the owner (licensor) of intellectual property, granting specific rights to a third party (licensee) to use and commercialise that IP. The primary objectives of such agreements are multifaceted: to ensure the diligent commercialisation of university technologies for public benefit, to comply with federal and institutional policies, and to generate a reasonable financial return for the university and its inventors.

University spin-off companies: Another important formal method for technology transfer is university spin-off businesses, sometimes called spin-outs. These are brand-new businesses established to market technology innovations created by university researchers, frequently by staff, teachers, or students. When a spin-off is formed, the university's intellectual property—mostly patents or copyrights—is usually transferred to the new business company or licensed.

Industry collaborations and research consortia: Universities work closely with industry partners and through research consortia in various ways in addition to direct IP licensing and spin-offs. These interactions include staff exchanges, collaborative R&D efforts, funded research, and university faculty consulting. These collaborations are advantageous to both parties. Exposing students to real-world applications and industry difficulties improves their learning experiences and frequently results in worthwhile internship and co-op opportunities.

Technology transfer offices: Technology Transfer Offices (TTOs), or Technology Licensing Offices (TLOs), are specialised intermediary bodies within universities that play a pivotal role in managing intellectual property assets and facilitating knowledge and technology movement from academic laboratories to commercial sectors. They are essential for bridging the gap between academic research and commercial applications.

When taken as a whole, these mechanisms demonstrate how important universities are in fostering industrial collaboration, entrepreneurship, and the creation of highly qualified human resources, all of which help turn research into useful applications that advance society.

Case Study 1: The Indian Institute of Technology Bombay

The Indian Institute of Technology (IIT) Bombay has long been an important centre for research, innovation, and entrepreneurship in India. A key enabler of this reputation is the institute's structured and proactive approach to intellectual property (IP) management through its Intellectual Property Rights (IPR) Cell. This Cell, operating under the Industrial Research and Consultancy Centre (IRCC), is instrumental in identifying, protecting, and commercialising the creative outputs of its faculty, researchers, and students (IIT Bombay, 2021). The IPR Cell is well-integrated into the larger innovation ecosystem at IIT Bombay, working closely with the Society for Innovation and Entrepreneurship (SINE) (Bulsara et al., 2009), the institute's business incubator (IIT Bombay, n.d.). Together, these entities have helped incubate several successful startups. Furthermore, the Cell collaborates with the Technology Transfer Office (TTO), which manages industry linkages, licensing agreements, and commercialisation strategies. In addition, regular workshops and awareness sessions are conducted to educate researchers and students on IP management, patent drafting, and valuation, thereby fostering an innovation-centric culture within the campus (IIT Bombay, 2021).

Seclore is a shining example of the success that can emerge from such a structured IP and entrepreneurship ecosystem. Founded in 2005 by IIT Bombay alumni Vishal Gupta and Abhijit Tannu, Seclore was born from a research project supervised by Prof. D. B. Phatak from the Department of Computer Science and Engineering (Nair, 2014). At a time when cybersecurity solutions primarily focused on network and device-level protection, Seclore introduced a pioneering concept: securing the document itself, regardless of where it travelled. This innovation, later commercialised as Information Rights Management (IRM), embedded security policies directly into files, allowing persistent control over access, editing, and sharing, even outside the organisation's firewall (Seclore, n.d.).

Recognising the uniqueness of this solution, the IPR Cell at IIT Bombay helped the founders protect their core technology through early-stage patent filings. These patents became critical assets that offered legal defensibility and increased the startup's credibility in the eyes of investors and enterprise clients. Moreover, the startup received significant support from SINE, which provided seed funding, infrastructure, business mentoring, and access to industry networks (IIT Bombay, n.d.). The backing of IIT Bombay facilitated pilot projects with large organisations and enabled Seclore to establish a reputation as a serious enterprise security player (Nair, 2014). Seclore soon gained many licensing collaborations in sectors such as banking, financial services, manufacturing, and defence, and it has expanded its wings globally. Seclore's IRM technology managed to gain a valued position by integrating its services with platforms like Salesforce, SAP and Microsoft 365 (Seclore, 2023) and is able to manage its presence in more than 30 countries, working with more than 2000 clients. It attracted funding from notable venture capital firms and gained recognition in Gartner's Magic Quadrant for Information Rights Management (Gartner, 2022). Its clientele included leading firms such as ICICI Bank, Axis Bank, Saudi Telecom, and Infosys (Times of India, 2020).

IIT Bombay model emerges as a benchmark for technology transfer from an academic institute. IIT Bombay can create pathways for successful startups and entrepreneur opportunities with strategic IP support, collaboration with industry, and transparent policies. Seclore's journey from academic research project to global cybersecurity leader represents the strong integration of academic research, IPRs protection, and successful technology transfer as an enterprise.

Case study 2: Sardar Vallabhbhai National Institute of Technology

The Association for Harnessing Innovation and Entrepreneurship (ASHINE) at the Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat operates as a Section 8 not-for-profit company under the institute's Research Park, established in 2017 with the Department of Science and Technology - National Science and Technology Entrepreneurship Development Board's (NSTEDB) National Initiative for Developing and Harnessing Innovations (NIDHI) - Technology Business Incubator (TBI) program funding. ASHINE's core mission is to foster interdisciplinary innovation and entrepreneurship across engineering domains such as materials, manufacturing, energy, and environment, as well as to promote the commercialisation of research outputs by providing infrastructure, funding, mentoring, and IPR support (SVNIT, 2025). It manages both pre-incubation and incubation activities, extending co-working spaces, laboratories, and a FabLab, and it supports startups through funding stages like Ignition, Catalyst, Energise, Leap, and Trigger under Gujarat's Student Startup and Innovation Policy (SSIP) and Scheme for Assistance for Startups (SAS) policies. Its official recognition as the nodal institute for South Gujarat under Gujarat's Scheme for Assistance for Startups Innovation empowers it to offer seed grants of up to ₹30 lakh (plus ₹10 lakh for social-impact), sustenance allowances, fees for training programs, and facilitation of connections to Gujarat Venture Finance Limited (GVFL) for pre-Series A funding (Times of India, 2021; ASHINE, 2024). To date, ASHINE has funded over 67 projects, incubated 57 startups, and disbursed more than ₹2 crore to innovators, including support for 12 IP filings (SVNIT, 2025). Additionally, it's Student Associateship and Startup India Learning Programs train students in entrepreneurial skills, while events like UNICEF's Innovation Festival and SVNIT Startup Expo engage over 2,000 participants and facilitate networking with industry experts (ASHINE, 2023; SVNIT, 2025). By integrating national schemes, institute policies, and industry partnerships, ASHINE exemplifies a robust ecosystem that transforms academic research into viable startups.

Recommendations for strengthening IP-driven transfer

The academic institute must adopt a multifaceted approach to develop strong IP-driven technology transfer. This involves building national and institutional frameworks, incentives for academic partners, operational capacity, and international collaboration. These strategies can develop a strong innovation ecosystem to boost technology transfer and create social impact (Thape, 2023; National Law School of India University [NLSIU], 2023). The following points can be considered as recommendations for developing effective IP-driven transfer.

> The fundamental requirement is to establish specific and detailed IP policies at a national and academic level. These policies should cover aspects such as ownership rights, licensing terms, models for revenue sharing, and resolution of disputes. Countries with well-articulated IP policies tend to exhibit more streamlined and effective commercialisation processes. Such policies reduce ambiguity and build trust between universities, researchers, and industry stakeholders (DKPTO, 2022).
>
> The capacity of Technology Transfer Offices (TTOs) and IP professionals must be significantly strengthened. TTOs require dedicated staff with legal, technical, and commercial expertise to manage the complex intellectual property lifecycle—from invention disclosure to patent filing, licensing, and startup creation. Targeted training and exposure to international best practices can enhance the effectiveness of these offices (World Intellectual Property Organization [WIPO], 2002; Law Office Sung, n.d.; Thakur, 2023).

Academic faculty should be encouraged and rewarded for participating in IP creation and commercialisation. This could include financial incentives such as royalty-sharing mechanisms, commercialisation bonuses, equity options, and non-monetary recognition such as awards and career advancement (WIPO, 2002; India Today, 2020; Singh & Patel, 2024). Universities that have embraced such incentives have reported higher patenting and licensing activity (LinkedIn, 2023a).

