

COMMERCIALISATION OF INTELLECTUAL PROPERTY IN TECHNOLOGY TRANSFER: ISSUES AND CHALLENGES

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Abstract

In an increasingly interconnected world, common problems demand global and sophisticated solutions. Technology transfer is one of the ways through which the same is achieved today. Technology transfer is a process that allows the flow of technology and related technical information from one entity to another such as between countries, different research organisations or from public to private users. As technology grows and increases human dependence on it, no development or civilisation advancement in today's time can be attained without technology. Moving ahead with the pace of changing technology is the need of the hour. Thus, progress towards overall development and growth, developing and transition economies desire the procurement of advanced technology. Technology transfer facilitates this desire. Technology transfer is the transfer of know-how or the transfer of the patent regarding the technology which may be the subject matter of a patent. Another aspect that technology transfer caters to is the commercialisation of intellectual property. Trade in technology or the buying and selling of technology, which form the essential aspects of the transfer happens with an ultimate motive of commercialisation of the particular technology. This technology protected by intellectual property rights assures the diffusion of the related intellectual property into the market of the recipient nation. While that may be the ulterior motive, intellectual property residing in the technology which is the subject matter of transfer is immediately compensated for in the form of royalties as may be specified in the transfer agreement. However, effective commercialisation of technology would depend on the success of the transfer which may be obstructed by many barriers. This paper intends to look into the rationale of commercialisation as the end of technology transfer and examine the effectiveness of such commercialisation.

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In the end, suggestions shall be made to come up with ways to overcome the difficulties faced in the market commercialisation of the technology on transfer to a foreign entity.

INTRODUCTION: TECHNOLOGY BRIDGING THE INNOVATION GAP

In the present digital era, characterized by rapid advancements in information technology, the significance of technology permeates every facet of our lives. Moreover, as we stand at the precipice of the Fourth Industrial Revolution, technology's role has become even more pronounced and transformative. In an increasingly evolving society, the importance of technology transcends to not just mere convenience; but it is the very foundation upon which our modern existence is built. With each passing day, technological advancements continue to redefine the way we live, work, and interact. The rapid pace of change is most evident in the digital revolution that has swept across the globe. The internet, once a novelty, has become an integral part of daily life, connecting people, businesses, and information in ways that were previously unimaginable. This connectivity has not only shrunk the physical distances between individuals but has also transformed the way we communicate, collaborate, and conduct business. The advent of smartphones and smart devices has further amplified this phenomenon, placing unprecedented computing power and information at our fingertips.¹

Talking of the digital era, the period of the Fourth Industrial Revolution is characterized by the convergence of physical, digital, and biological technologies. Artificial intelligence, blockchain, 3D printing, and advanced robotics are poised to revolutionize industries across the spectrum, from healthcare and manufacturing to transportation and agriculture. This wave of innovation promises to usher in a new era of efficiency, productivity, and economic growth. Automation, once a futuristic concept, is now a reality, streamlining processes and liberating human potential for more creative and strategic endeavours.

The impact of technology extends far beyond the realm of commerce. In healthcare, breakthroughs in genomics, telemedicine, and wearable technology are redefining patient care and disease management. Precision medicine, enabled by advanced data analytics and genetic

¹ Andrea Loubier, *Is Society Moving In The Right Direction With Technology Rapidly Taking Over The World?* FORBES, (Jun 01, 2021), <https://www.forbes.com/sites/andrealoubier/2021/06/01/is-society-moving-in-the-right-direction-with-technology-rapidly-taking-over-the-world/?sh=3e6196eb7c09> (last visited 7th January 2023)

research, holds the promise of tailoring treatments to individual patients, revolutionizing the way we approach health and wellness. Similarly, in education, technology has dismantled traditional barriers to learning, with online platforms and digital resources democratizing access to knowledge. Virtual classrooms and augmented reality tools are transforming the educational experience, making learning more engaging and interactive.

Furthermore, technology is playing a pivotal role in addressing some of the most pressing global challenges of our time. The imperative to combat climate change has spurred a wave of innovation in renewable energy technologies, energy efficiency, and sustainable agriculture practices. Smart cities, equipped with advanced sensors and data analytics, are reimagining urban planning, creating more liveable and environmentally friendly spaces. Additionally, technology is catalysing breakthroughs in healthcare, from the development of life-saving vaccines to the use of artificial intelligence in diagnosing and treating diseases.

