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2021/22 KSP Policy Consultation Report

ASEAN

IP Valuation - Best Practices for ASEAN Member States

Ministry of Economy and Finance

KDI Korea Development Institute

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Prepared by	Korea Development Institute (KDI)
Project Director	Jungwook Kim, Executive Director, Center for International Development (CID), KDI
Project Manager	Kyoung Doug Kwon, Director of Policy Consultation, CID, KDI
Project Officer	Seung Hyun Kim, Senior Research Associate, CID, KDI
Senior Advisor	Tae-Keun Rhee, Former CEO, Korea Institute of Patent Information
Principal Investigator	Tae-Eung Sung, Professor, Yonsei University
Authors	Chapter 1. Eungdo Kim, Professor, Chungbuk National University
	Chapter 2. Tae-Eung Sung, Professor, Yonsei University
	Chapter 3. Jongtaik Lee, Researcher, Korea Institute of Science and Technology Information
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IP Valuation - Best Practices for ASEAN Member States

Preface

Knowledge is an essential ingredient in a country's economic growth and social development. Of particular importance is a government's capacity to formulate and implement policies. The global society is focused on implementing the Sustainable Development Goals (SDGs), which promotes knowledge sharing between countries in order to improve their policy capacity and to tackle development issues and enhance global prosperity.

Indeed, knowledge has taken on an ever-greater importance as the world continues to confront countless challenges in the post-Covid-19 era including escalating climate change, global supply chain disruptions, and economic instability. In order to effectively tackle and resolve such global problems, knowledge sharing and capacity building cannot be underestimated.

When it comes to Korea's economic development, knowledge laid the foundation for the unprecedented transformation from a poor agro-based economy into a modern industrialized one with an open and democratic society. Technology transfer from abroad and educational investments helped expand the domestic knowledge stock and made this transformation possible. The Korean government accumulated invaluable practical lessons not found in conventional textbooks through trials and errors in its course of economic development.

Capitalizing on these lessons, Korea's Ministry of Economy and Finance (MOEF) introduced the Knowledge Sharing Program (KSP) in 2004 to share Korea's development experience with the international community through joint research, policy consultations, and capacity-building activities. The program has played a vital role in supporting socio-economic development of partner countries around the world.

Since the program's launch, Korea Development Institute (KDI) has participated in implementing the KSP and has been working with more than eighty foreign countries. KDI, Korea's leading think-tank with an extensive experience in policy research, has provided solutions to the challenges that partner countries face in a variety of fields ranging from industrial development to digital transformation. In the 2021/22 KSP cycle, KDI carried out nineteen policy consultation projects in a variety of areas including digital and green economy.

Among the nineteen 2021/22 KSP projects, one in particular is worth highlighting, which was initiated by the Association of Southeast Asian Nations (ASEAN) and titled, "IP Valuation - Best

Practices for ASEAN Member States." Based on the ASEAN and ASEAN Secretariat's request, the MOEF and KDI organized a research team consisting of ASEAN and Korean experts. The team conducted an in-depth analysis of internal and external policy environments, identified ASEAN's key development challenges, and offered policy recommendations and action plans.

On behalf of KDI, I would like to express my deepest appreciation to the ASEAN Secretariat for their collaboration in the project. In particular, I would like to extend my profound gratitude to Mr. Looi Teck Kheong, Head of Competition, Consumer Protection and IPR Division (CCPID), and Ms. Maslina Malik for their unwavering support. The completion of this project would not have been possible without their devotion. I also wish to thank the KSP consultation team—Senior Advisor Mr. Tae-Keun Rhee, Principal Investigator Professor Tae-Eung Sung, researchers Professor Eungdo Kim and Dr. Jongtaik Lee, and local consultants Mitchel Chua, Mary Jade Roxas, Ikhwan Bakri and Alan Adcock—for producing this report.

I would like to extend my sincere thanks to all who have made valuable contributions to a successful completion of the project. I am also grateful to the Center for International Development of KDI, in particular Executive Director Dr. Jungwook Kim, Project Manager Dr. Kyoung doug Kwon, and Project Officer Mr. Seung Hyun Kim, for their hard work and dedication to the project.

I firmly believe that the KSP will serve as a stepping stone to further elevate mutual learning and economic cooperation between ASEAN and Korea, and hope it will contribute to their sustainable development.

Youngsun Koh
Acting President
Korea Development Institute (KDI)

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List of Abbreviations

Abbreviations	Meaning
IP	Intellectual Property
AMS	ASEAN Member States
IPR	Intellectual Property Rights
KIPO	Korea Intellectual Property Office
KSP	Knowledge Sharing Program
WIPO	World Intellectual Property Organization
FCFF	Free Cash Flow to the Firm
M&A	Mergers & Acquisitions
KOSDAQ	Korea Securities Dealers Automated Quotation
KIAT	Korea Institute for Advancement of Technology
MOTIE	Ministry of Trade, Industry and Energy
MSIT	Ministry of Science and ICT
MSS	Ministry of SMEs and Startups
PCIP	Presidential Council on Intellectual Property
FSC	Financial Services Commission
SME	Small and Medium Enterprise
AHP	Analytic Hierarchy Process
NPV	Net Present Value
KTRS	Kibo Technology Rating System
DCF	Discounted Cash Flow
STBR	Standard Technology Business Rating
KCVA	Korea Certified Valuation Analyst
TP	Techno Park
TLO	Technology Licensing Organization
SIPS2030	Singapore IP Strategy 2030 Report
IPOS	Intellectual Property Office of Singapore
IVSC	International Valuation Standards Council
IVS	International Valuation Standards
SGX	Singapore Exchange
IPOPHIL	Intellectual Property Office of Philippines
DTI	Department of Trade and Industry
DOF	Department of Finance
DOST	Department of Science and Technology

List of Abbreviations

Abbreviations	Meaning
DICT	Department of Information and Communications Technology
PVS	Philippine Valuation Standards
BLGF	Bureau of Local Government Finance
DIP	Department of Intellectual Property
DBD	Department of Business Development
VAT	Valuers Association of Thailand
MyIPO	Intellectual Property Corporation of Malaysia
NIPP	National IP Policy
IPFS	Intellectual Property Financing Scheme
IPVM	IP Valuation Model
MDV	Malaysia Debt Ventures
JPPH	Valuation and Property Services Department
RISM	Royal Institution of Surveyors Malaysia
BVAM	Business Valuers Association Malaysia
IACVS	International Association of Certified Valuation Specialists
ITMA	Innovation and Technology Managers Association
NGO	Non-Governmental Organization
ICC	Innovation and Commercialization Center
ATTP	Alliance of Technology Transfer Professionals
MIGHT	Malaysian Industry-Government Group for High Technology
IDEAS	Intangible Disclosure Evaluation and Audit Scheme
PFI	Participating Financial Institution
RFR	Relief-From-Royalty
MITI	Ministry of International Trade and Industry
SIRIM Standard	Guidelines For Technology Commercialization in Malaysia
WSG	Workforce Singapore
PCP	Professional Conversion Program
SUSS	Singapore University of Social Sciences
MIPIM	Master of IP and Innovation Management
SSG	Skills Future Singapore
SFW	Skills Framework
CPVA	Certified Patent Valuation Analysts
TDRI	Thailand Development Research Institute Foundation

2021/22 KSP with ASEAN

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The Association of Southeast Asian Nations (ASEAN) is a regional intergovernmental organization established in 1967 to promote the integration of Southeast Asian countries from the economic, political, security, defense, education, and socio-cultural aspects. ASEAN consists of ten member states including Brunei, Malaysia, Indonesia, Singapore, the Philippines, Thailand, Vietnam, Cambodia, Laos, and Myanmar.

In December 1995, ASEAN signed the “ASEAN Framework Agreement on Intellectual Property Cooperation” in Bangkok, Thailand to promote close cooperation among member countries in the field of intellectual property rights. Since the signing of the Agreement, ASEAN member countries have made continuous efforts to improve the system for the protection of intellectual property rights, including amendments to domestic laws in line with international standards, and to homogenize intellectual property laws among the members. In 1996, ASEAN established the “ASEAN Working Group on IP Cooperation (AWGIPC)” as a consultative body to improve the patent and trademark-related policies and systems among ASEAN member countries.

In 2007, ASEAN adopted the “ASEAN Economic Community (AEC) Blueprint” with the goal of establishing a single market and single production-based ASEAN Economic Community by 2015. “AEC Blueprint 2015” presented specific goals in four major areas: establishment of a single base and production base, a highly competitive economic zone, balanced economic development, and integration with the global economy. After the first period set by the AEC Blueprint 2015, ASEAN adopted “AEC Blueprint 2025” by improving the contents of “AEC Blueprint 2015” and adding new concepts such as “resilience”, “sustainability” and “inclusiveness”. When it comes to intellectual property rights, AEC Blueprint prescribes “strengthening intellectual property rights and cooperation” as a measure to build a “competitive, innovative and dynamic ASEAN”.

In line with the Blueprint, AWGIPC has been implementing the "ASEAN Intellectual Property Action Plan 2016-2025", a-10-year strategic plan in the field of intellectual property. It aims to strengthen the protection and utilization of intellectual property rights and establish the proper environment for the development of intellectual property, and lays out four strategic goals and 19 specific tasks including intellectual property valuation.

The Knowledge Sharing Program (KSP) with ASEAN was initiated in 2018 as an outcome of the "Korea-ASEAN High-level Meeting" held in 2017. The ASEAN Secretariat and member countries requested a KSP to learn about Korea's experience in the field of intellectual property. The 2018/19 project was conducted under the theme of "Strengthening the Intellectual Property Infrastructure of ASEAN Member States". As a result, an online platform for IP education and training centers has been established. In November 2019, the "Joint Declaration on Intellectual Property Cooperation" was adopted at the "the ASEAN-KOREA Heads of Intellectual Property (IP) Offices Meeting" held during the ASEAN-Korea Special Summit (Busan). In that meeting, Korea and ASEAN members agreed on strengthening cooperation in the field of intellectual property rights.

Against this backdrop, the ASEAN Secretariat requested a-follow-up project titled "IP Valuation - Best Practices for ASEAN Member States" for the year 21/22 to promote strategic cooperation with the government and financial institutions, and to make it easier for ASEAN SMEs to access intellectual property valuation through the establishment of an intellectual property valuation model and strengthen the capacity of relevant institutions.

After due discussions, the topics and researchers for the 2021/22 KSP with ASEAN were finalized as below.

<table>
<tr><th>Korean Researchers</th><th>Korean Researchers</th><th>Local Consultants</th></tr>
<tr><td>Introduction to IP Valuation and the Current Status of IP Valuation Infrastructure in ASEAN Member States</td><td>Eungdo Kim
(Chungbuk National University)</td><td rowspan="3">Mitchel Chua
(BYTEDANCE)
Mary Jade Roxas
(PwC)
Ikhwan Bakri
(IP Consultant)
Alan Adcock
(Tilleke & Gibbins)</td></tr>
<tr><td>Introduction to IP Valuation in Korea and its Current Status</td><td>Tae-Eung Sung
(Yonsei University)</td></tr>
<tr><td>Korean IP Valuation Case Studies and Implications</td><td>Jongtaik Lee
(Korea Institute of Science & Technology Information)</td></tr>
<tr><td colspan="3">• Senior Advisor: Tae-Keun Rhee (Former CEO, Korea Institute of Patent Information)
• Project Manager: Kyoung doug Kwon (Director of Policy Consultation and Planning, CID, KDI)
• Principal Investigator: Tae-Eung Sung (Professor, Yonsei University)</td></tr>
</table>

Due to constraints presented by the Covid-19 pandemic, the entire activities of the 2021/22 KSP with ASEAN were conducted on-line. The launching Seminar was held on January 25th, 2022 via video conference. Looi Teck Kheong, head of the Competition, Consumer Protection and IPR Division (CCPID) from the ASEAN Secretariat and around 60 participants from the member states attended the seminar. During the seminar, participants shared ideas and comments on the research plan presented by the experts from Korea, and discussed the methodology and timeline for collecting relevant information and data from the member countries.

Since the level of development of the framework of intellectual property rights varies from country to country, in-depth studies were conducted to analyze current status of IP framework in each member country. The study was conducted in close cooperation with local consultants with high expertise in the field of intellectual property rights from March to August. The results from the in-depth study has not only been reflected in the interim and final reports, but also disseminated to relevant institutions in Vietnam, Indonesia and Cambodia.

The interim reporting was held on June 13th. Initially, it was planned to be held in Korea with the Policy Practitioners' Workshop. However, as the COVID-19 situation continued, the project team agreed to hold the workshop online after the final report meeting, and an interim reporting session was organized separately. Korean experts shared the progress of their research, and presented Korea's experience in each topic as well as tentative policy recommendations.

The Final Reporting Workshop was held online on August 18th of 2022, to share the research results and present policy recommendations. Korean researchers delivered their final outcomes for ASEAN member countries. At last, Policy Practitioners' Workshop was held online right after the Final Reporting Workshop.

Although the most of 2021/22 KSP ASEAN was conducted online, the Korean experts and their counterparts from ASEAN member countries put their best efforts to draw timely policy recommendations to develop IP valuation framework. As follow-up project focusing on IP valuation and financing, cooperation between Korea and the ASEAN will be strengthened and consequently draw meaningful outcomes in the field of IP valuation in the near future.

Executive Summary

Tae-Eung Sung (Yonsei University)

Executive Summary

Tae-Eung Sung (Yonsei University)

Intellectual Property (IP) as an intangible asset has had limitations in its value compared to tangible assets owing to its rapid development and the high uncertainty surrounding it. The concept of IP evaluation (IP Evaluation & Valuation) encompasses IP evaluation, which allows those who possess IP to capitalize on it, and IP valuation, which evaluates the economic value of the IP itself. The former can express the value of the IP as a grade score, and the latter can be expressed as a value. The scope of application of IP valuation is very wide, ranging from IP transfer transactions to investment in kind, establishment of security rights, calculation of liquidation value upon corporate restructuring, and calculation of damages in case of IP disputes and litigation.

Intellectual Property Rights (IPR) such as trademarks, copyrights, and design patents are potential tools for AMS to engage in business and compete, and are important for national economic development. Through the establishment of an IP valuation model and education program for evaluators, it will be possible to provide ASEAN SMEs with easy access to IP valuation, and facilitate strategic cooperation with the government and financial institutions.