International partnerships between academic institutions and industry can promote knowledge exchange and accelerate technology transfer through collaborative research and development projects, global startups, international licensing, partnerships, funding sources, and expertise. These are crucial for scaling innovation (WIPO, 2023; LinkedIn, 2023b).

In addition to the four primary recommendations, several supporting actions should be considered. Adequate funding and institutional support are crucial for research, IP protection, and commercialisation efforts. Institutions should allocate dedicated budgets for patenting and proof-of-concept development (Goyal & Mehta, 2022; PowerPatent, 2023). Public-private partnerships can further leverage government funding and industry capabilities to scale research outcomes (Thape, 2023).

Another important strategy is awareness and education. Institutions should conduct regular workshops and awareness campaigns to educate students, faculty, and research staff about the importance of IP and technology transfer (Goyal & Mehta, 2021; AIMT, 2025).

Finally, it is important to establish evaluation mechanisms to measure the effectiveness of IP-driven technology transfer practices by considering key performance indicators such as the number of patents, collaborations, revenue from licensing, and the number of successful startups (WIPO, 2023; Sustainability Directory, 2024).

If addressed comprehensively by the academic institutes, these areas can significantly improve the innovation ecosystem and efficiency of the IP-driven technology transfer. This will contribute to national development.

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How to exploit university patents for technology commercialisation and innovation in Viet Nam?

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Abstract

The demand for leverage of university patents for technology commercialisation and innovation is higher and higher in Vietnam under the context of Industrial Revolution 4.0. However, the rate of patents that are commercialised is quite low due to many reasons. This article will study the definition of commercial exploitation of university patent, legal forms of commercial exploitation of university patent, historical review of university patent commercialisation phases, the Vietnamese legal rules for university patent commercialisation forms and their practice, which helps to recommend and amend the existing rules.

Introduction

Law on Intellectual Property (IP) of Vietnam in 2005, amended in 2022 (Law on IP, 2005), considers a patent as one of the most crucial intellectual property rights (IPRs). Patent is one specific intellectual asset; it is one kind of intangible asset, which plays a vital role in the innovation and economic development of a country. Patents not only promote research and innovation but also attract investment capital and technology transfer.

The "Theory of Innovation" was created by J.A. Schumpeter in 1934; it is understood as a new product or a new way of doing things applied in practice using intellectual assets (Croitoru, Alin and Schumpeter, J.A., 2008). This term"innovation" has only been developed in the last 60 years. In the recent literature, the definition of "Innovation" has emerged as part of an effort to find new ways to coordinate and solve global and local problems in every country, as mentioned in the Sustainable Development Goals of the United Nations (Henry Chesbrough, 2003, and Chesbrough Henry, Vanhaverbeke Wim and West Joel, 2008).

Under the international integration context, with the improvement and development of laws on the protection and enforcement of IPRs according to the World Trade Organization's standards, the Vietnamese Government has been focused on the commercial exploitation of patents. In detail, laws on IP, on technology transfer, on commerce, on investment, on enterprise and secure transactions have regulations such as the promotion of patent owners to exploit their patents; the enhancement of university patent transfer to enterprises; the stimulation of organisations and individuals to contribute capital, mortgage of patent rights for doing business, setting up start-ups, spin-offs, etc. Moreover, the Vietnamese Government has been revising its legal rules on IPRs to satisfy commitments in international trade conventions and treaties such as Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) (CPTPP, 2019), EU–Vietnam Free Trade Agreement (EVFTA) (EVFTA, 2020), Regional Comprehensive Economic Partnership (RCEP) (RCEP, 2022), etc. In addition, Vietnam's new IP Strategy to 2030 was issued in 2019. Recently, in the context of the Industrial Revolution 4.0 in Vietnam, for the first time, the Resolution 57-NQ/TW (Resolution 57-NQ/TW, 2024), science and technology, along with innovation and digital transformation, are placed at the top of important breakthroughs with unprecedented goals and drastic solutions. Under this Resolution, the Vietnamese Government is developing policies for breakthroughs in the development of science, technology, innovation, and national digital transformation, in which scommercialisation of patents in general and that of university patents in particular are pilot policies.

However, the commercial exploitation of patents for technology commercialisation and innovation is rather new; patents are still stipulated in legal rules with the protection of IPRs (static position), not with the commercial exploitation (dynamic position). Vietnam's legal rules have many limitations and shortcomings in detailing the commercial exploitation of university patents. In fact, Vietnam needs to modify the relevant laws.

This paper focuses on the definition of commercial exploitation of university patents, legal forms, and the importance of university patent commercialisation, historical review of university patent commercialisation phases, current Vietnamese legal rules for university patent commercialisation forms and their practice, which helps to recommend and amend the relevant legal rules.

The methodology of this paper is the literature review - the research of available publications to analyse the management and commercialisation of university patents as well as the technology commercialisation phases and the policy review - the research of laws and policies (doctrinal research review) relating to the leverage forms of university patent for technology commercialisation and innovations in Vietnam. The author uses both doctrinal research and statistical survey methods to show the current situation of legal rules on university patent commercial exploitation and its practice in Vietnam.

Literature review

The commercial exploitation of patents was propagated with the technology commercialisation wave from developed countries to developing countries since the 1970s. The following publications are worth a look: *Licensing and exploitation of patents* (Holloway. H, 1968); *Licensing as a means of penetrating foreign markets (*Zenoff David B, 1970); *Breveté et licencié-Leurs rapports juridiques dans le contrat de licence* (Jean-Jacques Burst, 1970); *Emerging restriction on the transfer of technology* (John C. Green, 1971); *Brevets et sous-développement-La protection des inventions dans le Tiers-monde* (Martine Hiance and Yves Plasseraud, 1972); *Patent and Know-how Licensing in Japan and the United States* (Teruo Doi and Warren L. Shattuck, 1977); *Le Brevet Américain – Protéger et Valoriser l'Innovation aux États-Unis* (André Bouju, 1988); *Legal Aspects of the Transfer of Technology to Developing Countries* (Michael Blackeney, 1989); *Patents and Development* (Dr. Patricia Kameri-Mbote, 1994); *A concise guide to European Patents: Law and Practice* (Gerald Paterson M.A., 1995); *Droit des Brevets d'Invention et protection du savoir-faire* (Mireille Buydens, 1999); *Industrial Property Rights Standard Textbook-Patents* (Japan Institute for Invention and Innovation, 2003); *Patents and the Transfer of Technology to Developing Countries* (John Barton, 2003), etc.

During the past decades, many publications about the commercial exploitation of patents mentioned the leverage of patents to promote innovation. The following publications should be noted: *Patent Scope and Innovation in the Software Industry* (Cohen, J. and Lemley, M., 2001); *Open Innovation: The New Imperative for Creating and Profiting from Technology* (Henry Chesbrough, 2003); *How Do Patent Laws Influence Innovation: Evidence from Nineteenth Century World Fairs* (Moser, P, 2003); *How Does Patent Protection Help Developing Countries?* (Ali M. Imam, 2006); *Brevet, innovation et intérêt général-Le Brevet: pourquoi et pourquoi faire?* (Larcier, 2007); *Open Innovation: A Research Agenda* (Chesbrough Henry, Vanhaverbeke Wim and West Joel, 2008), etc.

Regarding the commercial exploitation of university patents for technology commercialisation and innovation, some publications could be noted: *Intellectual Property Management of National University Corporations Shift to Institutional Ownership and its New Challenges* (Shimoda, R., 2005) explores the transfer of IP ownership in Japan, from individual researchers to university corporations. It highlights the challenges: motivating researchers, resolving conflicts of interest, sharing revenues, facilitating start-ups, international considerations. *Management of Intellectual Property Rights in academia: The Estonian and Swedish perspectives* (Kelli, A., Mets, T., & Jonsson, L., 2014) compares the management of IPRs arising from academic research in Sweden and Estonia. The key findings indicate that both countries face challenges in balancing the principles of open science and IPR commercialisation. *The changing landscape of intellectual property management as a revenue-generating asset for US research universities* (Cummings, B., 2013) discusses how the U.S. research universities have increasingly focused on IP management and technology transfer as a way to generate revenue from research discoveries and inventions. Thanks to the Bayh-Dole Act, many universities set up technology transfer offices (TTOs) to exploit and license patents to companies.