Yet, amidst this remarkable progress, it is essential to acknowledge the ethical and social implications that accompany these technological advancements. Issues of privacy, security, and the equitable distribution of benefits must be carefully considered. Striking the right balance between innovation and ethical considerations is paramount to ensuring that technology serves the betterment of humanity as a whole.

In essence, the significance of technology in changing times cannot be overstated. It is the driving force propelling us forward into a future defined by innovation, connectivity, and limitless potential. As we navigate this era of rapid change, we must approach technology with a conscious and thoughtful mindset, harnessing its transformative power to create a more connected, innovative, and inclusive world.

TECHNOLOGY TRANSFER

Given the importance of technology in the present times, nations all over the world believe that the path to social and economic progress is keeping pace with technological developments and similar advancements. There are two ways to achieve the same-either a nation develops advanced technology or it borrows it. Either way, procurement or possession of the technology is of utmost desirable. Developed nations that generally have ample resources to invest in research and development are successful in creating technology whereas transition or lesser

developed economies usually procure this technology from developed nations, knowing that suitable deployment of technology is essential for all development processes.².

Technology transfer, often referred to as the transfer of technology (TOT), involves the conveyance or distribution of technology from the entity or individual holding ownership to another party or organization. Its aim is to convert innovations and scientific discoveries into fresh products and services that contribute to the welfare of society. Technology transfer is intricately linked with, and can even be seen as a subset of, knowledge transfer.

In today's comprehensive definition of technology transfer, a collaborative element has emerged, recognizing that global challenges necessitate global solutions. The transfer of knowledge and technology assumes a pivotal role in linking stakeholders in innovation and facilitating the transition of inventions from their originators to both public and private users.³.

Intellectual property (IP) stands as a crucial tool in the process of technology transfer, establishing an environment conducive to the sharing of research findings and technological advancements. An examination conducted in 2003 revealed that the specific context or circumstances, as well as the motivations of the involved organizations, influence the method employed in technology transfer. These motivations may differ across different organizational levels, particularly when commercial and governmental interests converge. The safeguarding of IP rights empowers all parties, including educational institutions and research organizations, to secure ownership of the scientific outcomes resulting from their intellectual endeavours. It grants them the ability to oversee the utilization of IP in alignment with their mission and fundamental principles. Through IP protection, academic institutions gain the capacity to promote their inventions, attract funding, seek collaborations with industrial partners, and ensure the widespread dissemination of new technologies, whether through licensing or the establishment of start-up ventures, all for the betterment of society.⁴.

IMPORTANCE OF TECHNOLOGY TRANSFER

Technology transfer is a vital mechanism that drives **economic growth** by introducing advanced technologies to less developed regions and industries, enabling them to enhance

² R. Alkhazaleh et. al, *The Success of Technology Transfer in the Industry 4.0 Era: A Systematic Literature Review*, 8(4) JOURNAL OF OPEN INNOVATION: TECHNOLOGY, MARKET, AND COMPLEXITY 202 (2022).

³ Sagar Pagar et. al, *Review Article on Technology Transfer*, 2(3) INTERNATIONAL JOURNAL OF PURE AND APPLIED BIOSCIENCE 145-153 (2014).

⁴ *Id.*

productivity, create jobs, and boost overall prosperity. The economic impact of technology transfer is evident in historical examples like the Green Revolution of the mid-20th century. During this period, the transfer of high-yielding crop varieties and modern agricultural techniques to developing countries revolutionized agriculture, leading to a substantial increase in food production and reducing hunger in many parts of the world. By empowering regions with innovative technologies, technology transfer can uplift entire economies, fostering sustainable development and improving the quality of life for millions of people. The ripple effects of such growth are manifold, including better infrastructure, enhanced education systems, and improved healthcare, all of which contribute to a more robust and resilient economy.

Beyond economic growth, **enhancing competitiveness** on the global stage is another significant benefit of technology transfer. In today's fast-paced, innovation-driven world, staying competitive requires access to the latest technologies and methodologies. Through technology transfer, organizations and nations can adopt cutting-edge advancements that improve efficiency, enhance product quality, and increase market prominence. This is especially crucial in industries characterized by rapid innovation cycles, such as information technology, biotechnology, and renewable energy. For instance, companies that embrace new manufacturing technologies can streamline their production processes, reduce costs, and produce higher-quality goods, thereby gaining a competitive edge in the global market. Similarly, countries that prioritize technology transfer in key sectors can strengthen their industrial base, attract foreign investment, and expand their export markets. In essence, technology transfer equips both businesses and nations with the tools needed to thrive in a highly competitive and ever-evolving global landscape.