IP valuation needs to be understood from the perspective of IP finance. Due to the nature of IP finance, which is a typical market failure area, the IP valuation system needs to be implemented under government-led policies. The purpose of government intervention in the IP valuation market is to establish an open valuation system by the market through stipulating IP valuation standards and procedures and enhancing the reliability of IP valuation results. Therefore, this study examines the government-led IP valuation infrastructure of Korea and AMS through literature reviews, expert surveys, interviews, and fact-finding, and draws policy recommendations to promote the establishment of a desirable IP valuation infrastructure that reflects the needs of the market in AMS.

Based on the analysis, policy measures for the successful establishment of IP valuation infrastructure and activation of IP valuation in AMS are presented as follows.

First, it is necessary to come up with a reasonable plan for 'structuring the IP valuation institutions'. This is a plan to integrate / operate functions related to IP valuation temporarily by forming a single valuation organization, the 'IP Valuation Cooperation Group' comprised of major public IP valuation institutions. In the future, when the IP valuation market enters the mature stage, it may be desirable to disband the organization and introduce a competition system based on market principles.

Second, 'plans to increase the utilization of IP valuation' should be devised. The study focuses on 'financing' and presents a step-by-step direction to 'expand the targets of technology evaluation during the registration examination in the stock market' and strengthen the IP valuation system by enhancing the utilization of IP valuation and selecting high-quality companies.

Third, continuous efforts are needed for 'improving and advancing the IP valuation model'. As a research direction for the improvement of the IP valuation model, it is advisable to build a 'financial information DB by industry/growth stage' of SMEs and venture companies and use them for IP valuation. The procedure for DB construction and examples of construction and application methods are presented.

Fourth, it is necessary to establish a plan for 'nurturing IP valuation experts.' In order to accomplish this, it is necessary to centralize the functions by unifying the scattered IP valuation qualification system, and to promote a nationally recognized qualification system.

This research reviewed the measures for revitalizing the IP valuation system of AMS comprehensively and presents a plan to create an environment in which the IP valuation market and system operation of AMS can develop into a more mature state, and SMEs/venture companies with excellent IP can grow.

Our research group is comprised of experts in IP valuation theory, models, and best practices, and aim to present to the AMS the importance of awareness regarding IP valuation, by introducing IP valuation models and the web-based valuation systems in Korea. Furthermore, we intend to deliver the value of IPR as financial assets and propose ways to apply valuation results to the fields of commercialization with various goals (e. g. IP transfers, financial loans). We will assist the officers in charge of IP valuation and commercialization in AMS and provide substantial mentoring to establish and/or customize the IP valuation framework best suitable for their current situations in ASEAN IP markets.

However, the excessively long time and high costs for completing the valuation of a technology frequently make it difficult for IP owners or a firm to get direct benefits in a timely manner for commercialization outcomes, since it takes normally 8 to 12 weeks and requires the valuation fee of about 1,500 USD or so. In addition, in order to be eligible to work as IP valuators, potential valuators should pass a series of written tests and hold a non-public certificate issued by KVA. They should fully understand how the valuation models are processed and how each variable for IP valuation is determined with meta data or reference information, and then complete a practitioner course in order to be equipped with the practical ability and knowhows for the commercialization support in the industry fields.

To make the IP valuation environment much easier and accessible for the web-based valuation system and the associated databases, the public institutions such as Korea Technology Finance Corporation (KIBO), Korea Invention Promotion Association (KIPA) and Korea Institute of Science and Technology Information (KISTI) have developed their own unique software for either IP valuation or evaluation. In order, KIBO, KIPA and KISTI operate KPAS (an AI-based patent valuation system), SMART (an IP-rating system), and STAR-Value (a patent- and financial data-based valuation system), where each is utilized distinctly for the applicable purposes. When each was released officially, the users or IP consultants welcomed those as auxiliary assessment tools in that each expedites fast-track online valuation/evaluation. However, there exists a limitation that a large quantity of input data is required, and the valuator should fully understand the technological characteristics and business circumstance of an IP.

As of August 2022, a total of 31 institutions and firms are certified by Korea Institute for Advancement of Technology (KIAT). Furthermore, it is known that about 3,400 cases were valuated by both public and private valuation institutions/firms in 2021 alone, and the number of valuation cases has been growing steadily for the past three-to-four years. In terms of law/policy regarding the IP valuation act, web-based system and databases, training programs (for fostering IP consultants), practices/valuation reports and templates, Korea's IP valuation capabilities are placed at the developed or matured stage world-wide. We will leave the detailed explanation regarding law/policy, training and case studies of IP valuation for the preceding or following chapters, and investigate the web-based infrastructure and valuation models that are mainly in use.

Lastly, we will introduce leading Korean web-based valuation systems (*STAR-Value, KPAS) and the various types of reference information databases. Further, we will explain both the structures and features of the web-based services, as well as the cases of utilization for business development in Korea. In addition, we will provide an analysis of IP valuation situations of four AMS countries (Singapore, Philippines, Thailand, and Malaysia), based on the data and information collected by local field specialists or consultants. We will also perform mentoring and provide guidelines to establish the support infrastructure or framework for IP valuation that is the best fit for each country's IP market status, if necessary, after discussions with AMS over the areas where support is desired, or propose methods to import Korean IP valuation framework and utilization practices for future benchmarks. Further, we would move toward assisting the other ASEAN countries besides the four above, if we are able to identify guiding strategies and comments in establishing an IP valuation framework and transferring practices and knowhows for countries such as Viet Nam, Cambodia, Indonesia, etc.

Next, our research group intends to propose implications related to the development of IP valuation framework in ASEAN countries in the future by analyzing the characteristics of the valuation reports published in Korea and reflecting and incorporating the lessons into the current status of intellectual property management and valuation in ASEAN countries.

By referring to Korea's practical guidelines for technology valuation, an 'appropriate' in-depth report will be selected and analyzed. Through case analysis of the report, the research team will examine the procedure for valuating technology value and provide guidance to determine key points (variables). Both in the in-depth valuation and in simple online valuation, the necessary information (DB) will be identified and step-by-step analysis will be performed. The research team will determine the valuation procedures and key variables and analyze how they have been reflected in the report, in parallel with a review of how the logic of the valuation model has been applied in the report. It is necessary to analyze the difference between the in-depth valuation report and the simple (online) valuation report, and understand the essential information (DB) required for calculating IP values.

It is also necessary to understand the current status of IP management and valuation in ASEAN member states in order to derive implications for the development of IP valuation models and related systems in ASEAN countries. Through collaboration with local experts, the local situation regarding intellectual properties in AMS was identified and related information was collected.

After identifying the current status of local IP management and IP valuation in ASEAN member states in collaboration with local experts and analyzing IP valuation case studies of Korea, this research team will propose matters to consider when developing an IP valuation framework in ASEAN member states according to local ASEAN member states' intellectual property database, valuation model and the status of the related system's development.

In order to develop models and systems to perform IP valuation effectively, it is necessary to establish the DB to be used in the model. Representatively necessary DBs include the economic lifecycle DB of technology, financial information by company, financial information by industry, and the running royalty rate. Since the DBs required for valuation have already been established and various models using it have been well developed in Korea, it is expected that valuation models and DBs can be developed according to the development level of each country by referring to Korea's IP valuation models and related systems.

It is advisable to develop a government-led IP valuation practice guide. It is also necessary to increase the reliability of the valuation results by developing the valuation model and the DB to be applied to the model at the government level. This in turn necessitates collaboration with organizations that collect and analyze DBs such as financial information and deal values to be used in the model. It is desirable to expedite the development of models and related essential DBs by conducting consulting projects with countries such as Korea that have advanced IP valuation systems, which have already conducted and utilized IP valuation nationwide for decades. In addition, it may be necessary to make it mandatory for related parties to perform IP valuation when governmental fund is provided for IP-based collateral or when any kind of IP-based governmental support is involved. Furthermore, in order to provide quick support to small and medium-sized enterprises using IP, it may be necessary to develop a 'quick' service system such as an online valuation system. In addition, in order for IP valuation practices to settle early in ASEAN member states, the governments will need to establish an IP valuation support policy such as full or partial supports for the valuation costs.

01

CHAPTER

Introduction to IP Valuation and the Current Status of IP Valuation Infrastructures in Korea and ASEAN Member States

Eungdo Kim (Chungbuk National University)

1. Introduction
2. Overview of IP Valuation
3. Current Status of IP Valuation Infrastructures in Korea
4. Current Status of IP Valuation Infrastructures in AMS
5. Policy Recommendations
6. Conclusion

Keywords
IP Valuation, IP Valuation Infrastructure, IP Valuation Law/Policy,
IP Valuation Organization, IP Valuation System, IP Valuation Education Program

Introduction to IP Valuation and the Current Status of IP Valuation Infrastructures in Korea and ASEAN Member States

Eungdo Kim (Chungbuk National University)

Summary

Intellectual Property (IP) as an intangible asset has had limitations in its value compared to tangible assets due to its rapid development and the high uncertainty surrounding IP. It is true that it has been difficult to expand and develop a business based on technology. The concept of IP evaluation (IP evaluation and valuation), encompasses IP evaluation, which allows those who possess IP to capitalize on it, and IP valuation, which evaluates the economic value of the IP itself. The former can express the value of the IP as a grade score, and the latter can be expressed as a value. The scope of application of IP valuation is very wide, ranging from IP transfer transactions to investment in kind, establishment of security rights, calculation of liquidation value upon corporate restructuring, and calculation of damages in case of IP disputes and litigation.

The IP evaluation (IP evaluation and valuation) system has been developed as a means to evaluate the development of industrial technology comprehensively and facilitate the transfer and commercialization of the developed IP to support the development of national industrial competitiveness. Intellectual Property Rights (IPR) such as trademarks, copyrights, and design patents are potential tools for AMS to engage in business and compete in the market, and are important for national economic development. Licensing and sale of IPR are becoming more common in the market, and there is a growing tendency to use intangible assets as loan collateral and funds (IPR financial assets), increasing the importance of IP valuation. In addition, the establishment of an IP valuation model and education program for evaluators will enable ASEAN SMEs to access IP valuation and facilitate strategic cooperation with the government and financial institutions.

IP valuation needs to be understood from the perspective of IP finance. Due to the nature of IP finance, which is a typical market failure area, the IP valuation system needs to be

implemented under government-led policies. The purpose of government intervention in the IP valuation market is to ultimately establish an open valuation system by the market through stipulating IP valuation standards and procedures, and enhancing the reliability of IP valuation results. Therefore, this study examines the government-led IP valuation infrastructure of Korea and AMS through literature reviews, expert surveys, interviews, and fact-finding, and draws policy recommendations to promote the establishment of a desirable IP valuation infrastructure that reflects the needs of the market in AMS.

Based on the analysis, policy measures for the successful establishment of IP valuation infrastructure and activation of IP valuation in AMS are presented as follows.

First, it is necessary to come up with a reasonable plan for 'structuring the IP valuation institution.' This is a plan to integrate / operate functions related to IP valuation temporarily by forming a single valuation organization, the 'IP Valuation Cooperation Group' for major public IP valuation institutions. In the future, when the IP valuation market enters the mature stage, the proposed organization may be disbanded and a competition system based on market principles may be introduced. If the formation of the 'IP valuation Cooperation Group' is difficult for various reasons, as an alternative, an entity tentative named the 'IP Valuation Cooperation Network' that forms a strong cooperative system among IP valuation-related institutions may be formed to expand the sharing of information related to IP valuation. Both proposed entities have differences in terms of operation as measures to develop the current IP valuation market, which is in an immature state, although the purpose of maximizing synergy effects by concentrating the scattered IP valuation functions through a cooperative structure is the same.

Second, 'plans to increase the utilization of IP valuation' should be devised. The study focuses on 'financing' and presents a step-by-step direction to 'expand the target of technology evaluation during the registration examination in the stock market' and to strengthen the IP valuation system by enhancing the utilization of IP valuation and selecting high-quality companies. These measures are intended to lay the foundation for the soundness of the stock market. In addition, while researching the 'expansion of financial support system and product development through IP valuation' with a focus on the IP valuation guarantee support system, this study presents a proposal to establish an IP valuation guarantee support system for each growth stage.

Third, continuous efforts are needed for 'improving and advancing the IP valuation model.' As a research direction for the improvement of the IP valuation model, it is advisable to build a 'financial information DB by industry/growth stage' of SMEs and venture companies and use them for IP valuation. The procedure for DB construction and examples of construction and application methods are presented.

Fourth, it is necessary to establish a plan for 'nurturing IP valuation experts.' In order to accomplish this, it is necessary to centralize the functions by unifying the scattered IP valuation qualification system, and to promote the nationally recognized qualification system. Plans to improve training for experts, such as nurturing IP valuation analysts and introducing a real-name IP valuation system, and mid/long- term action tasks are proposed.

This research reviewed the measures for revitalizing the IP valuation system of AMS comprehensively, and presents plans to create an environment in which the IP valuation market and system operation of AMS can develop into a more mature state, and SMEs/venture companies with excellent IP can grow. IP valuation agencies and related government ministries should work together to prepare effective and reasonable measures in this direction.

1. Introduction

1.1. Background

1.1.1. Background and Purpose of Research

The IP evaluation (IP evaluation and valuation) system has been developed as a means to comprehensively evaluate the development of industrial technology and the transfer and commercialization of the developed IP to support the expansion of national industrial competitiveness. Intellectual Property Rights (IPR) such as trademarks, copyrights, and design patents are potential tools for AMS to engage in business and compete in the market, and are important for national economic development. Licensing and sales of IPR are becoming more common in the market, and there is a growing tendency to use intangible assets as loan collateral and funds (IPR financial assets), increasing the importance of IP valuation. In addition, the establishment of an IP valuation model and education program for evaluators will make it easier for ASEAN SMEs to access IP valuation, and enable strategic cooperation with the government and financial institutions.

Against this backdrop, at the '2nd ASEAN-Korean Intellectual Property Office (KIPO) Directors' Meeting' held during the ASEAN-Korea Special Summit (Busan) in November 2019, the 'Joint Declaration on Intellectual Property Cooperation' was adopted and the cooperation between Korea and ASEAN was strengthened in the field of IPR. Subsequently, the ASEAN Secretariat requested Korea to share the country's best practices and policy recommendations for establishing an IP valuation infrastructure for ASEAN Member States.