In brief, there are no systematic and comprehensive publications relating to the legal rules on the university patent commercial exploitation forms and their practice in Vietnam.

Findings and discussions

Overview of university patents' commercial exploitation

Definition of a university patent's commercial exploitation

Patent commercial exploitation is not a new term. The patent is the certificate that is delivered by the patent office to the owner of patent when the invention satisfies the patentability. When granting patent, the IPRs to the invention arise accordingly.

Commerce is a broad and increasingly developed concept with a comprehensive denotation. According to the provisions of Clause 1, Article 3 of the Commercial Law No. 36/2005/QH11 (Commercial Law, 2005), commercial activities are activities for profit-making purposes.

In brief, "commercial exploitation" of a patent can be understood as the transformation of a patent into goods for circulation on the market, thereby bringing profits to the patent owner. Commercial exploitation of a patent has two basic unchanging characteristics: (1) the actual exploitation of the value of the patent; and (2) for profit purposes.

Legal forms of a university patent's commercial exploitation

The following are the ways a university patent can be commercially exploited:

- self-commercialisation;

- assignment and licensing of a patent;

- mortgage/collateral of a patent;

- contribution of patent as capital, cooperation in business with intellectual property rights to the patent.

The importance of a university patent's commercial exploitation

The commercial exploitation of a patent not only benefits individuals and organisations directly related to that patent but also contributes to promoting the development of the whole society.

The investment in creativity, innovation, and technology development is becoming a state trend. Many studies in the world show that patents used in industries in the European region in the period 2008 - 2010 generated EUR 1.7 trillion, accounting for 14% of the GDP of the European Union. For American industries, in 2010, patents brought in $763 billion, accounting for 5.3% of GDP. Patents are one of the abundant resources for the economic and social development of each country in the fierce competition on a global scale (Nguyen Huu Can, 2017).

The creation and management of patents in universities are essential to fostering innovation, accelerating economic expansion, and improving society at large. Universities can benefit from the outcomes of their research by licensing patents to business partners through effective IP management, which makes it easier for academics to transfer technology and information from the educational environment to the marketplace. Universities can also encourage students and researchers to explore new ideas, take chances, and pursue creative undertakings by encouraging a culture of innovation and entrepreneurship, knowing that their intellectual contributions will be acknowledged and valued.

Historical review of university patents' commercial exploitation

The legal framework to promote the commercial exploitation of university patents for technology commercialisation and innovation in the world is divided into four phases which started in 1980.

Phase 1: Initial policy formulation stage related to university patent commercialisation (1980-2003)

The Bayh-Dole Act of 1980 of the American Government is considered the world's pioneering national policy that directly addresses university patent commercialisation. This Act laid the foundation for systematic efforts to transfer technology from universities to the private sector (Slaughter & Rhoades, 1996). The university patent commercialisation can occur at any stage of the innovation process and can be carried out in various forms, including technology licensing or the establishment of a spin-off to self-commercialisation (Norman et al., 1997). In 2003, the Organization of Economic Cooperation and Development (OECD) emphasised the U.S. Bayh-Dole Act of 1980 as a key factor promoting the formation of TTOs at American universities (OECD, 2003) to commercialise research results by granting U.S. universities unconditional ownership of inventions created from federal research funds.

Phase 2: Stage of developing successful university patent commercialisation models (2004-2009)

During this period, the governments of many countries around the world have identified the promotion of patent commercialisation as a priority in their economic policies. Magnus Karlsson described in detail the process of commercialising patents in the USA, a country considered to have a large number of TTOs and that achieved many successes in commercialising patents (Karlsson, 2004). He also analysed the case of the Stanford University TTO and some other TTOs. He also pointed out the successful model in transferring patents in the field of medicine, typically the National Business Incubation Association.

In 2008, Anna S. Nilsson, Henrik Fridén, and Sylvia Schwaag Serger conducted a study on models of commercialising patents in the life sciences at medical universities in the USA, Japan, and China (Nilsson et al., 2008). Another study of Einar Rasmussen analysed the Canadian Government's solutions to support patent commercialisation activities at universities (Rasmussen, 2008). Several important studies showed university patent commercialisation policies in Korea: Kanghwa Choi and Soo W. Kim presented a comprehensive approach describing the interactive relationship between technological innovation, enterprise capacity innovation, R&D, and patent commercialisation (Choi & Kim, 2008). Young Roak Kim also presented the status of Korea's patent commercialisation policy at that time, with about 40 laws related to technology commercialisation. The Korean Government had also approved a series of programmes related to patent commercialisation (Kim, 2008). Thanks to the laws and programmes, Korea has had significant achievements in transferring patent into production and has become one of the most developed economies in the world with significant contributions from TTOs in Korean universities.

Phase 3: Stage of forming a policy system to promote university patent commercialisation in some countries (2009-2013)

In 2010, Erik Baark assessed an important component of China's reforms in the science and technology sector over the past two decades, which is the exploitation of technologies created in research institutes for commercialisation;he analysed various concepts and measures to guide technology commercialisation policies, as well as different approaches in light of "market-pull" innovation and public choice theories (Baark, 2010). In addition, Weiping Wu pointed out that there are important institutional platforms to build linkages between universities and the industrial sector (Wu, 2010).

Chandran Govindaraju published a study on R&D result commercialisation and the challenges for developing countries, focusing on the case of Malaysia, in Tech Monitor. Universiti Putra Malaysia, Universiti Sains Malaysia and several other S&T organisations have had some successful commercialisation of university patents. However, the rate of patent commercialisation from public research programs in Malaysia is still low, with the main reasons being the lack of seed capital and venture capital for commercialisation, weak linkages between universities, research institutes and businesses, as well as limited capacity of enterprises to absorb new knowledge and technology (Govindaraju, 2010).

Phase 4: Stage of developing national policies towards designing technical tools to promote patent commercialisation (since 2013)

This period witnessed a significant increase in research focusing on patent commercialisation, driven by many different strategies, trends, and technical tools. In 2013, OECD shed light on the main trends and strategies in commercialising research results from public research organisations. The main topics covered included diverse channels for transferring knowledge and commercialising scientific inventions, establishing benchmarking for operational efficiency in this field, specific public policy tools to encourage the process of knowledge transfer and commercialisation, as well as financial mechanisms to support the formation and development of spin-offs originating from public research results (OECD, 2013).

In 2015, Farhan Jamil, Kamariah Ismail and Nasir Mahmood focused on the role of university incubators and technology parks as important tools in the commercialisation process (Jamil et al., 2015).

In summary, the above-mentioned phases provided valuable insights into the roadmaps and tools (legal system, programs and support funds) to strongly promote the commercial exploitation of university patents that Vietnam can learn from.

Current status of the Vietnamese laws on university patent commercial exploitation and its practice

The existing legal rules on university patent exploitation forms in Vietnam

The current legal rules on university patent exploitation forms in Vietnam is divided into several relevant laws including Civil Code, Law on IP, Law on Enterprise and their sub-laws.

The self-exploitation of owner

Law on IP does not have specific and detailed provisions allowing the owner to commercialise a patent directly. The right to self-commercialise a patent arises from the owner's right to use the patent.

In essence, a patent is an asset in general and an intangible asset in particular. According to Article 158 of the Civil Code No. 91/2015/QH13 (Civil Code, 2015), "*ownership rights include the owner's right to possess, use and dispose of the property following the law.*" In addition, according to Article 190 of the Civil Code 2015, the owner is entitled to use the property at his/her will but must not cause damage or affect the national interests, ethnic groups, public interests, rights, and legitimate interests of others. Futhermore, the Article 124 of the Law on IP also clarifies that the use of a patent is the performance of the following acts: *"a) Producing the protected product; b) Applying the protected process; c) Leveraging the protected product or the product manufactured according to the protected process; d) Circulating, advertising, offering, storing for circulation the products specified at Point c of this Clause; dd) Importing products specified at Point c of this clause"*.