Lastly, technology transfer is indispensable in **addressing global challenges**, such as climate change, healthcare, and energy sustainability. Many of these challenges are complex and require innovative, cross-border solutions. Technology transfer plays a crucial role in disseminating these solutions worldwide, enabling different regions to tackle these issues effectively. For example, the global effort to combat climate change has been significantly bolstered by the transfer of renewable energy technologies. By sharing advancements in solar, wind, and hydroelectric power, countries worldwide have been able to reduce their carbon emissions and move towards more sustainable energy systems. In the healthcare sector, technology transfer has facilitated the spread of life-saving medical innovations, such as

vaccines, diagnostic tools, and treatment protocols, particularly in low- and middle-income countries. This not only improves health outcomes but also contributes to global health security by reducing the spread of infectious diseases. Furthermore, in the quest for energy sustainability, technology transfer has enabled the development and adoption of energy-efficient technologies and practices, which are crucial for reducing global energy consumption and mitigating the effects of climate change.

Developing or transition economies borrow technology from developed nations for several important reasons.⁵:

First and foremost, borrowing technology helps developing countries **accelerate developmental processes**. These countries may not have the resources or time to create certain technologies from scratch. By borrowing technology from developed nations, they can leapfrog ahead, thus quickly catching up with relatively more advanced countries. Secondly, technology transfer helps in the overall **economic growth** of a nation. Access to advanced technologies surely gives a boost to the economy. It can lead to increased productivity, efficiency, and innovation in industries such as manufacturing, agriculture, and services. This, in turn, can lead to higher income levels and improved living standards.

Additionally, advanced technologies may also appear as potential solutions to many specific problems that may be faced by society in general. It may be the case that these problems may initially have been encountered by developed countries while they persist with the developing nations. Borrowing technology allows the latter to tap into the expertise of more advanced nations and find solutions to their unique problems.

As far as knowledge is concerned, developing countries find an increasing need to **fill technical knowledge gaps**. Developing nations might not have the necessary expertise or knowledge base to develop certain technologies. Borrowing technology may provide a better route to acquiring the know-how needed to implement and adapt these innovations. This may also lead to overall **cost reduction and escaping associated risks**. Developing and building on advanced technologies right from the beginning may be extremely expensive and time-

⁵ Bernard M. Hoekman et. al, *Transfer Of Technology To Developing Countries: Unilateral And Multilateral Policy Options*, World Bank Policy Research Working Paper 3332, WPS3332, June 2004, <https://documents1.worldbank.org/curated/en/737591468762912473/pdf/wps3332.pdf>

consuming. By borrowing from developed nations, transitioning economies can avoid the high costs and potential risks associated with in-house development.

As populations in developing nations grow, so do their needs for various goods and services. Borrowed technology can help **meet these increasing demands** more efficiently, ensuring that essential resources like food, energy, and healthcare are readily available. Technology transfer in addition to providing convenience to developing countries, helps **environmental sustainability**. Developed nations often have more advanced and environmentally friendly technologies. There is a pressing need for green and clean technologies all over the world. Transfer of such technologies can help developing economies adopt more sustainable practices, reducing their environmental impact and promoting a greener future.

One major reason behind the transition economies borrowing technology from advanced nations is to **enhance their global competitiveness**. To compete in the global marketplace, it's crucial for developing nations to have access to the latest technologies. This allows them to produce high-quality goods and services that can compete on an international scale. No doubt that far beyond these reasons, technology transfer **facilitates innovation and research** on a whole new level. It serves as a foundation where new research thrives and leads to further innovation within the nation. It inspires local inventors and entrepreneurs to build upon existing knowledge and create new, tailored solutions.

Lastly, technology transfer **fosters international relationships**. Technology borrowing strengthens diplomatic and trade relationships between nations. It's a way of building mutual trust and cooperation, which can lead to further collaborations in other areas.