IP valuation needs to be understood from the perspective of IP finance. Due to the nature of IP finance, which is a typical market failure area, the IP valuation system needs to be implemented under government-led policies. The purpose of government intervention in the IP valuation market is to ultimately establish an open valuation system based on the market through stipulating IP valuation standards and procedures, and enhancing the reliability of IP valuation results. Therefore, this study examines the government-led IP valuation infrastructures of Korea and AMS through literature reviews, expert surveys, interviews, and fact-finding, and draws policy recommendations to promote the establishment of a desirable IP valuation infrastructure that reflects the needs of the market in AMS.

1.1.2. Scope and Method of Research

The Knowledge Sharing Program (KSP) research team and ASEAN agreed on the scope of this research topic as follows. First, IP valuation is limited to methods that express the economic value of IP rather than grades or scores. Second, in the overview of IP valuation, the definition, type, and application fields of IP valuation are introduced, and third, analysis of the current status of IP valuation infrastructures in both Korea and AMS are performed under four categories: law/policy, organization, system, and education. The status of IP valuation infrastructure in Korea was analyzed through literature reviews and fact-finding, and status review regarding the IP valuation infrastructures of AMS was carried out through expert surveys and online interviews with local experts and government officials. Through the ASEAN Secretariat, local IP valuation experts and government officials from each country were contacted. First, local experts and government officials from four countries (Singapore, Malaysia, Thailand, and the Philippines) were introduced, and surveys and online interviews were conducted. Second, online interviews were conducted with experts and government officials from Vietnam, Cambodia and Indonesia. Other countries were excluded from the study because they did not respond to an interview request through the ASEAN Secretariat. Finally, our research team intends to suggest a plan for the establishment of IP valuation infrastructures in AMS.

1.2. Composition of Research

The purpose of this study is to introduce an overview of IP valuation and examine the status of IP infrastructure construction in Korea and AMS, and to suggest plans for

IP infrastructure construction and development in AMS. Part 2 covers an overview of IP valuation, definition, types, and fields of application; Part 3 introduces the current status of Korea's IP valuation infrastructure; and Part 4 examines the IP valuation infrastructures of AMS. Lastly, in Part 5, our research team proposes policy implications that can align with the development of IP valuation infrastructure in AMS.

2. Overview of IP Valuation

2.1. Definition of IP Valuation

In order to define the concept of IP valuation, it is necessary to first look at the dictionary/international/legal definition of 'technology'. In the dictionary, technology means 'a means or method of processing things to make them useful in human life by applying scientific theories'. Internationally, the World Intellectual Property Organization (WIPO) defines technology as 'systematized knowledge to provide services in fields such as practical application processes, procedures, manufacturing, agriculture, and industry of specific field knowledge'. In the legal domain, Korean laws and regulations define technology as follows. In subparagraph 1 of Article 2 of the『Act on the Promotion of Technology Transfer and Commercialization』(hereinafter referred to as the『Technology Transfer Act』), technology is defined as 'intellectual property, such as patents, utility models, designs, layout designs of semiconductor integrated circuits and software, registered or applied for in accordance with related laws such as the『Patent Act』, capital goods in which such matters are integrated, and technical information on them, and other matters determined by the President'. In addition, in Article 3 of the『Enforcement Decree of the Industrial Education Promotion』and『Industry-University Cooperation Act Enforcement Decree』, technology is defined as 'patents, utility model, design and intellectual property equivalent to those registered or pending registration in accordance with related laws such as the『Patent Act』, the『Utility Model Act』, and the『Design Protection Act』, and science and industrial know-how that can be transferred and commercialized, as well as the accumulated capital goods and technical information'. In addition, there are cases where the law stipulates that technology should be included among the subjects of corporate investments in kind. Thus, it may be said that the law recognizes the importance of technology, which is an intangible asset in the corporate value, at a level that is similar to other forms of property such as money. On the other hand, Article 6 (1) of the『Act on Special Measures for Venture Business Promotion』(hereinafter referred to as the『Venture Business Act』) includes stipulations regarding patent rights, utility model rights, and design rights, as well as rights related to technology and its use, for in-kind investment in venture companies.

In summary, technology as an intangible asset is included in the scope of IP from a broad perspective. ‘IP’ refers to knowledge, information, technology, expression of thought or emotion, business or product display, species or genetic resources of living things, or intangible property values created or discovered through human activities or experiences (Article 3, Item 1 of the 『Framework Act on Intellectual Property』). Therefore, it can be said that the scope of technology valuation is very wide, including not only the technology itself, but also IP in a broader sense such as tangible and intangible knowledge and its results.

Next, before defining IP valuation in the present context, the IP to be evaluated needs to be limited to technology assets that create economic value as described above. In principle, the valuation of IP assets includes the valuation of the value of the company that possesses the IP (IP evaluation), the valuation of the IP possessed by the company (IP valuation), and the valuation of the impact the IP has, which is the ripple effect of IP on business or society (IP impact assessment). In addition, valuation of the performance of the relevant IP, valuation of the overall system of IP, and valuation of the demand for IP from the point of view of technology consumers can also be considered.

In consideration of the above, this study assesses the economic value of IP that can be generated through commercialization, which is stipulated in Article 2, No.4 of the 『Technology Transfer Act』 and the 『Operation Guidelines for Technology Evaluation Standards』 (Ministry of Trade, Industry and Energy Announcement). It is intended to be defined as ‘expressed in economic value’. From a broad perspective, the scope of IP valuation can be expanded to include IP evaluation, but in this study, ‘IP valuation’ that can capitalize on technology based on the market perspective is considered (refer to Table 1-1).

<Table 1-1> Difference between IP Evaluation and IP Valuation

Contents	IP Evaluation	IP Valuation
Result	Grade, Score	Value
Method	Technology scorecard (Checklist evaluation)	Cost, Market, Income approach etc.
Application	TCB evaluation, Venture company confirmation, Technology guarantee support etc.	IP guarantee, IP transfer etc.

Source: Ministry of Trade, Industry and Energy (2021).

2.2. Types of IP Valuation

Although the IP valuation method is not uniform and tends to vary depending on the institution or expert conducting the valuation, the method of comprehensively examining the technology, marketability, business feasibility, and rights of the valuation target is generally accepted in the IP market. In this case, techniques such as the market approach (transaction case comparison method, royalty deduction method, etc.), income approach (technology element method, royalty deduction method, residual value method, etc.), and cost approach (historical cost method, reproduction cost method, replacement cost method, etc.) are applied. <Table 1-2> presents the pros and cons of each type of IP valuation.

<Table 1-2> Advantages and Disadvantages among Types of IP Valuation Approaches

Contents	Market Approach	Income Approach	Cost Approach
Definition	Value the amount of a similar transaction in the market	Estimating the future value of the IP	Calculate the cost of creating the IP as a value
Advantages	Using the president function, it is possible to derive a comparative price based on the principle of supply and demand and to calculate the price that can be actually distributed through the transaction	Prediction of expected future earnings and creation of value through current suspension	It is possible to derive the input cost for IP calculations and it is relatively easy to measure
Disadvantages	Not possible to access the market due to the undeveloped secondary market for IP trading	Possibility of arbitrariness and error intervention in areas such as prediction of future value and analysis of technological contribution	The main concern for collateral is the possibility of repayment based on the expected future earnings, not input costs

Source: Ministry of Trade, Industry and Energy (2021).

2.2.1. Market Approach

Market approach is a method of estimating the relative value of the same or similar IP compared to the target IP through comparison and analysis based on the value traded in the active market. When there is a significant difference, an appropriate adjustment should be made to the difference. Market approach is a valuation method that estimates the value of similar IP assets by comparing the prices of exchanged assets between buyers and sellers who trade technology assets with multiple intentions. In other words, it is a method of measuring the present value of future revenue to derive the IP value determined in the market. The technical calculation method used in this approach is expressed as ‘net sales x actual rate x years’, and the net sales are either reversed from the total sales of IP -related products and related products in the company or a company of a similar size, or alternatively sales excluding transactions, etc., are calculated based on the ex-factory price in order to prevent double inclusion of profits in the distribution process.

2.2.2. Income Approach

Income approach is a method in which the IP value is calculated as the contribution of IP out of the sum of the present values of ‘Free Cash Flow to the Firm (FCFF)’ generated from IP-applied products. In other words, it is a method of estimating the value of an IP by calculating the additional cash flow generated by owning or operating the IP. This method obtains fair market value by capitalizing the IP’s ability to generate revenue. In particular, in the case of the domestic IP trading market, it is the most preferred in the fields related to IP valuation and IP commercialization given that reliable data on IP transfer or licensing royalty has not been accumulated. There is also the practical problem that technology cannot be sold only with IP development costs. It is necessary to estimate several valuation factors such as economic life of the technology, cash flow, discount rate, technology contribution, etc.

2.2.3. Cost Approach

Cost approach is a valuation method that calculates the amount required to refinance all future benefits of an IP, and regards the value of the future benefits of owning the IP. In practice, it is a calculation method of subtracting the amount of decline in value over the elapsed period from this on the basis of all development costs required to develop the IP. The cost approach is a method of estimating the value by estimating the cost of developing or purchasing an IP with the same economic benefits based on the economic principle of substitution. This method requires detailed cost information such as IP development cost, reproduction cost, and replacement cost.

2.3. Application Fields of IP Valuation

IP valuation is used for various purposes in various fields such as IP transfer transactions, cash investments, litigation, establishment of corporate strategy, and taxation, as shown in <Table 1-3>.

<Table 1-3> Application Fields of IP Valuation

Purpose	Details
Transfer/ Transaction	Purchase and sale of IP, including M&A, and licensing pricing
Investment in kind	Investment in kind of technology or IPR
Finance	Establishment of security rights in IP or attraction of investment
Strategy	Corporate value enhancement, commercialization of IP, spin-off, establishment of long-term strategic management plan
Tax	Tax planning and tax payment for IP donation, disposal and amortization
Lawsuits	Legal litigation related to infringement on intellectual property, IP theft, default, and other property disputes
Clearing	Asset valuation and debt repayment plan upon corporate bankruptcy or restructuring
Public domain	Basic valuation of R&D tasks, selection of R&D company support, project management, performance management, etc.
Etc.	KOSDAQ special listings*, etc.

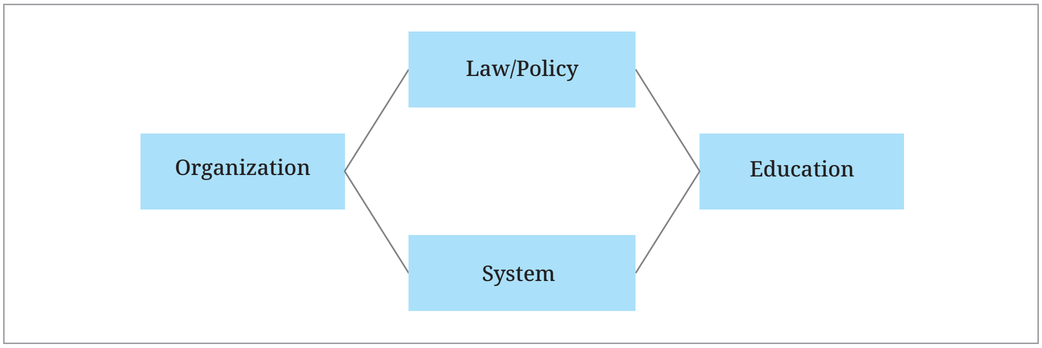
Note: * The KOSDAQ (Korea Securities Dealers Automated Quotation) is a Korean stock market established in 1996. It is modeled after the NASDAQ market, a high-tech stock market (benchmark), and is a sector for which regulatory measures are separate from those for the securities market. The KOSDAQ Special Listings System was first introduced in 2005 as a special listing system that eases the requirements for listing on the KOSDAQ market for companies with excellent technology. It is a system that provides an opportunity for early listing on the KOSDAQ market for early-stage small and medium-sized enterprises that have been evaluated by designated valuation agencies and whose valuation results are grade A and BBB or higher.

Source: Ministry of Trade, Industry and Energy (2021).

3. Current Status of IP Valuation Infrastructures in Korea

The IP valuation infrastructure can be said to encompass all tangible and intangible elements that provide the basis for IP valuation activities. As shown in [Figure 1-1], the structure of IP valuation infrastructure is divided into four main areas: Law/policy, organization in charge of implementing IP valuation, education and training programs, and IP valuation system such as the development and utilization of IP valuation methods or manuals.

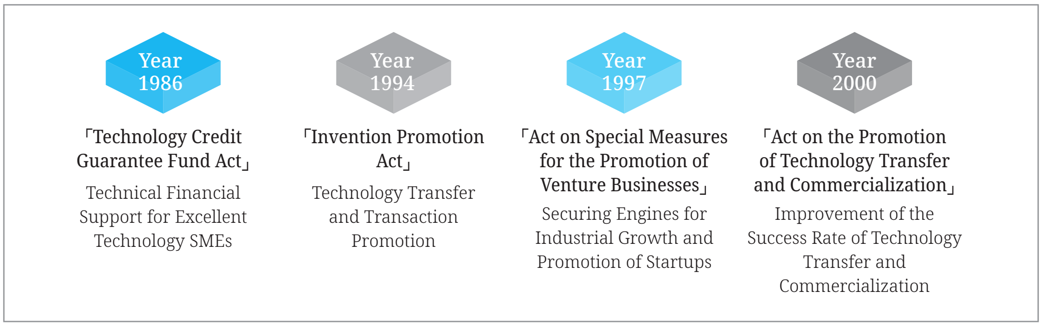
[Figure 1-1] Structure of IP Valuation Infrastructure



3.1. Definition of IP Valuation

Korea's IP Valuation Law has been developed as follows: 1) 'IP Financial Support' for SMEs with excellent IP (『Act on Financial Support for New Technology Business』; Former 『Korea Technology Credit Guarantee Fund Act』, 1986), 2) 'Government project to support valuation cost and establishment of IP exchange' to promote IP transfer and trade (『Invention Promotion Act』, 1994), 3) 'Fostering the development of venture businesses' to secure the engine for domestic industrial growth and promote start-ups (『Venture Business Act』, 1997), 4) 'Improving the success rate of IP transfer and commercialization' to enable private companies utilize the IP achievements developed by public research institutes and universities based on government R&D support projects, etc. (『Technology Transfer Act』, 2000). The overall IP valuation system has been developed in connection with the government's support policy to secure competitiveness in domestic industrial IP as shown in [Figure 1-2].