In brief, the university as patent owner has the right to use the patent at its will without depending on other subjects with protected objects themselves. However, there are still some limitations as follows: Lack of regulations on the export of protected products; the use of the term "protected product" (understood as a protected patent or a product containing a protected patent) is ambiguous. While these are two completely separate objects from each other, the scope is also different.

Transfer of patent rights

The patent owner has a fully legal basis to exploit the patent by himself but in reality, the owner rarely has enough economic, financial, physical, and human resources to do it. To overcome this situation, the patent owner often exercises the right to dispose (assignment) or the right to allow others to use (conveyance) his patent through a contract.

First, the transfer of patent ownership is stipulated in Clause 1, Article 138 of the Law on IP. In essence, the assignment of a patent is considered to be the "outright sale" of the patent. However, Vietnamese law has relatively evident provisions on the transfer of patent ownership:

Conditions restricting the transfer of patent ownership: According to Clause 1, Article 138 of the Law on IP, patent owners may only transfer their rights within the scope of protection (temporal or territorial).

Contract for transfer of patent ownership: According to Clause 2, Article 138 of the Law on IP, the patent transfer *"must be done in the form of a written contract..."*. Besides, a contract for patent assignment must comply with the general provisions on the validity of an ordinary civil transaction as prescribed in Clause 1, Article 117 of the 2015 Civil Code. Otherwise, the parties will face many risks and damages.

Contents of contract for patent transfer: according to Article 140 of the Law on IP, the contents must have *"1. Full name and address of the assignor and assignee; 2. Grounds for transfer; 3. Transfer price; 4. Rights and obligations of the assignor and the assignee"*. The lack of detailed and specific provisions related to the content has led to many difficulties and limitations in patent commercialisation in Vietnam.

Registration of a contract to transfer patent ownership: According to the provisions of Clause 9 Article 2 of the Law on IP, *"...the assignment contract shall only take effect when it has been registered at a state management agency in charge of industrial property rights"*. This regulation aims to protect Vietnamese patent owners in contractual relations with enterprises and organisations of industrialised countries, to limit the situation where the patent transferor in the developed countries imposes unfavorable conditions on the patent transferee in Vietnam. However, these rules also have certain shortcomings: the administrative procedures to register this contract are relatively complex and cumbersome, which are the main obstacles that make the patent transferor (usually a foreign partner) hesitate to transfer for fear of excessive time and cost spent. Therefore, the improvement of administrative procedures is essential for the innovation and technology commercialisation.

Second, licensing of patent use rights also have the following conditions:

Common forms of patent licensing: According to the provisions of Clause 1, Article 141 of the Law on IP, the transfer of the right to use a patent is the owner's permission or authorisation to another person to use their patent within a certain scope. Similar to patent assignment, patent licensing must be done in the form of a written contract according to the provisions of Clause 2, Article 141 of the Law on IP. Based on Article 143 of the Law on IP, patent licensing contracts are divided into three types: Exclusive, non-exclusive and secondary.

Provisions on patent licensing contracts: According to the provisions of Article 144 of the Law on IP, the content of a patent use contract must simultaneously satisfy the following 02 (two) conditions: Firstly, a patent use contract must not neglect to contain the required main contents. Secondly, the patent use contract must not contain/recognise provisions that unreasonably restrict the licensor's rights. In case the parties include the above provisions in the patent use contract, these terms are automatically invalid. It can be seen that the laws strictly limit the contents that the parties agree upon and are recorded in the patent use contract.

Mortgage/collateral of patent

According to the provisions of Article 17 of Decree 21/2021/ND-CP of the Government (Decree No. 21/2021/ND-CP, 2021), *"Owners of property rights arising from intellectual property rights, information technology, scientific and technological activities may use property rights … to secure the performance of obligations"*. Thus, patent rights can be used to mortgage/collateral at banks to raise capital. However, in practice, this approach to loans is not popular and is also very difficult to implement for the following reasons:

Firstly, it is difficult to assess the value of a patent. Currently, there are three (03) approaches (cost, income and market) to value an intangible asset according to the provisions of valuation standard No. 13, issued together with Circular No. 06/2014/TT -BTC (Circular No. 06/2014/TT –BTC, 2014). However, there is no equivalent patent in the market. The instability in the price of patents will affect the valuation when mortgaged, and may pose a risk to the mortgagee (Hoang Lan Phuong, 2021).

Secondly, the handling of industrial property rights to patent when obligations are violated faces many difficulties. According to the provisions of Clause 1, Article 303 of the Civil Code 2015, the disposal of the mortgaged property shall be agreed upon by the parties to the mortgage to choose one of the following methods: auction of the property; the secured party sells the property by itself. Moreover, the seizure of security assets requires corresponding knowledge at scientific and technical level.

Thirdly, it is not feasible in some cases to guarantee the value of patents at the time of disposal of the collateral.

As can be seen from the above analysis, this valuation still faces many difficulties.

Contributing capital by industrial property rights to patents

According to the provisions of Article 34 of the Law on Enterprise No. 59/2020/QH14 (Law on Enterprise, 2020): "*1. Assets contributed as capital are Vietnam Dong, freely convertible foreign currency, gold, land use rights, intellectual property rights, technology, technical know-how and other assets valuable in Vietnamese Dong...*". Thus, the contribution of capital as a patent to establish a company is completely legal and permissible.

Similarly, the valuation of a patent must comply with the general regulations on the valuation of intangible assets. However, the Law on Enterprise also sets forth the principles that individuals and businesses must comply with in Article 36. Pursuant to the provisions of Article 36, the valuation of industrial property rights to a patent for capital contribution must satisfy the following conditions: they must be valued in Vietnam Dong. In case of capital contribution to establish an enterprise, the industrial property rights to the contributed patent shall be valued according to the consensus principle or by a valuation organisation. The value of assets contributed as capital must be approved by more than 50% of the members and founding shareholders. In the case of capital contribution by patent to increase charter capital, the Members' Council, for limited liability companies and partnerships, or the Board of Directors, for joint-stock companies, , shall agree on a valuation agreement or the value appraised by a valuation organisation.

Thus, it can be seen that the valuation of a patent as capital contribution is carried out on the principle of self-negotiation and self-consensus between owners.

Practice

Overall, thanks to the relevant legal rules and policies of the Vietnamese Government, the awareness of patent importance is rising as can be seen from the higher number of patent filing and certificates. There are also many patents which are transferred from universities to enterprises for technology commercialisation and innovation to help enhance the competitiveness and brand of these enterprises. It could be noted that there is no official report about the number of university patents' commercial exploitation via the above legal forms. However, the study on the number of patent filings, patent certificates and registered patent transfer contracts could reveal partly the current situation of university patent commercial exploitation in Vietnam.

In fact, the number of patents granted and filing is still limited in comparison to the potential (Table 1). In addition, the number of applications and protection certificates for patent is seldom compared to other types of industrial property objects such as trademarks or industrial designs.

From Table 2, it is seen that patents have not developed yet strongly in Vietnam, also that the university patent commercial exploitation is still limited. In addition, patent owners still face many difficulties in commercialising their patents. In detail, many university patents are incomplete, requiring a long investment process to be commercialised. University patent owner does not exploit their patents effectively. Moreover, not all owners or creators have the resources to ensure this process. For example, recently, some scientists from the Faculty of Mechanics, Ho Chi Minh University of Technology manufactured a rice-paper device successfully. This project was funded by the Government budget. This device price is 470 million VND, which is much lower than an imported device. However, a food company bought it for manufacturing. After testing for a short duration, the number of successfully produced rice paper was found to be small, compared to the number of broken rice paper (*Le Duc Hien,* 2021).

Table 1. Number of patent filings and patents granted in Vietnam by the Vietnamese entitites in the period 2021-2024 (NOIP, 2025).

Year	Registration number			Certificate number		
	Patent	Industrial design	Trademark	Patent	Industrial design	Trademark
2021	1066	2055	44638	153	1196	25379
2022	895	1998	47754	153	1077	29444
2023	991	2012	50739	315	1144	25188
2024	1226	2046	51363	308	1189	38250

Table 2. Number of ownership transfer contracts and use rights transfer contracts for patent solution registered at NOIP for the period 2021-2024 (NOIP, 2025).