In essence, borrowing technology from developed nations is a strategic move for developing and transition economies. It accelerates their progress, addresses specific challenges, and positions them on a path of sustainable growth and prosperity. This process of technological transfer is an essential component of global development and cooperation. Technology transfer among nations is a process where one country shares its advanced knowledge and innovations with another. This is done to promote progress and development in the receiving nation. It happens because different countries have unique strengths and expertise in various fields. By sharing these valuable insights and technologies, nations can work together to solve common problems and improve their economies.⁶ For example, a country might be very good at creating

⁶ Markus A Kirchberger, *Technology commercialization: A literature review of success factors and antecedents across different contexts*, 41 THE JOURNAL OF TECHNOLOGY TRANSFER 1077-1112(2016).

clean energy solutions, while another excels in medical advancements. By sharing these technologies, both countries benefit, as they can use each other's strengths to build a better future for their people. This collaborative exchange ultimately helps create a more connected and prosperous world.

PROCESS AND MECHANISMS OF TECHNOLOGY TRANSFER

While the process of technology transfer may involve many steps, the process runs from the inception of an idea (of technological innovation), research on the idea to check feasibility, development of the technology based on research, collaboration with different industries, calling for investment from private companies, production, distribution and finally commercialisation.⁷ The end objective of technology transfer is commercialisation which incidentally is the case with any invention. Not only does the invention have to fulfil the needs of the society but it also makes sure that it fetches the inventor his due share. Thus, the importance of commercialisation cannot be ignored.

The technology transfer process involves several key steps to effectively move knowledge and technology from one entity to another.⁸ These steps generally include:

- **Identification of Technology:** This initial step involves identifying a technology or innovation that has the potential to benefit another entity. This could be a new product, process, or knowledge base.
- **Evaluation and Assessment:** The identified technology is then thoroughly assessed to determine its feasibility, potential benefits, and any potential challenges or risks associated with its transfer.
- **Protection of Intellectual Property (IP):** Where applicable, measures are implemented to safeguard the intellectual property rights linked with the technology, which may involve patents, copyrights, trademarks, or other legal means to ensure appropriate usage and dissemination.
- **Documentation and Knowledge Transfer:** Information and expertise regarding the technology are systematically documented and structured to facilitate efficient transfer, encompassing technical records, guides, and pertinent materials.

⁷ See, *IP Commercialization and Technology Transfer: IP and Innovation Ecosystems Sector*, World Intellectual Property Organisation (WIPO), CDIP (Oct 20, 2022), Available at: https://www.wipo.int/edocs/mdocs/mdocs/en/cdip_29/cdip_29_ppt_1.pdf

⁸ Richard C. Dorf et. al, *Technology transfer: Research to commercial product*, 5(3) ENGINEERING MANAGEMENT INTERNATIONAL 185-191 (1989).

- **Negotiation of Terms:** The parties involved in the transfer agreement negotiate the terms of the technology transfer, including any licensing agreements, royalties, or other financial arrangements. This is done to ensure clarity on the rights and responsibilities of both parties involved.
- **Training and Skill Enhancement:** If needed, the recipient entity undergoes training or skill enhancement to proficiently utilize and incorporate the transferred technology, a pivotal step for seamless integration.
- **Deployment and Assessment:** The technology is integrated into the recipient entity's operations or procedures, followed by comprehensive testing to ascertain its functionality and alignment with desired objectives.
- **Monitoring and Assistance:** Continuous monitoring and support are furnished to address any issues or queries during the initial phases of technology adoption, ensuring a smooth transition.
- **Evaluation of Outcomes:** The outcomes and impact of the technology transfer are evaluated to determine its effectiveness in achieving the intended goals. This step helps identify areas for improvement and future opportunities for technology transfer.
- **Feedback and Continuous Improvement:** Feedback from both parties is collected and used to refine the technology transfer process for future endeavours. Continuous improvement ensures that the process becomes more effective over time.
- **Sustainability and Long-Term Planning:** Consideration is given to the long-term sustainability of the technology transfer, including plans for maintenance, updates, and potential future transfers.

As many steps as the process may entail, technology transfer can broadly be categorised into four levels:

1. Level I: Knowledge Creation
2. Level II: Sharing of information
3. Level III: Implementation
4. Level IV: Commercialisation

The first level demarcates the first step which is the creation of technical knowledge and information. This step is the building steps to the process of innovation. Once knowledge and information are developed, technology transfer demands that this knowledge be shared with entities other than the ones that developed the knowledge so that it can benefit other

organisations or nations in the procurement of such technologies. The third is putting the process of technology transfer into implementation, by borrowing and subsequently absorbing the technology as per the receiver's needs. Lastly, the technology ought to be commercialised. The commercialisation would help both the donor in the diffusion of its technology further into different markets and the receiver in helping not just generate income but also exploitation of advanced technologies that subsequently benefit society and boost one's economy.