[Figure 1-2] Development History of Korea's IP Valuation Law



Source: Korea Institute for Advancement of Technology (2017).

In the area of IP valuation related to IP finance, the 'Technology Guarantee Fund (formerly Technology Credit Guarantee Fund)' established by the 『Act on Financial Support for New Technology Businesses』 enacted in 1986 was initiated in 1997 to strengthen guarantee support based on IP valuation. The Fund expanded in earnest with the opening of the 'Technology Evaluation Center'.

In addition, the IP valuation area related to certification is a field that was formed starting with the introduction of the venture business system. With the enactment of the 『Venture Business Act』 in 1997, Korea started using IP valuation systems such as the Korea Technology Guarantee Fund and the Small and Medium Business Corporation to identify venture businesses.

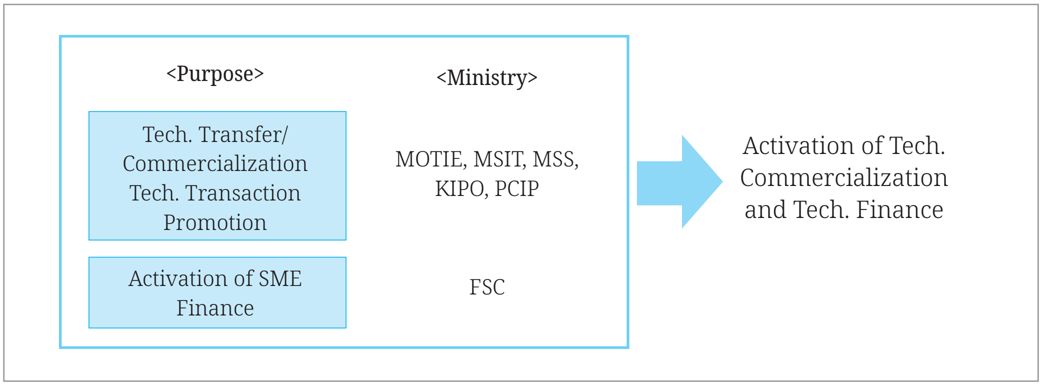
With the gradual introduction of various corporate support systems related to venture businesses, such as corporate tax reduction benefits for start-up venture businesses, reduction of taxes on acquisition/registration of real estate assets for business use, and preferential allocation of personnel for special military service, the number of companies seeking to be certified as a 'venture business' increased rapidly in the 2000s, and as a result, the capabilities of domestic IP valuation agencies improved rapidly.

Finally, IP valuation for IP transfer, etc. is regulated by the 『Invention Promotion Act』 established in 1994 and the 『Technology Transfer Act』 established in 2000. After legislation such as the 『Act on Promotion of Transfer and Commercialization of All Technology』 was enacted, the government prepared various evaluation cost support projects such as Patent Technology Evaluation Support Project (KIPO) and New Technology Idea Commercialization Feasibility Evaluation Project (Small and Medium Business Administration). Finally, with the establishment of a 'Technology Transaction Book' for IP transfer and transaction promotion, a model for IP valuation was prepared.

Recently, the Korea Institute for Advancement of Technology (KIAT, Ministry of Trade, Industry and Energy) took the lead in improving and developing the valuation model for IP transfer (transaction) and IP-secured loans, by measures such as preparation of operating guidelines for IP valuation standards centered on the IP valuation organization designated in accordance with the 『Act on Promotion of Commercialization』.

In addition, the Korean government has established and implemented various mid- to long-term policies to promote IP finance (financial policy) and, specifically, to create an environment where the economic value of the IP to be commercialized can be valuated reasonably in the market (IP commercialization policy), as presented in [Figure 1-3].

[Figure 1-3] Direction of Government Policy Related to IP Valuation



Source: Sohn (2019).

As a financial policy, the Financial Services Commission (FSC) is promoting an IP valuation policy from the perspective of revitalizing SME finance such as IP credit loans. As part of the government's IP commercialization policy, the Ministry of Trade, Industry and Energy (MOTIE), the Ministry of Science and ICT (MSIT), the Ministry of SMEs and Startups (MSS), the Korean Intellectual Property Office (KIPO), and the Presidential Council on Intellectual Property (PCIP) support the transfer and commercialization of IP developed by public research institutes to the private sector and facilitate the commercialization of transactions developed in the private sector. For this purpose, a policy to activate IP valuation has been established and is being implemented.

<Box 1-1> shows the mid- to long-term policies established and implemented at the pan-government level to revitalize IP finance and IP valuation. Relevant policies were established centered on major economic ministries such as the Ministry of Trade, Industry and Energy, the Ministry of Science, ICT and Future Planning [currently the Ministry of Science and ICT (MSIT)], the Presidential Council on Intellectual Property (PCIP), and the Financial Services Commission (FSC), as well as consensus-based administrative agencies.

Through the following mid- to long-term policies, first, as interest and awareness regarding IP commercialization increased along with the continuous expansion of R&D investment, the role and value of IP commercialization expanded as a central axis for innovation-based growth. Next, the government's role and basis for support projects were consolidated centered on the 『Technology Transfer Act』, and IP commercialization support organizations and laws were expanded under the related ministries. Finally, universities, government-funded research institutes, regional intermediaries, and private specialized companies led the activation of awareness regarding IP commercialization, training of professional manpower, infrastructure construction, technology incubation, and IP finance support.

In addition, support for securing research results was expanded to facilitate the utilization of research results. In particular, in order to create added value through the utilization of R&D achievements, the promotion of IP trade; nurturing of commercialization agents; expansion of facilities, equipment, and space infrastructure; and expansion of IP finance were carried out.

<Box 1-1> Trends in Establishing Mid- to long-term Policies Related to IP Valuation

- 「The 7th Technology Transfer and Commercialization Promotion Plan (2020~2022)」-2020.9., Ministry of Trade, Industry and Energy, Technology Transfer and Commercialization Policy Council.
- 「The 6th Technology Transfer and Commercialization Promotion Plan (2017 ~ 2019)」
  - 2017.3., Ministry of Trade, Industry and Energy, Technology Transfer and Commercialization Policy Council proposed.
- 「Market-led IP and Technology Transaction Activation Status and Follow-up Plan (draft)」
  - 2015. 7.22., The Presidential Council on Intellectual Property proposed.
- 「Market-led Open IP · Technology Valuation System Establishment Performance Check Results (plan)」
  - 2015. 7.22., The Presidential Council on Intellectual Property proposed.
- 「Technical Finance Systematization and System Improvement Plan」
  - 2015. 6.8., Financial Committee.
- 「Main Obstacles to the Activation of Market-led IP and Technology Transactions and Improvement Measures」
  - 2015. 4.10., The Presidential Council on Intellectual Property proposed.
- 「Market-led Open IP/Technology Valuation System Establishment (plan)」
  - 2014. 4.10., The Presidential Council on Intellectual Property, National Science and Technology Advisory Council.
- 「Improving and Revitalizing the Reliability of Technology Value Evaluation to Promote the Use of Public Research Results」
  - 2014. 3.21., Ministry of Science, ICT and Future Planning, The Presidential Council on Intellectual Property.
- 「Measures to Establish a Technology Evaluation System for Revitalization of Technology Finance」
  - 2014.1., Financial Services Commission, Economic Relations Ministers' Meeting.
- 「Measures to Enhance the Reliability of Intellectual Property and Technology Valuation」
  - 2013. 10.16., Ministry of Science, ICT and Future Planning.

Source: Collaboration with Related Ministries (2017).

3.2. Organization

The 『Technology Transfer Act』, the 『Venture Business Act』, the 『Technology Guarantee Fund Act』, and the 『Invention Promotion Act』, stipulate the institutions that can conduct IP valuation and the contents of the valuation as described in <Table 1-4>. The IP valuation stipulated in the Promotion Act is aimed at nurturing and promoting related industries, such as promoting IP transfer and commercialization, and providing IP-secured loans for small and medium-sized venture companies. In addition, at the private level, the 'Korea Enterprise Technology Valuation Association' was established in 2000 to provide IP valuation services, nurture related professionals, and issue certificates. In accordance with Article 39 of the 『Technology Transfer Act』 and Article 43 Subparagraph 2 of the 『Enforcement Decree of the Same Act』, the Ministry of Trade, Industry and Energy has entrusted the registration of an IP trading company.

In the 『Technology Transfer Act』, enacted to promote the transfer and commercialization of IP, corporations that meet certain criteria, such as possessing IP valuation experts and valuation models, are designated as IP valuation agencies. This contributes to the promotion of IP transfer/commercialization by enhancing the reliability of IP valuation and revitalizing the IP valuation market.

In the 『Venture Business Act』, enacted for the revitalization of venture businesses, the Small and Medium Business Administration stipulates an IP valuation institution for venture certification and IP security. In Article 2, Paragraph 4, Article 4 of the Enforcement Decree of the 『Venture Business Act』, among 11 institutions recognized by the Small and Medium Business Administration, nine institutions are directly related to IP valuation.

The 『Invention Promotion Act』, enacted to promote the commercialization of inventions, designates a specialized institution under the government to evaluate the IP and assess the feasibility of the IP for commercialization and transaction activation. Through this, it has been possible to raise funds and promote R&D for small and medium-sized enterprises (SMEs) and venture companies that are unable to pursue commercialization due to lack of capital or collateral despite possessing excellent IP. In addition, there are IP valuation institutions designated by the 『Foreign Investment Promotion Act』 and the 『Special Act for Science and Technology Innovation』, but most overlap with the above institutions.

<Table 1-4> IP Valuation Institutions Specified in the Law

Relevant Laws and Provisions	IP Valuation Designation Institution	Purpose
「Act on the Promotion of Technology Transfer and Commercialization」 Article 35 (Designation of Technology Evaluation Institution, etc.) ① The head of a related central administrative agency may designate an institution that meets the standards prescribed by Presidential Decree, such as a dedicated manpower and management organization for technology evaluation, as a technology evaluation institution in order to facilitate technology transfer and commercialization. ② A technology evaluation institution designated pursuant to paragraph (1) (hereinafter referred to as “technology evaluation institution”) shall conduct the following activities: 1. Technology evaluation 2. Investigation and analysis of demand for technology evaluation 3. Collection, analysis and distribution of technology evaluation information and establishment of a related information network 4. Projects for joint utilization and dissemination of information on technology evaluation	Institutions designated by the notification of the Minister of Trade, Industry and Energy	IP valuation for IP transfer and commercialization

<Table 1-4> Continued

<table>
<tr><th>Relevant Laws and Provisions</th><th>IP Valuation Designation Institution</th><th>Purpose</th></tr>
<tr><td>「Act on Promotion of Industrial Education and Promotion of Industry-University Cooperation」
Article 36-4 (Investment by Branch Companies, etc.) ② “Technology” to be invested in a technology holding company must be technology according to subparagraph 6 of Article 2, and the “technology transfer and commercialization” must take place within one year retroactively from the date of certification of the articles of incorporation. It must undergo technology evaluation by a technology evaluation institution as stipulated by Article 23 of the Promotion Act.</td><td rowspan="3">Korea Institute of Industrial Technology Promotion, Technology Guarantee Fund, Korea Industrial Technology Evaluation and Management Institute, Korea Environment Corporation, National Institute of Technology and Standards, Korea Institute of Science and Technology, Korea Institute of Science and Technology Information, Information and Communication Industry Promotion Agency</td><td rowspan="3">Valuation of industrial IPR</td></tr>
<tr><td>「Act on Special Measures for Promotion of Venture Businesses」
Article 6 (Special Cases for Investment in Industrial Property Rights, etc.) ② When a technology evaluation institution prescribed by Presidential Decree evaluates the price of industrial property rights, etc., the details of the evaluation shall be assessed by a certified appraiser pursuant to Articles 299-2 and 422 of the Commercial Act.
「Enforcement Decree of the Act on Special Measures for the Promotion of Venture Businesses
Article 4 (Technology Evaluation Institution) “Technology evaluation institution prescribed by Presidential Decree” in Article 6 (2) means any of the following institutions:
1. Korea Industrial Technology Promotion Agency
2. Technology Guarantee Fund
3. Korea Industrial Technology Evaluation and Management Institute under Article 39 of the Industrial Technology Innovation Promotion Act;
4. Korea Environment Corporation under the 「Korea Environment Corporation Act」 (Applicable only to the technical evaluation of environmental technologies pursuant to subparagraph 1 of Article 2 of the 「Environmental Technology and Environmental Industry Support Act」)
5. National Institute of Technology and Standards
6. The Korea Institute of Science and Technology and the Korea Institute of Science and Technology Information under the「Act on the Establishment, Operation, and Fostering of Government-Funded Research Institutions, etc. in the Science and Technology Field」;
7. Information and Communication Industry Promotion Agency</td></tr>
<tr><td>「Foreign Investment Promotion Act」
Article 30 (Relationship with Other Laws and International Treaties) ④ When the technology evaluation institution prescribed by the Presidential Decree evaluates the price of industrial property rights, etc. pursuant to Article 2 (1) 8 (d), the evaluation contents shall be subject to Article 299 of the「Commercial Act」. It is deemed to have been appraised by a certified appraiser pursuant to paragraph 2.</td></tr>
<tr><td>「Technology Guarantee Fund Act」
Article 28 (Business of the Fund) ① The Fund shall perform the following tasks.
1.~5. Omitted
6. Technology evaluation (refers to the comprehensive evaluation of technical aspects, marketability, business feasibility, etc. related to the relevant technology and is expressed in terms of amount, grade, opinion, or score)</td><td>Technology Guarantee Fund</td><td>IP guarantee and IP valuation for the purpose of supplying funds for new IP projects</td></tr>
</table>

<Table 1-4> Continued

Relevant Laws and Provisions	IP Valuation Designation Institution	Purpose
「Invention Promotion Act」 Article 28 (Designation of Invention Evaluation Institution, etc.) ① When the Commissioner of the Korean Intellectual Property Office deems it necessary for the prompt commercialization of an invention registered as industrial property rights, he/ she shall consult with the heads of relevant administrative agencies for the evaluation of the invention. However, a private research institution or an institution that specializes in technical and feasibility evaluation may be designated as an invention evaluation institution (hereinafter referred to as "evaluation institution"). ② An entity that intends to be designated as an evaluation institution under paragraph (1) shall have professional manpower and facilities prescribed by the Presidential Decree. ③ A person who intends to commercialize an invention may request an evaluation agency designated pursuant to paragraph (1) to evaluate the technicality and feasibility of the invention.	Public research institutes, government-funded research institutes, private research institutes	Evaluation of technological feasibility and business feasibility of an invention
「Spatial Information Industry Promotion Act」 Article 21 (Special Cases for Investment in Industrial Property Rights, etc.) In the case of investment in kind, when the price is evaluated by a technology evaluation institution prescribed by Presidential Decree, the content of the appraisal shall be deemed to have been appraised by a certified appraiser pursuant to Article 299-2 of the Commercial Act. 「Enforcement Decree of the Spatial Information Industry Promotion Act」 Article 15 (Technology Evaluation Institution) In Article 21 of the Act, the term "technology evaluation institution prescribed by Presidential Decree" means the following institutions. 1. Korea Industrial Technology Promotion Agency under Article 38 of the 「Industrial Technology Innovation Promotion Act」 2. Korea Institute of Industrial Technology Evaluation and Management under Article 39 of the Industrial Technology Innovation Promotion Act; 3. The Technology Guarantee Fund under Article 12 of the Technology Guarantee Fund Act; 4. Korea Advanced Institute of Science and Technology under the Korea Advanced Institute of Science and Technology Act; 5. Technology evaluation institutions under Article 11 of the 「Construction Technology Promotion Act」 6. The Ministry of Land, Infrastructure and Transport said that as a corporation established pursuant to Article 32 of the Civil Act, it can evaluate patents, utility model rights, design rights, and other equivalent technology and rights related to the use of spatial data under Article 21 of the Act. Non-profit corporations recognized by this	Korea Institute of Industrial Technology Promotion, Korea Industrial Technology Evaluation and Management Institute, Technology Guarantee Fund, Korea Institute of Science and Technology	IP valuation for in-kind investment related to geospatial data business

Source: Ministry of Government Legislation (2022).