Time	Registered Contracts of Patent ownership transfer	Registered Contract of Patent use right transfer
2021	71 (98)	8 (14)
2022	135 (155)	12 (14)
2023	96 (144)	16 (22)
2024	92 (147)	8 (8)

It can be seen that the total number of ownership transfer contracts and patent/utility solution licensing contracts during recent years are not many, not commensurate with the potential of the patent as well as the mode of commercialisation. In fact, businesses, individuals and organisations have not been proactive or even active in the transfer of industrial property rights to inventions, thereby creating many negative consequences in innovation and economic development activities.

In recent years, several universities in Vietnam are aware of the importance of their technology transfer office in managing and exploiting university patents. Vietnam National University, Hanoi set up the Center for Knowledge Transfer and Startup Support (CSK) according the Decision No. 269/QĐ-ĐHQGHN dated 24/01/2017. This Center is a legal entity according to the model of TTO under Park for High Technology and Innovation according to the Decision No. 202/QĐ-ĐHQGHN dated 13/01/2025. The Center has implemented the Program of VNU-Techgate since 2021 to incubate, support transfer and commercialisation of university patents. Initial results are good: 15 patent filings and 03 transferred patents in 2021; 13 patent fillings and 03 spin-offs in 2022, 43 patent fillings and 03 transferred patents in 2023; 30 patent fillings and 05 spinoffs in 2024. In particular, the following patents are supported for commercial exploitation: Material Nanobiochar applied in pharmaceutics and beauty; Paint for cooling; Chitosan to preserve agricultural products, etc.

Recently, the Decree No. 109/2022/ND-CP stipulating the Regulations on science and technology activities in higher education institutions has been launched to "set forth the organisation and management of scientific and technological activities in higher education institutions; research groups and strong research groups in higher education institutions; scientific, technological and innovative activities in higher education institutions; develop scientific and technological potential in higher education institutions; responsibilities of agencies, organisations and individuals for scientific and technological activities in higher education institutions." (Article 1) (Decree No. 109/2022/ND-CP, 2022). This Decree is one of the bases for building regulations on the management and development of IP and technology transfer centers in universities, including regulations such as the organisation and management of activities. science and technology in higher education institutions; research groups in university facilities; science, technology and innovation activities in higher education institutions; invest and develop scientific and technological potential; and responsibilities of agencies, organisations and individuals for science, technology and innovation activities. The situation of limitation of university patent commercialisation could be improved.

Conclusion and recommendations

University patent commercial exploitation for technology commercialisation and innovation is very important. Vietnam is one of the fastest-growing economies in Southeast Asia. It may be that the success of Vietnam's economic development could be caused by the effective commercial exploitation of university patents for technology commercialisation and innovation. To gain this objective, the Vietnamese Government should improve and stipulate more details the legal rules on university patent commercial exploitation forms, such as self-exploitation by patent owner, transfer of patent rights, commercialisation of university patent via mortgage/collateral and contribution of patent as capital. Moreover, Vietnam should follow the phases of university patent commercialisation to have a suitable policy to develop tools for university patent commercialisation. In particular, the regulations on technology transfer offices at universities could be more detailed and improved to support the setup and activities of these units. The fact and case study of Vietnam National University, Hanoi is a good example.

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Patent and technology commercialisation

Bridging the gap between academia, government and industry

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Abstract

Universities and research institutes are increasingly recognising intellectual property (IP) as a strategic asset for economic growth. In India, bridging the gap between academia and industry through effective IP commercialisation has gained momentum in recent years. This article examines how Indian higher education institutions (HEIs) are leveraging IP for technology commercialisation and diffusion, drawing on policy research and on-ground incubation experiences. We provide an overview of India's IP and technology transfer landscape, highlight key challenges in moving innovations from lab to market, and showcase successful commercialisation models at select Indian HEIs. The article concludes with policy recommendations to strengthen IP commercialisation in Indian academia, emphasising supportive policies, capacity-building, and inclusive strategies to accelerate technology diffusion for national development.

Introduction

The effective commercialisation of intellectual property (IP) – particularly patents and innovations arising from academic research – is vital for fostering innovation, enhancing business growth, providing competitive advantages, and driving economic development. Across the Asia-Pacific region, universities are being called upon to play a more entrepreneurial role, translating research outcomes into marketable products and startups. In India, this call has grown louder in the past decade, as the country seeks to leverage its strong scientific output for societal and economic impact. Bridging the gap between academia and industry is at the heart of this effort, requiring robust models of IP management, technology transfer, and collaboration.

This article focuses on the role of government support and intermediaries, examining how initiatives and policies have begun to strengthen academia-industry linkages. We also discuss the regional impact of such efforts and consider gender dimensions, noting the importance of inclusive innovation ecosystems. Finally, we offer policy recommendations to further empower Indian academia in leveraging IP for commercialisation, with an eye on sustaining the momentum and ensuring broad-based benefits. By examining both the policy framework and on-ground examples, this paper provides a comprehensive look at bridging the academia-industry gap in India through IP commercialisation. The findings and recommendations should interest policymakers, university administrators, researchers, and industry partners seeking to enhance technology commercialisation and diffusion in the Asia-Pacific context.

Evolution of IP policy and academic technology transfer

India's journey with intellectual property in the academic context has evolved significantly over the past few decades. Historically, Indian universities have focused more on fundamental research and publications than on patenting or commercialising research results. In the absence of a Bayh-Dole style framework (The Council on Governmental Relations, 2021) that allowed universities to own and license inventions from federally funded research, Indian academia lacked a uniform mandate for owning and exploiting IP. Nonetheless, individual institutions and government bodies took steps to promote innovation, protection, and tech transfer. The Indian Patents Act of 1970 (Office of the Controller General of Patents, 1970) laid the legal foundation, but it was only by the 1990s and 2000s that universities began establishing IP policies and dedicated cells for patent filing and industry linkages.

A notable early initiative was the Foundation for Innovation and Technology Transfer (FITT) at the Indian Institute of Technology (IIT) Delhi in 1992, one of India's first Technology Transfer Offices (TTOs). Around the same period, other leading institutes like the Indian Institute of Science (IISc) and IITs started exploring commercialisation via limited patent licensing and the incubation of startups by entrepreneurial faculty or alumni. However, widespread adoption of formal tech transfer mechanisms remained slow. A proposed "Indian Bayh-Dole" – the Protection and Utilisation of Public Funded IP (PUPFIP) bill – was introduced in the late 2000s to grant universities automatic ownership of inventions from government-funded research, but it did not become law. In its absence, IP ownership and commercialisation practices varied by institution, with many public research organisations assigning IP to the government or not actively managing it at all.

By the 2010s, policy shifts signalled a more concerted push for academic innovation utilisation. The National IPR Policy 2016 (Trade, 2016) explicitly highlighted commercialisation and technology transfer as key outcomes of the IP system. Moreover, national missions like Start-up India ((DPIIT), n.d.) (2016) and Make in India (India, n.d.) underscored the role of research institutions in entrepreneurship. The Department of Science and Technology (DST) and other agencies launched programs to build innovation capacity within academia, for example, (DST, n.d.) under DST and Atal Incubation Centres (Aayog, n.d.) under NITI Aayog's Atal Innovation Mission, placed at universities across states. Similarly, the Ministry of Education (formerly the Ministry of Human Resource Development - MHRD) rolled out a National Innovation and Startup Policy (NISP) for students and faculty, providing guidelines for IP ownership, startup participation, and equity sharing to encourage commercialisation in HEIs.

Key challenges in commercialisation of academic IP

Transforming an academic invention into a commercial product or venture is a complex process, and Indian HEIs face several well-documented challenges in this journey. Some of the key barriers include:

Institutional and cultural barriers: Academia traditionally values publications and fundamental research, whereas commercialisation demands a market-oriented approach. Faculty and students may lack awareness or training on IP rights and entrepreneurship. Until recently, university reward systems did not sufficiently incentivise patenting or startup activities (e.g., promotions rarely accounted for patents or licences). This academic culture is gradually changing with new policies, but inertia remains a challenge.