Mechanisms of Technology Transfer: The different mechanisms through which technology transfer takes place can be summarised as⁹

1. Formal Agreements and Licensing

One of the most common mechanisms of technology transfer is through formal agreements and licensing arrangements. In this model, the owner of the technology (often a research institution or corporation) grants the recipient the right to use, modify, and often commercialize the technology in exchange for a fee or royalty.

2. Joint Ventures and Collaborative Research

Joint ventures and collaborative research initiatives are another effective means of technology transfer. In this approach, organizations pool their resources, expertise, and knowledge to jointly develop and commercialize new technologies¹⁰. This often occurs in industries with high research and development costs, such as pharmaceuticals and aerospace.

3. Educational Programs and Capacity Building

Capacity building and educational initiatives are pivotal in technology transfer, particularly in developing areas. Such programs offer instruction, training, and skill enhancement to individuals and institutions, enabling them to proficiently employ and tailor existing technologies to suit local circumstances. The information thus transferred in training personnel for such skill enhancement leads to technology transfer.

4. Open Source and Open Innovation

⁹ Andre Buys, *A review of Technology Transfer mechanisms*, 13(1) SOUTH AFRICAN JOURNAL OF INDUSTRIAL ENGINEERING (Jan 2012).

¹⁰ Samantha R. Bradley et. al, *Models and Methods of University Technology Transfer*, 9(6) FOUNDATIONS AND TRENDS IN ENTREPRENEURSHIP 571-650 (2013).

Open source innovation facilitates technology transfer by providing free access to technology, enabling customization to meet diverse needs, fostering global collaboration for knowledge exchange, and promoting rapid iteration and improvement based on community feedback. This inclusive and collaborative approach accelerates the adoption and dissemination of technology across different regions and industries, driving innovation and development worldwide

5. Foreign Direct Investment

When a multinational enterprise invests in another country, it typically introduces state-of-the-art technologies, managerial skills, and operational methods. Such investment provides the host country with access to advanced knowledge and techniques that might otherwise be unavailable. Additionally, multinational corporations often set up research and development facilities in the host country to tailor technologies to local needs and discover new uses, thereby fostering local innovation and knowledge development.

Additionally, through training programs, local employees learn to work with these advanced technologies, raising their skill levels.¹¹ Overall, FDI not only injects capital into the host country's economy but also facilitates the transfer of valuable technological know-how, contributing to the growth and development of the recipient nation.¹²

6. Mergers and Acquisitions

In some cases, technology transfer occurs through mergers, acquisitions, or strategic partnerships between companies. This can involve the acquisition of intellectual property rights or the integration of technological assets. When a company undergoes M&A, it may gain access to the technologies and intellectual property of the acquired company, allowing it to integrate these innovations into its operations. Acquisitions also bring together teams of experts from both companies, fostering collaboration and knowledge sharing that can lead to the transfer of technological know-how.

7. Trade and Export of Technology Intensive Goods

¹¹ Hezron M. Osano, *Role of Foreign Direct Investment on Technology Transfer and economic growth in Kenya: a case of the energy sector*, 31(5) JOURNAL OF INNOVATION AND ENTREPRENEURSHIP (2016).

¹² *Id.*

When a good is traded in a market, some amount of technology is transferred with the good. Technology transfer can also occur through international trade, where products or goods containing advanced technologies are exported to other countries.

8. Government Programs and Initiatives

Governments often play a role in facilitating technology transfer through grants, subsidies, tax incentives, and other policy measures designed to support research and innovation.

COMMERCIALISATION OF TECHNOLOGY IN TECHNOLOGY TRANSFER

Technology transfer, the process of disseminating valuable innovations and knowledge from research institutions to practical applications, is a crucial bridge between academic research and real-world impact. However, for technology transfer to truly flourish and bring about societal benefits, commercialization plays a pivotal role. Commercialization involves the transformation of these innovations into market-ready products or services, effectively bridging the gap between the laboratory and the marketplace.¹³

Transfer of technology may encompass the transfer of the technology itself or transfer of related know-how or both. In all of these cases, one kind of intellectual property or the other is transferred, which is the reason why technology transfer is also defined as the transfer of a patent or IP attached to the technology.