In order to enhance and revitalize the professionalism of IP valuation, Korea has annually designated specialized IP valuation organizations since early 2000s, and continues to ensure that IP valuation conducted through the specialized organizations maintains public confidence. In Korea, IP valuation organizations are mostly designated by the 『Act on the Promotion of Technology Transfer and Commercialization』 (hereinafter referred to as the 『Promotion Act』), the 『Act on Special Measures for the Promotion of Venture Businesses』 (hereinafter referred to as the 『Venture Act』), and the 『Invention Promotion Act』. As of April 2022, IP or technology valuation is being conducted by 39 certified valuation organizations in Korea.

<Table 1-5> Current Status of IP Valuation Organizations

No.	Organizations	Technology Transfer Act	Venture Business Act	Invention Promotion Act
1	Defense Agency for Technology and Quality	○		
2	Korea Technology Finance Corporation	○	○	○
3	Korea Agriculture Technology Promotion Agency	○		○
4	Korea Electronics Technology Institute	○		
5	Korea SMEs and Startups Agency	○		
6	Korea Institute of Science and Technology Information	○	○	○
7	Korea Invention Promotion Association	○		○
8	Korea Health Industry Development Institute	○		
9	Korea Institute for Advancement of Technology	○	○	○
10	Korea Development Bank	○		○
11	Korean Agency for Technology and Standards		○	
12	National IT Industry Promotion Agency		○	
13	Korea Institute of Science and Technology	○	○	
14	Korea Evaluation Institute of Industrial Technology		○	
15	Korea Environment Corporation		○	
16	Korea Conformity Laboratories			○
17	Korea Testing Certification Institute			○
18	Korea Testing Laboratory			○
19	Korea Testing & Research Institute			○
20	Korea Agency for Infrastructure Technology Advancement	○		
21	Korea Credit Guarantee Fund	○	○	○
22	Korea Innovation Foundation	○		
23	Korea Institute of Machinery & Materials	○		
24	Electronics and Telecommunications Research Institute	○		
25	Korea Institute of Industrial Technology	○		
26	Korea Research Institute of Bioscience and Biotechnology	○		
27	Korea Institute of Marine Science & Technology Promotion	○		
28	Knowledge & Tech Group	○		○
29	T-Value	○		
30	WIPS Corporation	○		○
31	E-credible	○		○
32	Darae Law & IP Group	○		○
33	Dana Patent Law Firm	○		○
34	Dodam IP Law Firm	○		○

<Table 1-5> Continued

No.	Organizations	Technology Transfer Act	Venture Business Act	Invention Promotion Act
35	KoDATA	○		○
36	NICE Dun & Bradstreet	○		○
37	NICE Information Services	○		○
38	Korea Institute of Energy Technology Evaluation and Planning	○		
39	YOU ME Patent & Law Firm	○		
Total		31	9	20

Source: Ministry of Trade, Industry and Energy (2022).

Each valuation organization above has its own specialized IP valuation systems, and some of the representative characteristics of these organizations are as follows.

- Defense Agency for Technology and Quality: In the first stage, expert evaluation is conducted using Delphi technique, Analytic Hierarchy Process (AHP), and peer review; in the second stage, the Agency evaluates the factors of depreciation or decreasing of the value using Net Present Value (NPV) and then calculates the final value of IP.

- Korea Technology Finance Corporation: It uses an influential valuation method, referred to as KTRS (Kibo Technology Rating System), which excludes corporate financial information or credit information, and calculates the valuation rating of the IP-based business by combining IP-oriented valuation factors and empirical insolvency risk into a matrix.

- Korea SMEs and Startups Agency: The evaluators' judgments are graded to segment the grades using the AHP technology feasibility evaluation model.

- Korea Institute of Science and Technology Information: The KISTI model consists of three steps, including (1) the analysis of market and cost structure; (2) the estimation of an IP's contribution profit, followed by (3) the estimation of IP value through profit volatility analysis; and Discounted Cash Flow (DCF) model that utilizes the Net Present Value (NPV) of future cash flows growth, multiplied by the adjustment factor of the IP.

- Korea Invention Promotion Association: After selecting and extracting useful elements for patent valuation using patent information, natural language processing results, key words, and similar patents, the weight coefficient for each valuation element generated by the machine learning algorithm is obtained, and through this, an automatic evaluation score is generated, and the relative evaluation rating is visualized.

- Korea Health Industry Development Institute: IP is valuated using an online/offline valuation system through an evaluation committee made up of experts from industry, academia, and research institutes. Valuation is conducted considering the stability of IP rights, progress of technology and marketability (marketability, promise, and profitability of technology).

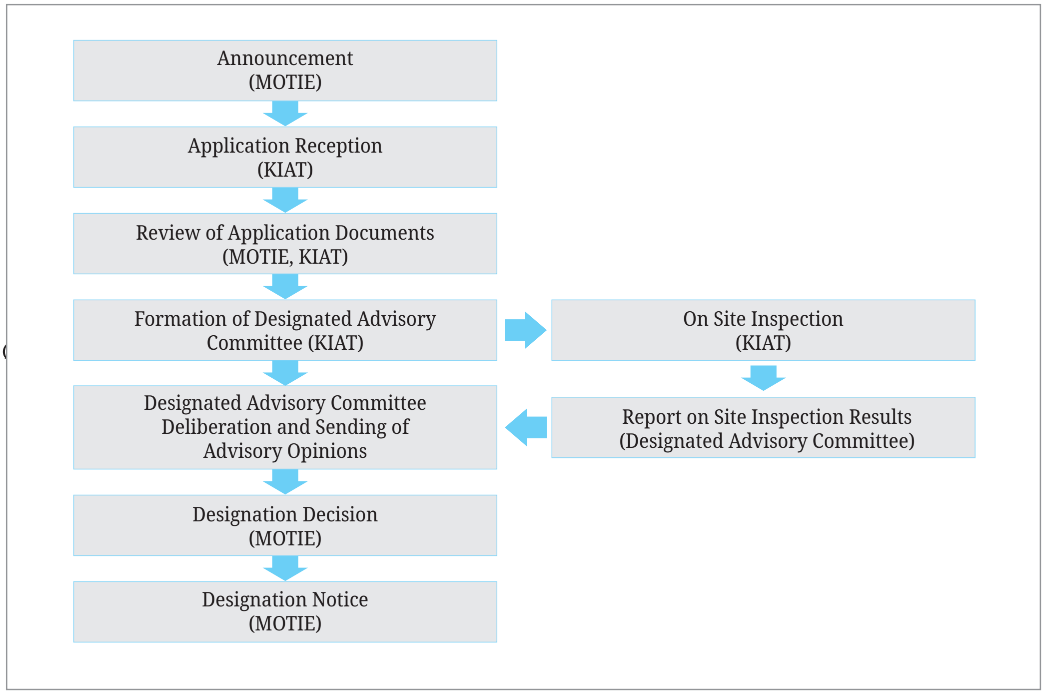
- Korea Agriculture Technology Promotion Agency: The 'Technology Evaluation Model for Supporting Commercialization of Excellent Technology', jointly developed by the Ministry of Agriculture, Food and Rural Affairs, Korea Agriculture Technology Promotion Agency, and Korea Invention Promotion Association is used. It is based on a total of 21 items for evaluation in four areas with technology management ability (three items), technology characteristics (seven items), marketability (six items), and business feasibility (five items).

From 2001 to 2015, all designated IP valuation organizations were public institutions. Starting from 2016, the number of designated private organizations (technology patent analysis institutions, law firms, and patent firms) has increased, and accordingly the IP valuation market built mainly for the public has expanded gradually to the private sector.

On the other hand, to be designated as an IP valuation organization, certain requirements must be met. Article 32 Paragraph 1 of the 『Enforcement Decree of the Technology Transfer Act』 stipulates that all of the following requirements be met as standards. First, three or more experts who have obtained qualifications as an IP trader, lawyer, patent attorney, certified public accountant, appraiser, or engineer and can engage in business pursuant to Article 35 (2) of the Act must be employed at all times. Second, 7 or more experts who have been employed for more than five years must be employed at all times. Finally, it will have an information network for the collection, management and distribution of information on IP valuation in accordance with the standards set and announced by the Ministry of Trade, Industry and Energy.

Looking at the procedure for designating a IP valuation organizations, an IP trading organization, commercialization specialized company or IP valuation organization is designated by the heads of relevant central administrative agencies, such as the Minister of Trade, Industry and Energy, based on the requirements stipulated by Article 35 (1) of the '『Technology Transfer Act』 and Article 32 of the 『Enforcement Decree of the same Act』 (Ministry of Industry and Trade Guidelines), after the application for designation of an IP valuation organization is announced, the designation requirements are reviewed, and an IP valuation organization is finally designated. In the case of the Ministry of Trade, Industry and Energy, the procedure for designating an IP valuation organization is as shown in [Figure 1-4].

[Figure 1-4] Procedure for Designation of an IP Valuation



Source: Ministry of Trade, Industry and Energy (2022).

3.3. System

3.3.1. IP Valuation Methods and Manuals

The 'Technology Valuation Practice Guidelines,' was first published in 2008 as an expanded version of the 'Technology Valuation Practice Guidelines' of 2006, which is a basic guideline for IP valuation. Since then, four revisions have been made, from the 'Technology Valuation Practical Guide' in 2011 to the 'Technology Evaluation Practical Guide' in 2021.

By 2014, the government amended and standardized the 'Technology Evaluation Standard Operation Guideline' as a standard that can be used commonly in performing IP valuation tasks. The Guideline stipulates ethical standards, considerations for IP evaluation and IP valuation, IP valuation input information, and reporting standards. It contributes to securing the objectivity and reliability of IP valuation by providing a commentary on it.

The second 'Technology Valuation Practice Guide' published in 2014 additionally presented an IP valuation model based on the profit approach and the royalty deduction method. In addition, the improved research contents were reflected in the estimation of the economic lifespan, cash flow, discount rate, and technology contribution of the technology, and the information was updated from the point of view of practical application, giving autonomy in the choice of the evaluator to increase utilization.

The third ‘Technology Valuation Practice Guide’ published in 2017 unifies the valuation methodology that was divided into technology valuation and IP valuation, and provides detailed and updated information for estimating the economic life of technology, cash flow, discount rate, and technology contribution.

The fourth ‘Technology Evaluation Practical Guide’ for 2021 has added the contents of the IP valuation practical guide that combines the STBR model, the IP valuation model used by the Korea Industrial Technology Promotion Agency, and the investment evaluation model. In addition, the rNPV method, a method applicable to biopharmaceutical technology, was added to the IP valuation methodologies, and the royalty deduction method was improved.

In particular, Korea has established, announced, and utilized its own valuation standards based on the IVS, an internationally unified and consistent valuation standard presented by the IVSC in 2016 (Technical Evaluation Operation Guidelines, Ministry of Industry and Trade Notice No. 2016-114). The following are some examples of the IP valuation practice guides published so far.

[Figure 1-5] IP Valuation Methods and Manuals

Source: KIAT (2014), (2017), (2021).

3.3.2. IP Valuation Process and Major Valuation Factors

The method and procedure for conducting 'IP valuation' may differ to some extent depending on the valuation organization and IP valuation model. It starts with defining the technology (step 1).

This is followed by the following stages of analysis: the company's internal/external influence factors related to the commercialization of various technologies, such as the benefit and competitiveness of the IP, the Technology Readiness Level (TRL) and expected performance of the technology, the competency of the business entity, the size and growth rate of the target market, and the competitive situation (Step 2); the possibility of securing IP (product) competitiveness of the product in which the IP is implemented (Step 3); and marketability analysis (Step 4) to understand whether the target market has sufficient conditions to generate profits. Further, the IP valuation reaches the feasibility analysis stage (stage 5) that considers the market environment targeted by the IP and the capabilities of the business entity.

<Table 1-6> Valuation Factors and Contents of IP Valuation

Factors	Contents
Technology	Assess the usefulness and competitiveness of the IP (Additional consideration of IP implementation costs, etc.)
Technological competency of the business entity	Technical competency of the CEO, management, research personnel, etc.
Legal rights	Ease of implementation, scope and stability of legal rights, etc.
Market	Characteristics and size of the target market, which are external factors
Commercialization capability of the business entity	HR management, financing, sales/marketing skills, etc.
Commercialization	Possibility of successful commercialization and economic feasibility of the IP business, etc.