Limited technology transfer capacity: As noted, many Indian universities do not yet have fully resourced Technology Transfer Offices or experienced personnel to scout inventions, manage patent portfolios, and negotiate licences. Where TTOs exist, they might be understaffed or the staff may lack specialised legal and business skills required for complex IP transactions. The Department of Science & Technology (DST) – Centre for Policy Research (CPR)[1] study highlighted bottlenecks such as cumbersome administrative processes and the need for capacity building in TTOs[8]. Without professional commercialisation support, many inventions stagnate at the prototype stage.

Funding gap ("Valley of Death"): Early-stage technologies from academia often require further development (proof-of-concept, prototyping, trials) to become attractive for industry or investors. However, research grants typically end at proof-of-concept, and venture capital or industry funding is wary of unproven academic ideas. This creates a "valley of death" where promising innovations may languish due to a lack of translational funding. While government seed grant programs (such as DST NIDHI PRAYAS (DST, n.d.) or Biotechnology Industry Research Assistance Council, BIRAC's, Biotechnology Ignition Grant) ((BIRAC), n.d.) exist, demand outstrips supply.

IP management and ownership issues: Clear IP ownership frameworks are essential to avoid disputes and delays. In India, ownership of IP from publicly funded research can involve multiple stakeholders – the inventor, the institution, and sometimes the funding agency. Around 84% of TTOs reported that their host institution retains ownership of patents generated, with certain cases granting a share to funding agencies (Deployment, 2023). Negotiating these rights can be complex. Moreover, many institutes historically didn't have comprehensive IP policies, though this is improving with virtually all major HEIs now adopting IP policies and revenue-sharing models. The Patents (Amendment) Rules 2021 (CGPDTM, 2021) extending 80% fee reduction to educational institutions has helped academic patentees, but high costs and procedural burdens can still deter patent filing and maintenance for cash-strapped institutions.

Industry engagement and trust: From the industry perspective, companies at times perceive academic research as too theoretical or not aligned with market needs, while academics may be unfamiliar with industry requirements. Bridging this perception gap takes deliberate effort. Companies have also cited concerns about negotiating with public institutions (e.g., lengthy approval times, rigid terms). The government is trying to simplify these processes, but streamlined contract and IP licensing practices are still evolving at many HEIs.

Regulatory and legal hurdles: Depending on the sector (biotech, pharmaceuticals, aerospace, etc.), moving a lab innovation to market might involve navigating complex regulatory approvals, which academics are not equipped for alone. Legal issues like ensuring Freedom-to-Operate (FTO) or managing IP infringement risk require expert guidance. In some cases, outdated rules (for instance, restrictions on faculty equity in startups in older statutes) created hurdles, though the NISP 2019 guidelines (MoE, 2019) now, encourage flexibility, such as permitting faculty up

1 DST-Centre for Policy Research (CPR) at Panjab University (PU) is a premier institution dedicated to advancing research and policy development in Science, Technology, and Innovation (STI). The centre is supported by the Department of Science and Technology. (https://cpr.puchd.ac.in/).

to 20% time for startups or holding equity with permission.

Scale and diffusion challenges: Even when a technology is licensed or a startup is formed, scaling up production and achieving market diffusion is a further challenge. Many university spin-offs struggle to scale due to limited business experience and networks. They need connections to larger industry players for manufacturing, distribution, or integration into value chains. Without those linkages, the impact of academic IP may remain localised or delayed.

Resource constraints and sustainability: For technology commercialisation efforts to sustain, financial and infrastructural support is crucial. Few Indian universities have large endowments or innovation funds of their own. Hence, most rely on government grants (which can be project-based and time-limited) or occasional industry Corporate Social Responsibility (CSR) support. Building a sustainable model where licensing royalties or equity returns feed back into funding new research is still an aspirational goal for most HEIs – currently, less than 1% of Indian TTOs reported being self-sustaining from their commercialisation income (Deployment, 2023).

Inclusive participation: There are also challenges related to inclusion, ensuring that researchers across regions and demographic groups (including women) participate in and benefit from commercialisation. We observe disparities: a handful of top metropolitan institutions account for a large share of patents and spin-offs, while many universities, especially in lesser-developed regions, have minimal IP activity. Similarly, women are underrepresented in India's patent and startup landscape – women inventors accounted for only about 18% of all patent applications in 2023 (Chatterjee & Ramu, 2018). This gender gap indicates untapped talent and the need for targeted interventions to support women innovators. Identifying these challenges is the first step; the next sections explore how some institutions have tackled these hurdles and what models are emerging to bridge the academia-industry divide effectively.

Government policy incentives and schemes

Policy measures by the Government of India have directly tried to encourage IP commercialisation in a few ways.

IPR fee and process reforms: The Patents Rules amendments in 2016 and 2021 were geared to make IP filing more academic-friendly. As mentioned, since 2021, educational institutions have enjoyed an 80% reduction in patent filing and prosecution fees, similar to startups. Moreover, the patent examination system introduced expedited examination for certain categories – initially startups, and later extended to applications from institutions, and even to female applicants and SMEs. This means a university patent can be granted faster (sometimes within a year of request), which is crucial when trying to attract licensees or investors who prefer granted patents. Faster and cheaper patenting lowers one hurdle on the path to commercialisation.

Proof of Concept and Scaling Grants: Recognising the 'valley of death' funding gap, agencies like DST, Department of Biotechnology (DBT), and Department of Scientific and Industrial Research (DSIR) provide grants specifically to take academic innovations closer to market. For example, DST's Technology Development Program and Promoting Innovations in Individuals, Startups and MSMEs (PRISM) scheme, and BIRAC's later-stage product development awards have helped certain lab technologies reach pilot plant or field trial stages. Similarly, Innovate UK–India partnerships and the Global Innovation & Technology Alliance (GITA) provide industry-matched grants to encourage companies to co-develop academic tech – an approach tying funding to eventual commercial uptake.

Commercialisation awards and competitions: To motivate researchers, the government and professional bodies have instituted awards for commercialisation success (e.g., NRDC's annual awards for successful technology transfers, or Indian Patent Office, IPO's, National IP Awards, which often recognise top academic patentees and licensees) Hackathons and innovation challenges (Smart India Hackathon, etc.) also spur industry-defined problem solving by students, sometimes leading to IP that companies adopt.

Facilitation services: The Cell for IPR Promotion and Management (CIPAM) under the Department for Promotion of Industry and Internal Trade (DPIIT) has been active in spreading IP awareness in universities. It runs workshops, publishes guides, and has also facilitated setting up Technology and Innovation Support Centres (TISCs) in collaboration with World Intellectual Property Organisation (WIPO) across India to assist with patent searches and drafting. Additionally, the Startups Intellectual Property Protection (SIPP) (Office of the Controller General of Patents, 1970) scheme offers startups (including those from academia) free or subsidised professional IP filing support. Some state governments have similar programs where they reimburse patent filing costs for universities in their state.

Startup/Innovation rankings and funding allocation: The government launched a University Innovation Ranking (ARIIA – Atal Ranking of Institutions on Innovation Achievements), which ranks institutions on parameters including commercialisation and entrepreneurship. Such rankings put healthy pressure on HEIs to improve their ecosystems. In parallel, the Ministry of Education ties some funding in its HEI grants to innovation outcomes, nudging institutions to prioritise this area. Collectively, these supports form an enabling environment, but effective utilisation varies. Some institutions leverage these schemes fully and have dedicated teams tapping into them, while others are still catching up. A positive development is that state governments are also stepping up – many states now have their own startup policies that encourage academia-industry collaboration (e.g., Invest Punjab, Chandigarh UT, Karnataka's Elevate program, Kerala's Startup Mission linking colleges, etc.).

Linking IP management, startup incubation, and commercialisation outcomes: A recurring theme in this discussion is the interplay between managing IP, incubating startups, and achieving real-world commercialisation. These elements cannot operate in silos – their integration is key to bridging the academia-industry gap. Indian HEIs are learning to create virtuous cycles that connect these steps.