Intellectual property (IP) can be an invaluable asset, as businesses frequently leverage it to gain a competitive edge, expand into new markets, foster partnerships, and secure funding. When there is significant demand for the invention, creators of IP have various avenues for commercializing their work.

For those with an entrepreneurial spirit, there's the option to personally oversee the commercialization process, selling products and services directly to customers. This path demands considerable effort, including tasks like identifying production sources, conducting market research, packaging, and handling logistics. However, it also entails substantial risk, as the creator assumes full responsibility for managing the IP, business operations, and associated expenses. Nonetheless, the potential rewards are commensurate with the risks. Recognition for

¹³ *Supra* Note 6.

the invention and financial gains are among the potential benefits, as exemplified by the success of several companies.

Alternatively, a creator may choose to transfer IP rights to a third party. In certain scenarios, especially in academic research or collaborative industrial ventures, this transfer may occur before a discovery through institutional policies, research agreements, or contracts. This approach helps mitigate risk; the creator still receives recognition for their work and may still realize financial gains, but they effectively relinquish ownership rights to the assignee.

Another avenue for IP commercialization is licensing, wherein the owner enters into a legal agreement specifying terms for the use of the IP. In this arrangement, the owner retains ownership while the licensee gains the right to utilize the IP under the agreed-upon conditions, often in exchange for fees or royalties. Once again, this method serves to distribute or reduce risks. The terms of the agreement may delineate territories, cost-sharing arrangements, or other stipulations intended to benefit both the licensor and the licensee.

Without commercialization, the potential economic value of a technology remains untapped. Turning a technological concept into a marketable product or service allows for revenue generation, which in turn fuels further innovation and research. Commercialization leads to the creation of businesses and industries, which in turn generate jobs. This not only reduces unemployment rates but also contributes to overall economic growth and stability. It also ensures that technologies are tailored to meet specific market demands. This process involves refining and adapting the technology to suit the preferences and requirements of consumers. Companies that successfully commercialize technology gain a competitive edge in the market. They can offer innovative solutions that set them apart from competitors, attracting customers and partners. Commercialized technologies have a broader reach and impact. They can be adopted by a wider audience, benefiting more individuals and industries. This diffusion accelerates the pace of technological advancement. Hence, commercialization is essential to unlock the full potential of technology transfer. It transforms theoretical concepts into tangible products or services, creating economic value, jobs, and societal benefits. Without effective commercialization, the true impact and value of a technology may remain unrealized.

Thus, technology transfer seems to be one of the ideal means through which intellectual property can be commercialised. Even when the technology itself is the one that gets commercialised in the market, the IP within gets commercialised too.

COMMERCIALISATION OF INTELLECTUAL PROPERTY IN TECHNOLOGY TRANSFER

The commercialization of intellectual property (IP) in the process of technology transfer faces several key challenges that can hinder the successful transition of innovations from the laboratory to the marketplace. One of the primary challenges is the **valuation of intellectual property**, where accurately assessing the worth of IP can be difficult due to its intangible nature and the uncertainty surrounding its market potential. This can lead to disputes over licensing terms or deter investors who are unsure of the IP's future value. Additionally, **legal and regulatory hurdles** can complicate the commercialization process, as differing intellectual property laws and regulations across jurisdictions can create complexities in securing and enforcing IP rights. Navigating these legal landscapes requires significant expertise and resources, which may be beyond the reach of smaller entities or startups.

Another significant challenge is the **alignment of interests between stakeholders**, including inventors, research institutions, industry partners, and investors. Each party may have different objectives, timelines, and risk tolerances, which can lead to conflicts during the negotiation and execution of technology transfer agreements. Moreover, the **lack of market readiness** for new technologies can impede commercialization. Innovations often require substantial further development, adaptation, and validation before they are ready for commercial use, which can be both time-consuming and costly. Securing the necessary funding and resources for these steps is often challenging, especially for early-stage technologies.

Finally, **managing the transition from research to commercialization** is a complex process that requires not only technological expertise but also business acumen. Many research institutions and inventors may lack the necessary experience or support to navigate the commercialization process effectively, including market analysis, business development, and scaling up production. Overcoming these challenges requires a coordinated effort, involving robust IP management strategies, strong collaboration among stakeholders, and access to resources that can bridge the gap between innovation and market entry.