Source: Ministry of Trade, Industry and Energy (2021).

Next, a business feasibility analysis is performed on how much profit can be realized compared to the investment cost by considering the valuation factors derived from the above analysis process comprehensively. Here, rather than a qualitative evaluation, 'cost and profit structure analysis' and quantitative valuations such as 'share' and 'cash flow estimation' are mainly performed (step 6).

When quantitative analysis through feasibility valuation is performed, the cash flow expected through the technology can be estimated, and the exchange value (value of the IP at the present time) can be calculated based on this. This process is called IP value calculation (step 7).

Up to this point, the process can be referred to as the ‘valuation stage of IP’, and after the IP is judged up to a certain level, an IP valuation report (a report to be provided to consumers of IP valuation according to the purpose of the IP valuation) is prepared.

[Figure 1-6] IP Valuation Process and Evaluation Factors Derived from Each Stage

(Stage 1) Definition of the valuation IP and product regulations that are expected to be applied.

↓

(Stage 2) Derivation and analysis of major internal/external factors that can affect commercialization of the IP

↓

(Stage 3) Evaluation of the possibility of securing product competitiveness (IP) after commercialization

↓

(Stage 4) Evaluation of market conditions (marketability) related to the IP, such as the size and growth rate of the target market

↓

(Stage 5) Prediction of the potential for product competitiveness and commercialization success (business feasibility) considering the competency of the business entity and the market environment

↓

(Stage 6) Prediction of feasible profit compared to the investment cost (revenue analysis) by considering the above technology, marketability, and business feasibility comprehensively

↓

(Stage 7) Providing the necessary decision-making standards, i.e., IP valuation results, to stakeholders related to IP commercialization

Source: Ministry of Trade, Industry and Energy (2021).

The format of the IP valuation report for reporting the results of IP valuation is organized and structured according to the unique purpose of each IP valuation organization. On the other hand, although there may be some differences in the specific composition and format, all report formats include ‘opinion’, ‘grade’, and ‘value’ for expressing the results of IP valuation. It is rare to use only one method, and a common practice is to include two or all three methods.

3.3.3. Types of IP Valuation Reports

The composition of the IP valuation document that is often used in practice is: 1) an IP valuation document that describes only the IP valuation opinion, 2) an IP valuation document that provides a grade of the valuation result after describing only the IP and the company, 3) an IP valuation report that provides a rating along with a brief opinion on technology, marketability and business feasibility, 4) an IP valuation report that converts the estimated cash flows that the IP will generate in the future to its present value, and provides this information along with detailed opinions on technology, marketability and business feasibility, etc.

1) Opinion Valuation

'IP valuation by opinion description' is a method of expressing the degree of an IP's usefulness and commercialization feasibility through qualitative explanation or relative comparison, rather than expressing the result of IP valuation quantitatively through IP valuation indicators. Therefore, this method has the advantage that the IP valuation users can have high confidence in the IP valuation results because it can provide more detailed information about the rationale and logic for deriving the IP valuation results compared to other expression methods.

In general, opinion evaluation is often conducted as a preliminary examination or data review prior to the main evaluation. In the case of evaluation for financial support decisions regarding an IP, such as the IP valuation report for guarantee by the Korea Technology Guarantee Fund, opinions are evaluated in parallel with the company's credit and IP rating to support the basis of the rating. In such a case of conducting rating or valuation practically, it is common to opt for opinion evaluation as the basis for valuation, but depending on the type of valuation document, it is abbreviated to the beginning of the report or includes the rating or value result in the form of an opinion in a certain format.

2) Rating Valuation (Including Score Valuation)

Rating valuation methods include 'grading method', 'comparative valuation method', 'expert review method', and 'Delphi method.' Furthermore, the composition of valuation items applies a model in which quantitative and qualitative indicators are mixed appropriately.

Six IP valuation organizations such as the Technology Guarantee Fund, the Technology

Exchange (former Korea Promotion Agency), the Korea Institute of Science and Technology Information, the Korea Development Bank, the Korea Invention Promotion Association, and the Small and Medium Business Corporation, under the supervision of the Small and Medium Business Administration, adopted the rating valuation method in 2006 as a representative valuation model. One example of the rating valuation method is the Standard Technology Business Rating (STBR) developed based on valuation items and Inno-Biz valuation index items. Except for the Korea Technology Guarantee Fund, other IP valuation organizations either use STBR, or apply a modified rating valuation model in which the valuation index is corrected or weighted in consideration of the characteristics of individual IP valuation organizations.

Meanwhile, in the case of the Korea Technology Guarantee Fund, a rating valuation model called the Kibo Technology Rating System (KTRS) has been developed and used in consideration of the risk management aspect of IP finance.

KTRS 1) optimizes the weights of individual valuation index items so that the default rate can be minimized through statistical analysis of the correlation between the valuation results of each valuation item and the default rate, and 2) generates IP valuation results according to the characteristics of each IP. It is differentiated from the rating valuation models of STBR and other organizations in that a logic to minimize the occurrence of differences is added. In addition, KTRS provides various IP rating valuation models (items and grades of evaluation indicators) such as investment/loan, guarantee, and technology transfer/transaction and the field of IP to be evaluated. Furthermore, KTRS presents the results of valuation of the technology, marketability, business feasibility, and other factors such as the management environment of the company holding the IP in the form of grades and scores.

3) Valuation

Valuation can be said to be an IP valuation method that is generally included in the case of IP valuation used for the purposes of IP transfer/transaction and investment attraction. This is a method to judge the technology, marketability, competency and business feasibility of the business entity comprehensively, and then convert the value added or increase in corporate value expected to be created by the IP into an amount based on this, and thereby derive the present value of accumulated profits.

3.4. Education

In order to improve the quality of IP valuation, it is necessary to expand the market according to the increase in the utilization of IP valuation, research and develop objective evaluation models, and nurture experts related to IP valuation. Korea's professional manpower training institutions that provide direct training in IP valuation are the Korea Technology Transfer Agents Association and the Korea Valuation Association. These institutions establish and revise the curriculum periodically and train professional manpower to equip them with skills in the areas of IP valuation. Details of the Korea Certified Valuation Analyst (KCVA) training course of the Korea Valuation Association, a representative private educational institution, are as follows <Table 1-7>.

<Table 1-7> Details of KCVA Training Course

KCVA Training Course	
Education Goals	- Promotion of technology commercialization and technology transaction through evaluation of technology value - Induction of sound investments and M&A support for venture companies through corporate value evaluation - Fostering experts in technology project feasibility assessment and corporate technology value assessment
Features of Education	- Training course for professional manpower equipped with theoretical knowledge and practical competency for evaluation of IP value - Systematic curriculum comprised of pre-online training → regular training → qualification test → practical training - Expert training course using specialized contents such as <Technology Valuation Theory>, <Excel Practice>, and <Usage Workbook> - Professional training course conducted by the best instructors in Korea
Application Fields/ Targets	- Personnel in charge of technology value evaluation, R&D, and commercialization of research institutes, Techno Parks (TPs), Technology Licensing Organizations (TLOs), and technology holding companies - Professional manpower from industry-academic associations, patent firms, accounting firms, appraisal firms, and law firms related to technology evaluation
Type of Education	- Operated as a certification course

Source: Korea Valuation Association (2022).

The Korea Institute of Industrial Technology Promotion, a public organization, regularly supplements, promotes, and distributes the 'Technology Valuation Practical Guide'; operates the 'Technology Valuation Specialized Training Program'; and provides refresher training for IP valuation experts. In addition, education for nurturing IP valuation experts is conducted mainly in the form of registration education when acquiring relevant qualifications, except for cases where relevant knowledge is acquired through practice at an IP valuation institution. The IP valuation-related qualification system (approximately 10 types) implemented and operated in the private sector by IP traders, who have national qualifications, requires a certain period of online and offline education to be completed as an essential requirement for qualification <Table 1-8>.

The qualification system for IP valuation in Korea is largely divided into national qualifications and private qualifications based on the 'Framework Act on Qualifications'. The national qualification is a system that has been newly established and managed/operated by the state based on laws and regulations, and the private qualifications are based on a qualification system that has been newly created and managed/operated by the private sector (corporate entities, organizations, individuals). In accordance with Article 17, Paragraph 2 of the 'Framework Act on Qualifications', the qualifications offered by the private sector are recognized only when they are registered and certified by the competent Minister.

<Table 1-8> IP Valuation Related Education and Training Programs

Title of Qualification	Technology Transfer Agent	Korea Certified Valuation Analyst	Technology Valuation Analyst	Technology Commercialize Valuation Agent	Technology credit rating Agent (Level 1, 2, 3)	Enterprise Value Evaluator	Valuation Analyst
Qualification Type	National qualification	Private qualification (Registered)	Private qualification (Registered)	Private qualification (Registered)	Private qualification (Registered)	Private qualification (Registered)	Private qualification (Registered)
Legal Basis	Article 14 of the Act on the Promotion of Technology Transfer and Commercialization	-	-	-	-	-	-
Institution Issuing or Managing the Qualification	Issuance of registration certificate in the name of the Ministry of Trade, Industry and Energy	Korea Valuation Association	Korea Technology Commercialization Association	Korea Technology Transfer Agents Association	Korea Technology Finance Corporation	Korea Institute of Valuation	Korea Productivity Center
Education Method	Offline education + online education	Offline education + online education	offline education	Offline education + online education	Offline education or online education	offline education	offline education
Educational Institution	Korea Institute of Industrial Technology Promotion, Korea Technology Trading Society	Same as the issuing organization	Same as the issuing organization	Same as the issuing organization	Same as the issuing organization	Same as the issuing organization	Same as the issuing organization
Start Year	2000	2000	2008	2017	2016	2002	2002
Qualifications	Eligibility limited by law	No special requirements	No special requirements	No special requirements	No special requirements	No special requirements	No special requirements

Notes: 1) The types of qualifications are divided into 'national qualifications' and 'private qualifications' according to Article 2 of the 'National Qualification Act'.

2) The status of private qualifications can be searched and checked on the Private Qualification Information Service (https://www.pqi.or.kr) operated by the Korea Vocational Training Institute.

3) Registration training for IP traders, etc. is provided by the Korea Industrial Technology Promotion Agency and the Korea Technology Trade Association in accordance with Article 10-4 of the 'Technology Trading Company Registration and Management Guidelines' (Ministry of Industry and Trade).

4. Current Status of IP Valuation Infrastructures in AMS

4.1. Law/Policy

4.1.1. Singapore

There is currently no law (i.e. statute) in Singapore directly related and/or relevant to IP valuation. Singapore's government's policy related to IP valuation is enshrined in the latest edition of the Singapore IP Strategy 2030 Report (SIPS2030). The SIPS2030 was prepared by the Intellectual Property Office of Singapore (IPOS, and other supporting agencies), published on 26 April 2021, and is Singapore's national 10-year strategy to promote Singapore as a legal, financial and modern services hub that is able to leverage IP effectively and efficiently to fuel value creation and growth of the country.

The SIPS2030 clearly sets out Singapore's current attitude towards IP valuation, based on the awareness that credible IP valuation capabilities is necessary for Singapore's continued relevance as a key financial hub regionally and even globally. IP valuation has therefore been identified as one of the key pillars of the SIPS2030. To build a credible and trusted IP valuation ecosystem, Singapore plans to put in place 'IP Valuation Guidelines' and 'IP Disclosure Guidelines'.

Regarding IP Valuation Guidelines, there is no IP valuation practice that is commonly accepted by the industry. Singapore plans to spearhead an international IP valuation panel to develop IP valuation guidelines based on international valuation standards that can be widely adopted internationally. In order to do this, Singapore aims to work closely with various valuation professional organizations including the International Valuation Standards Council (IVSC). It is also noteworthy that Singapore generally follows IVSC's International Valuation Standards (IVS), in which (as of July 2021, and effective 31 January 2022) IVS 210 contains guidelines on the valuation of IP. Presently, it is unclear when Singapore's IP Valuation Guidelines will be published.

Regarding IP Disclosure Guidelines, as in the aforementioned IP Valuation Guidelines, the SIPS2030 states, 'internationally, there exists a range of IP reporting methodologies promulgated by academics and international organizations, but no jurisdiction has developed a standardized IP reporting framework. To build Singapore into a market with enhanced IP information conducive for IP-based transactions, [the Accounting and Corporate Regulatory Authority (ACRA)] and IPOS will co-lead an inter-agency committee with the technical expertise to develop an IP disclosure framework/guidelines. The interagency committee will work with the private sector to roll out an effective IP disclosure framework/guidelines to help Singapore enterprises better communicate the value of their IP'. By developing such standardized IP disclosure guidelines and making it mandatory for listed and soon-to-be listed companies to disclose and communicate their IP value through the Singapore Exchange (SGX), Singapore hopes to enhance transparency and certainty in IP transactions. Presently, it is unclear when Singapore's IP Disclosure Guidelines will be published.

4.1.2. Philippines

There are five laws (i.e. statute) in Philippines related to IP valuation.

1) Philippine Technology Transfer Act of 2009 and its Implementing Rules and Regulations

It is an Act providing 'The framework and support system for the ownership, management, use, and commercialization of intellectual property' generated from research and development funded by the government and for other purposes.

2) Guidelines on IP Valuation, Commercialization, and Information Sharing of the Philippine Technology Transfer Act of 2009 (2013)

The Guidelines (Chapter III) include the guiding principles on technology-based intellectual property valuation established by the Intellectual Property Office of Philippines (IPOPHIL) and Department of Trade and Industry (DTI).

3) Republic Act (RA) 11057, Personal Property Security Act (August 17, 2018)

It is an Act to promote economic activity by increasing access to least-cost credit, particularly for micro, small, and medium enterprises, by establishing a unified and modern legal framework for securing obligations related to personal property. This Act, promulgated by the Department of Finance (DOF), directly recognized intellectual property assets as collateral.

4) RA 11337 Innovative Startup Act (2019)

This Act was enacted to provide benefits and programs to strengthen, promote and develop the Philippine startup ecosystem under the auspices of DTI, Department of Science and Technology (DOST) and Department of Information and Communications Technology (DICT). It is aimed to help remove the regulatory barriers and provide incentives to support the growth of startups especially in the crucial stage of development.