From IP to startup: Many innovations, especially in cutting-edge fields or where a new product category is being created, are best commercialised via startups founded by the inventors. This is because established companies may be risk-averse or not have the expertise for very novel technologies. For such cases, the inventor (faculty or student) needs to take the lead in forming a company. Here, the role of the incubator is crucial to provide entrepreneurial training and business support, while the TTO handles IP protection. For example, at IIT Madras, the fact that over 50% of the 104 startups in 2024-25 were founded by institute members shows a healthy pipeline where university IP is directly seeding new companies. (Cell, n.d.) Those startups, in turn, often license the IP from the institute (with royalty or equity arrangements). Thus, the IP is managed in a way to facilitate the startup, often offering the startup an exclusive licence, which helps the startup secure funding on the strength of proprietary technology.

From IP to industry licence: Not all technologies require a new startup; some can be transferred to existing companies for scaling. For instance, Panjab University's nanomicelle platform was licensed to an industrial partner in the cosmetics sector, since the company already had manufacturing and market channels to exploit it. In such cases, the TTO's capability to market the invention and negotiate a fair deal is vital. The measure of outcome here would be licensing revenue or the successful introduction of a product to the market by the licensee. Indian TTOs are gradually racking up such successes, although data on licence counts and revenues are not uniformly reported. It is known, however, that institutions like the Council of Scientific and Industrial Research (CSIR) (a network of national research labs), through its tech transfer units and National Research Development Corporation (NRDC), have collectively licensed hundreds of technologies (many being smaller process improvements or know-how licences). Universities are catching up – for example, IIT Bombay has licensed technologies ranging from advanced materials to telecom software to both Multi-National Companies (MNCs) and Indian startups via its Industrial Research and Consultancy Centre (IRCC) and Society for Innovation & Entrepreneurship (SINE) incubator interactions.

Feedback loop: When a startup succeeds or a licence yields impact, it often feeds back into academia positively. Successful alumni entrepreneurs might donate to their university's innovation fund or mentor the next generation. Licence royalties coming to institutions can be reinvested in research or infrastructure (though currently the scale of royalties is modest, the principle is important). Moreover, seeing peers succeed encourages other faculty and students to engage in IP creation and commercialisation, gradually changing the institutional culture. We see this at play in places like IIT Madras and IIT Delhi, where each big success story (be it a unicorn startup or a high-profile licence) has spurred more interest in entrepreneurship on campus.

Policy alignment: The linkage of IP and startups has been acknowledged in policy through mechanisms like the NISP 2019. Many Indian HEIs have now adopted guidelines that, for example, allow a faculty startup to use university labs and equipment at nominal cost, or let students take a semester off for a startup. IP policies increasingly clarify how IP ownership or revenue sharing will work when a startup is involved (e.g., many institutes take small equity instead of licensing fees to startups founded by their people, to reduce the upfront burden on the startup). This alignment ensures that procedures support rather than hinder the flow from IP to commercialisation.

Metrics and outcomes: How do we measure success in this linkage? Traditional metrics like the number of patents or the number of startups are one-dimensional. Progressive institutions and government reports are starting to track metrics like "technologies commercialised", which could mean patents licensed or products launched, and "startups still active after 2-3 years" as a measure of sustainability. For instance, in the DST-CPR study (Bhardwaj, 2021), they attempted to gather data on *technologies generated vs. commercialised vs. patents filed*, but found inconsistencies in reporting. They pointed out that some counted each patent as a technology, and equated a patent licensed with technology commercialised, which is not always accurate. There is a need for standardised reporting so that outcomes can be better measured and correlated with inputs (like how many full-time staff or how much budget a TTO has). Early evidence indicates that institutions with higher patent filings and strong incubation support do show better commercialisation outcomes – IIT Madras being a prime example where high patenting coincides with high startup output and some significant economic value creation

Societal impact: Ultimately, IP commercialisation outcomes should be seen not only in financial terms but also in societal benefits – new solutions to problems, improved services, local employment, etc. Many of the startups from academia in India are working in areas of societal importance: affordable healthcare devices, clean energy, educational technologies, agriculture improvements, etc. The diffusion of these technology solutions addresses developmental needs while also creating economic opportunities. For example, a startup from an Indian university that develops a low-cost water purification system may license it for mass production, thereby providing clean water access (social impact) and generating business (economic impact). When scaled across many such innovations, the impact can be transformative for society. Therefore, bridging the academia-industry gap is also about moving closer to self-reliance in technology (Aatmanirbhar Bharat)[2] and achieving

2 **Atmanirbhar Bharat**, or Self-Reliant India, is a visionary initiative launched by the Government of India to strengthen the nation's economy by fostering domestic production, innovation, and resilience across sectors. It emphasises reducing dependency on imports, promoting indigenous technologies, and empowering startups, MSMEs, and rural enterprises.

sustainable development goals through indigenous innovation. In summary, integrating strong IP management with active startup incubation and industry linkage leads to a multiplier effect on outcomes. Indian HEIs that recognise and implement this integration are showing promising results, as detailed above. The challenge ahead is to broaden this model to more institutions and ensure it is inclusive and sustainable.

Policy recommendations

Building on the analysis and case insights, here are key policy and strategic recommendations to further leverage IP for technology commercialisation and diffusion in India's academic sector. These recommendations are aimed at policymakers (government bodies like DST, MeitY, DPIIT, and MoE), academic institution leaders, and supporting agencies.

Strengthen and network TTOs nationwide: Establish or reinforce Technology Transfer Offices in all major research institutions and universities. The government should consider a dedicated program to fund TTO personnel positions and training. Creating a national network or forum of TTOs under APCTT or a similar body could facilitate sharing best practices. As recommended in the DST-CPR study, a stronger governance and capacity-building framework for TTOs will help standardise processes and raise performance. Metrics-driven funding (rewarding TTOs for licences executed or startups formed) can incentivise results. Smaller or resource-constrained institutions can be served via regional TTO hubs – for example, one TTO office could cater to a cluster of colleges in a region, especially for IP filing and initial industry outreach.

Enhance incentives for researchers to commercialise: Academic promotion and reward systems should formally acknowledge patents, licences, and startup initiatives. Already, some institutes include patents as a criterion for faculty promotion or offer faculty a share in royalties (often 30-70%). This needs to be uniformly adopted across HEIs. Additionally, awarding sabbatical leave or reduced teaching loads for faculty engaging in commercialisation projects would encourage more participation. On the student side, universities should allow flexible academic credit for startup projects (in line with NISP guidelines) so that students can take entrepreneurial risks without derailing their academic progress.

Increase proof-of-concept funding and incubation support: The government and private sector should boost funds available for transitioning prototypes to products. Expanding grants like PRAYAS, BIG, or introducing a "Research to Market" challenge fund for universities could fill the critical early-stage funding gap. In parallel, incubators should receive sustained operational funding – many currently depend on 3–5-year grants. A national incubation sustainability fund could match contributions raised by incubators from alumni or industries, to help them become long-term fixtures. Moreover, encouraging CSR investments into academic incubators (with possibly tax incentives) could be explored.

Promote industry collaboration through policy and platforms: Policies should make it easier for industries to engage with academia. Simplifying IP clauses in government-sponsored research (e.g., allowing industry partners certain licensing rights) can attract more industry-funded projects. The government can facilitate industry-academia matchmaking platforms – perhaps an annual "Innovation Marketplace" where academia showcases licensable technologies to industry in a sector-focused manner (some sectors like biotech already have forums, but others could benefit.) Revival or strengthening of organisations like NRDC (National Research Development Corporation) to actively broker deals between academic inventors and companies, especially micro, small and medium enterprises (MSMEs), would also help – essentially acting as a tech transfer intermediary for those who don't have their own.

Implement National IP-Startup Consortia: Taking inspiration from successful models abroad (such as some countries that have joint patent pools or university startup consortia), India could establish consortia in key domains. For instance, a Pharma Innovation Consortium where multiple university pharmacology departments pool their patents and work with a group of pharmaceutical companies to license or co-develop them reduces transaction costs (companies get a one-stop view of innovations) and improves bargaining power for academia through collective action. Similar consortia could be envisaged for clean energy technologies or Artificial Intelligence (AI) and robotics, aligning with national missions.