ISSUES AND PROPOSED MITIGATION

A crucial element in technology transfer revolves around setting the right price. Determining royalties and pricing strategies requires careful and efficient management. One significant

challenge in this regard is establishing the appropriate pricing models. If the technology is priced too high, it may deter potential buyers who are genuinely interested, potentially resulting in lower levels of commercialization. Conversely, if the technology is undervalued, it can lead to substantial revenue loss, which the inventor would want to avoid at all costs. Finding the right balance is essential for a successful technology transfer process. IP valuation is a desired step in this regard. Market forces and the demand-supply chain are key players in the determination of what the IP attached to the technology is worth. This in return shall also guide towards the right price of the technologically advanced product¹⁴.

Also, there has to be adequate awareness and publicity of the technology. Promoting the technology slated for commercialization through transfer is instrumental in pinpointing potential buyers. The more widely the technology is advertised, whether through outreach or other means, the simpler it becomes to locate interested parties who recognize the true value of the technology. Lack of awareness on the front of technological advancements or less publicity of the borrowed/intended-to-be borrowed technology can lead to poor commercialisation. Thus efforts should be made in the present context to increase awareness and publicity by investing in workshops, conferences on the issue and proper advertising and marketing of the technology.

Adequate investment is an important factor which is longed for from the point of view of the development of a technology and its eventual commercialisation. Since developing countries lack the resources to develop technology, they may sometimes face difficulties in procuring the desired technology also due to monetary limitations. This would adversely affect the process and subsequent commercialisation as it is then that the nations will price the technology accordingly. The more price spent on procurement, the more will be the commercial market price for the sale of the product. To do away with such constraints, what is required is that the government appropriately fund research in transition economies so that the nation can stand tall on research and development which in turn shall attract venture capitalists and other private players in the market to invest in such technologies.

CONCLUSION

In short, commercialization stands as the linchpin of successful technology transfer. It is the transformative process that takes innovative ideas from the drawing board to the marketplace,

¹⁴ Ramya Ravi & Manthan D. Janodia, *Factors Affecting Technology Transfer and Commercialization of University Research in India: a Cross-sectional Study*, 13 JOURNAL OF THE KNOWLEDGE ECONOMY 787-803 (2022).

where they can make a tangible impact on society. Through commercialization, advanced technologies find their way into industries, driving economic growth, creating jobs, and ultimately improving the quality of life for people around the world. This process not only bridges the gap between research and practical application but also fosters a dynamic ecosystem of innovation, where academia, industry, and government collaborate to bring about positive change. Moreover, by attracting investments, stimulating research, and fostering entrepreneurship, commercialization fuels a self-sustaining cycle of progress. Therefore, recognizing the pivotal role of commercialization in technology transfer is not just a strategic imperative, but a fundamental driver of societal advancement in the modern era.

The ultimate objective of technology transfer is its commercialization. This international process entails the movement of technology from developed nations to developing ones, where the recipient country integrates it for the production of commercially viable products. The receiving party is willing to invest in the technology only when it foresees potential benefits or profits upon its successful commercialization. Commercialization not only allows the recipient to align production with demand but also provides the transferor with increased visibility and wider outreach. Any technology transfer is undertaken with the primary aim of leveraging the technology for commercial exploitation, either as an urgent necessity or for advancing related technologies and products that promptly cater to people's needs. Therefore, a successful technology transfer is ultimately marked by the effective commercialization of the technology.

From the perspective of a developing country, technology transfer holds immense significance as it represents an opportunity for progress and development. Technology transfer refers to the process of acquiring and adopting advanced knowledge, expertise, and technologies from more developed countries or institutions. For a developing nation, technology transfer means gaining access to cutting-edge innovations, industrial practices, and technical know-how that might otherwise be challenging or costly to develop internally.

In conclusion, technology transfer is a dynamic and multifaceted process that holds immense potential for driving economic growth, enhancing competitiveness, and addressing global challenges. By understanding the mechanisms that facilitate this exchange and addressing the associated challenges, we can unlock the full potential of technology transfer for the betterment of society as a whole. As we navigate an increasingly interconnected world, fostering a culture of innovation and collaboration will be essential in bridging the innovation gap and ensuring that the benefits of technology are accessible to all.