5) **Philippine Valuation Standards (PVS) (2009 and updated in 2020) – Adoption of the IVSC Valuation Standards under Philippine Setting (Attachment 7)**

It requires that the valuation standards conform to the generally accepted valuation principles and internationally accepted standards and practices recognized by the DOF, and is operated through the Bureau of Local Government Finance (BLGF). The PVS includes standards relating to the valuation of intangible assets, which includes intellectual property rights.

4.1.3. Thailand

Aside from general IP laws, there are also more specific laws that address IP valuation directly in Thailand.

1) Regulations in Relation to the IP Securitization Program of the DIP

In 2004, the Department of Intellectual Property (DIP) initiated a program called ‘IP Securitization’ to allow IP owners obtain loans from financial institutions. The DIP issued the Rules on Procedure and Practice for IP Securitization Program B.E. 2546 (2003) to set the procedures for IP owners to obtain loans from four specific financial institutions in Thailand.[1]

The IP owners who wanted to participate in this program were required to file an application for a loan with one of the financial institutions, together with a business plan and supporting documents as required by the financial institution. The DIP helps the financial institutions in conducting due diligence regarding the validity of the IP in order to assure the financial institutions. If the financial instruction accepted the request for the loan, the DIP recorded this information within the system. Once the loan was fully paid back, the IP owners were required to submit an application to conclude the IP securitization process with the DIP. The IP owners were required to submit the security agreement, together with the application, in accordance with the Notification of the Department of Intellectual Property regarding the Application for IP Securitization Program, dated December 31, 2003.

1 Mr. Piboon Tansupon, “The Use of Trademark as Security under IP Securitization Program”, Department of Intellectual Property, 2008.07.30.

Unfortunately, the IP Securitization Program lasted for only five years. Nevertheless, the Thailand government took efforts to build the infrastructure and promote the use of IP in obtaining financial support. The government later issued a new law to allow IP to be used as collateral or security — such security interest can be registered according to the Business Security Act B.E. 2558.

2) Business Security Act (BSA)

The BSA was published in the Royal Thai Government Gazette on 5 November 2015. Most of the provisions took effect on 2 July 2016. It requires the Department of Business Development (DBD) to provide the rules and procedures for registration and to publish them in the Royal Thai Government Gazette before the effective date of the BSA. The DBD has established procedures in accordance with the BSA.

3) Regulations in Relation to IP Valuers

The Thai Valuers Association and the Valuers Association of Thailand (VAT), hereinafter known together as the “Professional Association”, issued notifications in order to ensure uniform standards of IP valuation and coherence with the rules set out in the BSA. Details can be summarized as follows:

① The Professional Association arranges capacities to test the knowledge and qualification level of the primary valuer, who is a natural person named in the Registry of the Valuer of the Securities and Exchange Commission in order to group such valuers into various expertise levels and to announce the list of those who passed the Professional Association’s testing criteria.

② The Professional Association distinguishes property valuation by valuation techniques and by valuation type, as specified in the BSA. The three main asset groups are: 2.1 Business, 2.2 Intellectual Property, and 2.3 Other Types of Property(property in categories other than groups 2.1 and 2.2, including real estate claims where the collateral provider engages directly in business involving real estate or movable property for the collateral provider to use in business operations such as inventory machinery or raw materials in manufacturing goods).

③ The property valuer shall uphold, practice, and refer to the professional code of conduct in accordance with the Notification of the Professional Association on Professional Ethics Standards of Property Valuation for Thailand for asset groups 2.1, 2.2 and 2.3. For assets in group 2.3, aside from the aforementioned, it is mandatory to adhere and refer to professional ethics according to the Notification of the

Professional Association on Standards and Professional Ethics for Factory, Machinery, and Equipment Assessment.

④ In applying professional standards for valuation of enterprises and Intellectual Property, valuers must comply with the Professional Association's Notification on the 'Guidelines and Criteria for Valuing Businesses'.

⑤ For professional standards for property valuation for asset group 2.3, valuers must comply with the standards and professional ethics of property valuation in Thailand or follow standards and professional ethics for the valuation of factories, machinery, and equipment, depending on the nature and type of assets. Nevertheless, certain types of property in asset group 2.3 include all kinds of claims, except the right to lease and inventory goods, or raw materials used in production, which is considered to be a unique and special property that tends to be categorized as current assets according to accounting standards and methods. The property valuer shall ask for opinions or arrange to seek assistance from an additional property valuer with a background in auditing, who can provide guidelines on valuation.

⑥ The valuation of property in accordance with procedures stipulated in the BSA may require the arrangement of a property valuation before obtaining credit approval, or a review of the value of the collateral in accordance with rules of collateral in the process of an installment payment of debt, or the valuation of the property upon request from the security enforcer in accordance with Section 73 of the BSA (using a business as collateral). The property valuer performing duties as a security enforcer under the BSA must not be involved in valuation of the same property. In all cases, such an act will be deemed as a violation of the Code of Professional Conduct, under Topic 4 of the Standards and Professional Ethics of Asset Valuation in Thailand on Conflict of Interest.

4.1.4. Malaysia

Malaysia currently does not have laws (i.e. statutes) that are directly related and/or relevant to IP valuation. However, in the past few years, the intellectual property-related acts or laws in Malaysia such as the Patents Act, Trademarks Act, Industrial Design Act and Copyright Act have been amended to support the development of the IP valuation ecosystem. The following are the details of the related amendments:

1) Patents Act

The Malaysian Patents Act was amended on 18 March 2022. Sections 36 and 39 were amended to allow Malaysian patents to be dealt with as security interest. According to these newly amended sections, a patent may be the subject of a security interest and can be recognized in the same way as other personal or moveable property. They also allow security interest transactions to be recorded in the Register.

2) Trademarks Act

The Malaysian Trademarks Act was amended on 9 December 2019. Section 62 of the amended Trademarks Act states that a registered trademark shall be considered personal or moveable property, and may be the subject of a security interest in the same way as other forms of personal or moveable property. Section 64 further elaborates on the assignment or transmission of the registered trademark. According to Section 64, a registered trademark shall be transmissible by assignment or transmission in the same way as other personal or moveable property, and shall be so transmissible either in connection with the goodwill of a business or independently. Section 64 further explains that the registered trademark can be the subject of an assignment by way of security in a manner that is similar to any other assignment. Furthermore, it can be the subject of a charge in the same manner as other personal or moveable property. In addition to that, Section 65 states that the security interest transaction shall be recorded in the Register.

3) Industrial Design Act

Industrial Design Act was last amended on 1st July 2013. In that amendment, a registered industrial design has been recognized as personal property. According to Section 29, a registered industrial design is personal property and is the subject of assignment, transmission or being dealt with by operation of law in the same way as other personal or moveable property. Furthermore, Section 29 states that the registered industrial design may be the subject of a security interest in the same way as other personal or moveable property.

4) Copyright Act

In general, the Copyright Act also allows copyrighted items to be managed as a security interest in the same way as other personal or moveable property.

Currently, the Intellectual Property Corporation of Malaysia (MyIPO) is preparing a 5-year National IP Policy (NIPP) with the assistance of WIPO and a few local IP experts. One of the strategic thrusts is the focus on the IP valuation and IP Financing issues. The NIPP is scheduled to be launched by the end of year 2022.

4.1.5. Other countries

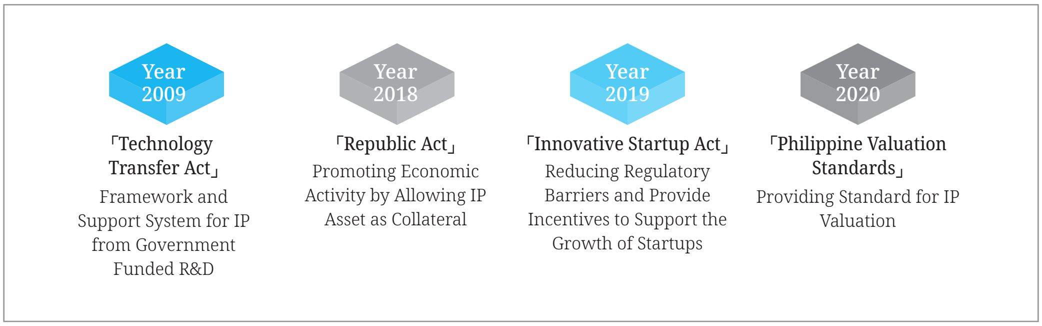
According to the analysis, currently other AMSs have not established laws and policies that are directly related to IP valuation.

4.1.6. Summary

Currently only two ASEAN member countries have either laws or policies related to IP valuation.

In the case of Philippines, the 'Technology Transfer Act' was enacted in 2009 to provide a framework and support system for IP based on government funded R&D. Following this, the 'Republic Act' was enacted in 2018 to promote economic activity by allowing the use of IP asset as collateral. After that, in 2019 the 'Innovative Startup Act' was enacted to reduce regulatory barriers and provide incentives to support the growth of startups, and finally in 2020, the Philippine Valuation Standards were published to provide standards for IP valuation (see Figure 1-7).

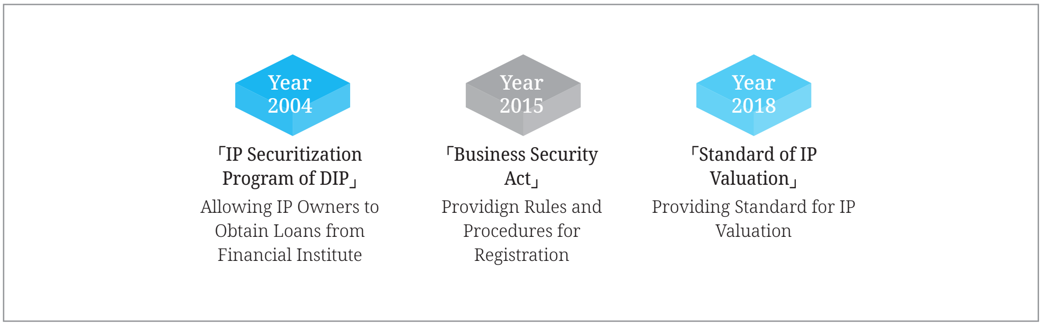
[Figure 1-7] History of Laws/Policies Related to IP Valuation in Philippines



Source: Author, based on surveys and online interviews with local experts and government officials.

In the case of Thailand, the 'IP Securitization Program of DIP' was enacted in 2004 to allow IP owners to obtain loans from financial institutions. Subsequently, the 'Business Security Act' was enacted in 2015 to provide rules and procedures for business registration, and finally in 2018, Standard of IP Valuation was published by the Professional Association to provide standards for IP valuation (see Figure 1-8).

[Figure 1-8] History of Laws/Policies Related to IP Valuation in Thailand



Source: Author, based on surveys and online interviews with local experts and government officials.

In Singapore, in year 2021, the Intellectual Property Office of Singapore (IPOS) prepared SIPS2030, which is Singapore's national 10-year strategy to strengthen the country's capabilities as a legal, financial and modern services hub that is able to leverage IP effectively and efficiently to fuel value creation and growth.

In Malaysia, currently MyIPO is preparing a 5-year National IP Policy (NIPP) with the assistance of WIPO and a few local IP experts. One of the strategic thrusts is the focus on the IP valuation and IP Financing issues. The NIPP is scheduled to be launched by the end of year 2022. Regarding Cambodia, currently the Cambodian government is finalizing the government's long term supporting policy including IP valuation under the national IP committee through collaboration between the Ministry of Finance and Ministry of Commerce. According to the analysis, currently other AMSs do not have laws/policies that are directly related to IP valuation.

4.2. Organizations

4.2.1. Singapore

This following section will be categorized as follows: (1) Government Organizations, (2) Private Organizations and (3) Other Organizations (IP Valuation Educational Institutions):

1) Government Organizations

<Table 1-9> Government Organizations Related to IP Valuation in Singapore

S/No.	Name of Organization	Remarks
1	Prime Minister's Office (PMO)	Minister (Ms. Indranee Rajah) is the Chairperson of the SIPS2030 Implementation Committee
2	Ministry for Culture, Community and Youth (MCCY)	Minister (Mr. Edwin Tong) is the Deputy Chairperson of the SIPS2030 Implementation Committee
3	Ministry of Law (MinLaw)	Committee Member of the SIPS2030 Implementation Committee
4	Ministry of Trade and Industry (MTI)	Committee Member of the SIPS2030 Implementation Committee
5	Ministry of Finance (MOF)	Committee Member of the SIPS2030 Implementation Committee
6	IPOS	Committee Member and Secretariat of the SIPS2030 Implementation Committee Various other subsidiaries of IPOS are also supporting SIPS2030 in the drafting and publication of the document, and reinforcing the capabilities of IPOS International, the IP academy that undertakes IP valuation education and training in Singapore
7	ACRA	Supporting Agency of SIPS2030 Working closely with IPOS and other agencies (e.g. SGX) to establish the standardized IP Disclosure Guidelines for listed and soon-to-be listed enterprises in Singapore
8	Agency for Science Technology and Research (A*STAR)	Supporting Agency of SIPS2030
9	Economic Development Board (EDB)	Supporting Agency of SIPS2030
10	Enterprise Singapore (ESG)	Supporting Agency of SIPS2030
11	Infocomm Media Development Authority (IMDA)	Supporting Agency of SIPS2030
12	Monetary Authority of Singapore (MAS)	Supporting Agency of SIPS2030
13	Singapore Accountancy Commission (SAC)	Supporting Agency of SIPS2030
14	SkillsFuture Singapore (SSG)	Supporting Agency of SIPS2030 Providing financial support (i.e. Government Subsidies) for IP valuation related educational courses in Singapore

Source: Author, based on surveys and online interviews with local experts and government officials.

2) Private Organizations

There are several private organizations that provide IP valuation services in Singapore. IPOS has a panel of appointed valuers under its Intellectual Property Financing Scheme (IPFS). Where relevant it is indicated if the organization has an appointed valuer or not. According to IPOS, any IP valuation report that is not prepared by an appointed valuer will be invalid for financing purposes under its IPFS.