Regional innovation cluster development: Continue and expand the Science & Technology Cluster initiative to more cities, fostering local innovation ecosystems. State governments should be encouraged (via central incentives or matching grants) to set up Innovation Zones around leading state universities or technical institutes, where incubators, common fabrication labs, and co-working spaces for industry research and development (R&D) can co-exist. These zones would drive regional tech entrepreneurship and help retain local talent. For example, building on the model of IIT Madras Research Park in the south, similar parks or innovation hubs in the north, northeast, central India, etc., can balance regional development.

Encourage Bayh-Dole-like institutional policies: Rather than a single law, the government can push via funding requirements that any institution receiving research grants above a threshold must have an IP policy aligning with certain principles (institutional ownership with inventor incentives, obligation to commercialise or else allow government "march-in", etc.). Many top institutions have such policies, but ensuring all research-active HEIs adopt them will create uniform expectations. This also reassures the industry that when they deal with a university, the IP terms will be straightforward. Where appropriate, consider revisiting national legislation for publicly funded research IP utilisation, learning from earlier attempts and current ecosystem maturity.

Sustain momentum through recognition and success showcases: Continue to celebrate and publicise success stories of IP commercialisation from academia. Government and media can highlight case studies (like those in this article) to a wider audience, which helps change mindsets and encourages other institutions and companies to collaborate. Recognition programs at regional and national levels (for the best TTO, best incubator, most innovative university, etc.) could motivate lagging institutions to improve. Furthermore, fostering an innovation narrative where academia-industry linkages are seen as key to India's development will help sustain political and public support for these initiatives. Implementing these recommendations requires coordinated effort among multiple stakeholders – ministries, educational regulators, universities, industry bodies, and international partners (like WIPO, which can provide training, or foreign universities open to sharing models). The good news is that the trajectory in India is already positive; with each policy refinement and success story, the ecosystem becomes more robust.

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Tech Events

2025

09-10 September, 2025
Central Asia Green Energy & Hydrogen 2025
Tashkent, Uzbekistan
https://www.peakevents.org/green-energy-central-asia/

09-11 September, 2025
Enlit Asia
Bangkok, Thailand
Contact:
Ms. Nongluck P. (AON)
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Mob: (66) 62 949 6636
Email: nongluck@worldexgroup.com; info@enlit-asia.com
https://www.enlit-asia.com/

16-18 September, 2025
Asia Pacific Wind Energy Summit
Melbourne, Australia
Contact:
Summit Office
119 Buckhurst Street South Melbourne
VIC 3205, Australia
Tel: +61 3 9645 6311
Fax: apac2025@wsm.com.au
https://www.apacsummit2025.com.au/

18-19 September, 2025
9th International Conference on Green Energy and Environmental Technology (ICGEET-2025)
Jakarta, Indonesia
Contact:
Interglobe Research Network
Tel/WhatsApp: +91-7606986241
Email: igrnetconference@gmail.com
https://www.icgeet.igrnet.org/483/indonesia/

01-02 October, 2025
7th Clean Energy and Technology Conference (CEAT)
Kuala Lumpur, Malaysia
Contact:
CEAT2025 Secretariat
Level 4, Wisma R&D UM, Jalan Pantai Baharu,
59990 Kuala Lumpur, Malaysia
Tel: +603-22463246
Email: umpedac_ceat@um.edu.my
https://umevent.um.edu.my/CEAT2025

15-17 October, 2025
International Greentech & Eco Products Exhibition & Conference Malaysia (IGEM)
Kuala Lumpur, Malaysia
Contact:
Conference Secretariat
Tel: +603-8921 0800
Email: nursyamimi@mgtc.gov.my
https://www.igem.my/

28-30 October, 2025
Asia Clean Energy Summit (ACES)
Singapore
Contact:
ACES Secretariat
Tel: +65 6338 8578
Email: secretariat@asiacleanenergysummit.com
https://www.asiacleanenergysummit.com/home

05-07 November, 2025
SOLAR ASIA 2025
Gyeonggi-do, Republic of Korea
Contact:
SOLAR ASIA Exhibition Bureau
13F Shinhan DM Bldg., 25, Mapo-Daero, Mapo-Gu, Seoul 04167, Republic of Korea
Tel: +82-2-719-6933 (Ext: 502);
Fax: +82-2-715-8245
Email: interexpo@infothe.com
https://www.exposolar.org/eng/about/sub01.asp

07-09 November, 2025
2nd International Conference on Green Technology and Energy Engineering (GTEE 2025)
Kuala Lumpur, Malaysia
Contact:
Conference Secretary
Tel: +852-30697939; +86-15756280447
Email: gtee_conf@163.com
https://www.ic-gtee.org/index.html

08-10 November, 2025
10th Asia Conference on Environment and Sustainable Development (ACESD 2025)
Fukuoka, Japan
Contact:
Conference Secretary
Tel: +86-13290000003
Email: acesd_conf@126.com
https://www.acesd.org/

20-21 November, 2025
Asia-Pacific Hydrogen 2025 Summit & Exhibition
Sydney, Australia
Contact:
The Sustainable Energy Council (SEC)
Email: info@sustainableenergycouncil.com
https://www.asia-hydrogen-summit.com/

10-12 December, 2025
Clean Energy Transition Asia
Kuala Lumpur, Malaysia
https://ceta.asia/

2026

28 February- 02 March, 2026
2026 12th International Conference on Environment and Renewable Energy (ICERE 2026)
Nha Trang, Viet Nam
Contact:
Ms. Alice Lin
Conference Secretary
Tel: +86-18148151445
Email: icere@ieet.ac.cn
https://icere.org/

06-08 March, 2026
2026 16th International Conference on Renewable and Clean Energy (ICRCE 2026)
Osaka, Japan
Contact:
Ms. Rachel Cao
Conference Secretary
Tel: 86-132-9000-0003
Email: icrceconf@126.com
https://www.icrce.org/

28-30 March, 2026
2026 7th Asia Conference on Renewable Energy and Environmental Engineering (AREEE 2026)
Singapore
Contact:
Vera Liao
Conference Secretary
AREEE Conference Secretariat
Tel: +86-17311381986
Email: areee@iacsitp.com
https://www.areee.org/

09-11 June, 2026
Asia Pacific Green Hydrogen 2026
Sarawak, Malaysia
Contact:
Conference Secretariat
Email: secretariat@borneobizconnect.com
https://hydrogenapac.com/

23-26 June, 2026
World Hydrogen Energy Conference (WHEC) 2026
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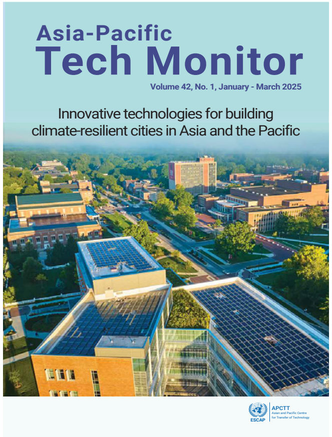
Conference Secretariat
Email: info@whec2026.org
https://whec2026.org/



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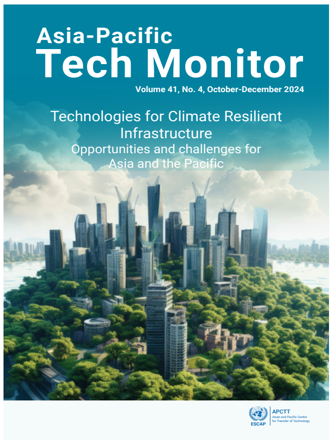
Innovative technologies for building climate-resilient cities in Asia and the Pacific



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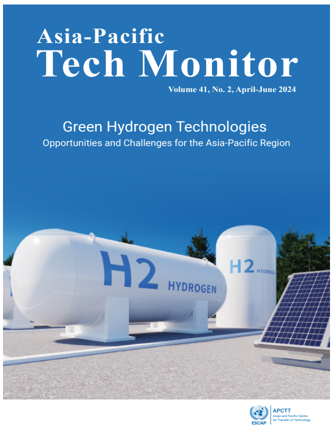
Artificial Intelligence for climate change mitigation and adaptation

Opportunities and challenges



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