<Table 1-10> Private Organizations Related to IP Valuation in Singapore

No	Name of Organization	Remarks
1	Baker & McKenzie.Wong & Leow	Appointed Valuers Website: www.bakermckenzie.com/singapore
2	CONSOR Intellectual Asset Management	Appointed Valuers Website: www.consor.com
3	Deloitte & Touche Financial Advisory Services Pte. Ltd	Appointed Valuers Website: https://www2.deloitte.com/sg/en.html
4	Duff & Phelps Singapore Pte. Ltd	Appointed Valuers Website: http://www.duffandphelps.com/
5	Ernst & Young Solutions LLP	Appointed Valuers Website: http://www.ey.com/sg/en
6	EverEdge Global (NZ) Ltd	Appointed Valuers Website: http://everedgeip.com/
7	KPMG Services Pte. Ltd	Appointed Valuers Website: https://home.kpmg.com/sg/en/home.html
8	PricewaterhouseCoopers Advisory Services Pte. Ltd	Appointed Valuers Website: https://www.pwc.com/sg/en/
9	Valuation Consulting LLP	Appointed Valuers Website: http://www.valuationconsulting.com/
10	Max Lewis Consultants Pte. Ltd	Non-Appointed Valuers Website: https://www.maxlewis.com.sg/
11	Valueteam Pte. Ltd	Non-Appointed Valuers Website: https://valueteam.com.sg/
12	Yusarn Audrey (Law Firm)	Non-Appointed Valuers (Website mentions IP Financing as a service, but it is unclear if they offer IP valuation services directly or through another service provider) Website: https://www.yusarn.com/

Source: Author, based on surveys and online interviews with local experts and government officials.

4.2.2. Philippines

There are two organizations primarily responsible for IP protection, valuation and commercialization.

1) DOST-TAPI

The Technology Application and Promotion Institute (TAPI) is the implementing arm of the Department of Science and technology in promoting the commercialization of technologies and in marketing the services provided by the other operating units of the department. The roles of TAPI, stipulated in 'Reorganization Act of the National Science and

Technology Authority' (1987), are to: 1) undertake contract research, particularly at the pilot plant and semi-commercial stage; 2) provide technical consultancy including engineering design services, patenting and licensing services; and 3) provide grants and/or venture-financing for new and/or emerging projects.

2) IPO Philippines

The Intellectual Property Office of the Philippines or IPOPHL is a government agency attached to the Department of Trade and Industry. The IPOPHL handles the registration of intellectual property and resolution of conflicts regarding intellectual property rights in the Philippines.

Although not indicated explicitly in the law, the DOST-TAPI leads the promotion of valuation of IP in the Philippines. Its primary purpose is to help in the commercialization of technologies and valuation is a key component of commercialization.

4.2.3. Thailand

There are four main organizations responsible for activities in relation to IP valuation, namely, the Thailand Department of Intellectual Property (DIP), the Department of Business Development (DBD), and the two professional associations, namely the Thai Valuers Association and the Valuers Association of Thailand (VAT).

IP valuation is being carried out systematically in Thailand, although mostly in the private sector. IP valuation is usually conducted when there is a business merger or acquisition, as IP valuation is required in the Purchase Price Allocation Report (PPA Report). The frequency with which IP valuation is being conducted has been increasing over the years. The two main associations that are most often engaged in IP valuation are the Thai Valuers Association (TVA) and the Valuers Association of Thailand (VAT).

1) DIP

The Department of Intellectual Property (DIP) is responsible for all matters relating to the protection, enforcement, and commercialization of IP. The Department of Intellectual Property aims to facilitate the efficient protection of IP, safeguarding IP rights in a fair manner, promote the creation and commercial exploitation of IP, and strengthen knowledge and understanding related to IP. The DIP's three main strategies include developing systems for the protection of IP rights at both domestic and international levels, suppressing infringements on IP and creating fairness as well as discipline in trade, and promoting the creation and commercial exploitation of IP.[2]

2) DBD

The Department of Business Development (DBD) is responsible for all matters related to the registration of a business, including the registration of security interests under the BSA. As stated above, the security agreement must be made in writing and registered with the DBD. The DBD is preparing to establish a Business Security Registration Office having the duties of accepting registration, amending the particulars of registration, revoking a business security contract registration under the BSA, and providing information concerning registration to the public.

3) Thai Valuers Association

The Thai Valuers Association aims to serve as the center for publishing information, knowledge and related information in relation to the valuation of assets, including IP. Its objective is to promote and support personnel and thereby develop the quality of valuation and the profession.

4) The Valuers Association of Thailand (VAT)

The Valuers Association of Thailand (VAT) was established in cooperation with the Land Department and other related governmental agencies, financial institutes, professional associations, and educational associations on January 30, 1986. The main objective of the VAT is to promote personnel and develop the valuation profession in cooperation with the ASEAN Valuers Association and other institutions, both domestic and international. In addition, the VAT supports the research and distribution of information, by organizing educational seminars on the topic of valuation of property, providing advice and reviewing disputes in valuation-related issues among members and related agencies, as well as establishing rules, regulations, and etiquette for the valuation profession.[3]

The volume of IP valuation being conducted by the firm, when compared to other types of valuation, is assessed at around 20%, with a trademark valuation being done approximately every one to three months, and a patent valuation being done one to two

2 Noppadol Phuakthongkham, "Department of Intellectual Property Ministry of Commerce Thailand," [https://www.wipo.int/edocs/mdocs/aspac/en/wipo_asean_ip_tyo_12/wipo_asean_ip_tyo_12_ref_z_thailand.pdf] (accessed on May 31, 2022)

3 The Valuers Association of Thailand, "About Us," [https://vat.or.th/about-us/] (accessed on May 31, 2022)

times a year.[4]

However, it should be noted that the ecosystem of IP valuation is not yet well established in Thailand to facilitate IP financing. There is no publicly available transaction database on IP valuations conducted in Thailand. In addition, data on IP assets are not synchronized, not in real time, and are updated manually by the government authorities. Furthermore, there are insufficient incentives for IP owners or financial institutions to conduct IP valuations, which are costly for small to medium businesses. Therefore, IP valuations are normally conducted by large companies and information on the value of their IP assets is kept confidential.

4.2.4. Malaysia

There are five organizations responsible for activities in relation to IP valuation in Malaysia.

1) The Intellectual Property Corporation of Malaysia (MyIPO)

The Intellectual Property Corporation of Malaysia (MyIPO) is the custodian of Intellectual Property in Malaysia. Since 2013, MyIPO has been involved in IP financing, IP valuation, and IP Rights Marketplace Initiatives. The following are the initiatives and achievements:

- Developed an IP Valuation Model (IPVM) to enable IP rights to be valued. The IPVM is developed for use by potential lenders in the financial sector who are considering lending to SMEs with low tangible asset backing.
- Created the IPR Marketplace as a platform for IP rights transactions (Please visit http://iprmarketplace.myipo.gov.my/ for further information)
- Conducted IP valuations for selected & suitable SMEs to be considered for funding under the IP Financing Scheme managed by Malaysia Debt Ventures (MDV).
- Conducted capability building programs to increase stakeholders' understanding about IP Financing, IP Valuation and IPR Marketplace especially to support the idea of using IP as a source to seek financing.

2) Valuation and Property Services Department (JPPH)

The Valuation and Property Services Department (JPPH) is a government department

4 Interview with a professional valuer company in Thailand, May 2022.

responsible for providing advisory services to the government and its agencies on all matters related to property such as valuation, consultancy and property services. In 2013, JPPH decided to embark on a project to develop intellectual property valuation services by sending a group of property valuers consisting of JPPH valuers and also personnel from private property valuation companies for IP valuation training conducted by MyIPO under the IP Valuation Initiative program. Five of their valuers managed to pass the examination and three of them are still working with JPPH. Currently, JPPH has its own IP Valuation Unit that provides IP valuation services to other government agencies. Furthermore, they have a team of Business Valuers. Both teams i.e. IP Valuation and Business Valuation teams are under the Valuation & Property Services Division. Some of their clients on IP valuation include the Malaysian Department of Insolvency and the Ministry of Transport. However, their services are not extended to the private sector.

3) Royal Institution of Surveyors Malaysia (RISM)

The Royal Institution of Surveyors Malaysia (RISM) is a professional body for four main professions that include land surveyors, quantity surveyors, property surveyors and building surveyors. Starting from 2014, IP valuers certified by MyIPO through the IP valuation training conducted in 2013 have been accepted as members of the RISM, which allows them to use the “Sr.” (Surveyor) title. The membership is under the Property Surveying Division of RISM. An Intangible Assets Sub-Committee has been formed under the Valuation Committee.

4) Business Valuers Association Malaysia (BVAM)

The Business Valuers Association Malaysia (BVAM) was founded in 2015 as Malaysia Charter Member of the International Association of Certified Valuation Specialists (IACVS). The BVAM’s main objective is to promote the role of business valuers in Malaysia and also to honor and uphold the integrity of the profession of business valuers. BVAM provides support to professionals performing valuation on businesses, and connects local practitioners to the global network of IACVS members. BVAM works closely with the IACVS headquarters and is responsible for providing training and continuous professional development to its members, as well as developing best practices that are aligned with local, international and IACVS standards. BVAM currently has 150 registered members led by nine committee members. Business Valuation Guidance Notes as contained in the Malaysian Valuation Standards Sixth Edition 2019 have been introduced by BVAM.

A ‘Professional Business Valuation Course’ is organized jointly by the Business Valuers

Association Malaysia (BVAM) and the International Association of Certified Valuation Specialists (IACVS). The course includes examinations by IACVS that the participants need to pass in order for them to apply for membership of BVAM. The course offers insights and guidance regarding the valuation process of intangible assets such as patents, trademarks and other types of intellectual property.

5) Innovation and Technology Managers Association Malaysia (ITMA)

The Innovation and Technology Managers Association (ITMA) is a Non-Governmental Organization (NGO), which serves as a platform for the Innovation and Commercialization Center (ICC) for universities in Malaysia. It aims to share best practices and explore opportunities to combine Intellectual Properties of commercialization initiatives in order to generate better technologies that have the potential to succeed in the market.

From 2017 to 2019, the Alliance of Technology Transfer Professionals (ATTP) Accredited Technology Transfer Workshops were organized in collaboration with the Malaysian Industry-Government Group for High Technology (MIGHT), PlaTCOM Ventures Sdn. Bhd. and ITMA. The two-year capacity-building project aimed to train and produce for Malaysia a pool of technology transfer professionals with international recognition under the purview of the ATTP.

With support from the Malaysian Industry-Government for High Technology (MIGHT), ITMA has been registered and recognized as an Alliance Association of ATTP since May 2019. This marks a great achievement for ITMA, being the first and only Malaysian technology transfer association to join ATTP – the worldwide Alliance of Technology Transfer Professionals.

4.2.5. Other Countries

According to the analysis, among other AMS, only Vietnam, Indonesia and Cambodia have a national agency for IP valuation, and other countries do not have such an agency. In Vietnam and Indonesia, the respective Ministries of Finance are responsible for all matters related to business appraisals including IP whereas both the Ministry of Finance and Ministry of Commerce manage related responsibilities in Cambodia.

4.2.6. Summary

First, the primary responsible government agencies in AMS related to IP valuation are as follows (see Table 1-11).

In Singapore, IPOS is the primary responsible government agency implementing SIPS2030. In Philippines, DOST-TAPI is the primary agency responsible for promoting valuation of IP. In Thailand, DIP is responsible for all matters related to the protection, enforcement, and commercialization of IP and DBD is responsible for all matters related to the registration of a business. In Malaysia, MyIPO is responsible of supporting IP valuation whereas JPPH is responsible for providing advisory services on all matters related to property. In Vietnam, Indonesia, and Cambodia, the respective Ministries of Finance are responsible for all matters related to business appraisals including IP.

<Table 1-11> Primary Government Agencies Responsible for IP Valuation in AMS

#	Name of AMS	Name of Agency	Role of Agency
1	Singapore	Intellectual Property Office of Singapore (IPOS)	Implementing SIPS2030
2	Philippines	Department of Science and technology-Technology Application and Promotion Institute (DOST-TAPI)	Promoting of valuation of IP
3	Thailand	Department of Intellectual Property (DIP)	Responsible for all matters related to the protection, enforcement, and commercialization of IP
		Department of Business Development (DBD)	Responsible for all matters related to the registration of a business
4	Malaysia	Intellectual Property Corporation of Malaysia (MyIPO)	Responsible for supporting Intellectual Property
		Valuation and Property Services Department (JPPH)	Responsible for providing advisory services on all matters related to property
5	Vietnam	Ministry of Finance	Responsible for all matters related to business appraisals including IP
6	Indonesia	Ministry of Finance	Responsible for all matters related to business appraisals including IP
7	Cambodia	Ministry of Finance, Ministry of Commerce	Responsible for all matters related to business appraisals including IP

Source: Author, based on surveys and online interviews with local experts and government officials.

Secondly, the institutions supporting IP valuation in AMS are as follows (see Table 1-12). In Singapore, these are the institutions supporting the SIPS2030, working closely with IPOS to establish standardized 'IP Disclosure Guidelines', and provide financial support for IP valuation as well as educational courses. In Thailand, Thai Valuers Association and Valuers Association of Thailand are promoting and assisting personnel to develop the quality of valuation by supporting educational courses and establishing rules and regulations for the valuation profession. In Malaysia, there are three institutes that support IP valuation. The Royal Institution of Surveyors Malaysia (RISM) is a professional body for four main professions that include land surveyors, quantity surveyors, property surveyors and building surveyors. Business Valuers Association Malaysia (BVAM) promotes the role of business valuers, provides support to professionals performing valuation on businesses, and connects local practitioners to the global network of IACVS members. The Innovation and Technology Managers Association Malaysia (ITMA) is a Non-Governmental Organization (NGO) that serves as a platform for the Innovation and Commercialization Center (ICC) for universities in Malaysia. It aims to share best practices and explore opportunities to combine the Intellectual Properties of commercialization initiatives in order to generate better technologies that have the potential to succeed in the market.

<Table 1-12> IP Valuation Supporting Institutions in AMS

#	Name of AMS	Name of Agency	Role of Agency
1	Singapore	Agency for Science, Technology and Research; Economic Development Board (EDB); Enterprise Singapore (ESG); Infocomm Media Development Authority (IMDA); Monetary Authority of Singapore (MAS); Singapore Accountancy Commission (SAC); SkillsFuture Singapore (SSG)	Supporting institutes of SIPS2030, working closely with IPOS to establish standardized IP Disclosure Guidelines, and provide financial support for IP valuation as well as educational courses.
2	Thailand	Thai Valuers Association	Promoting and supporting personnel to develop the quality of valuation and the profession including IP
		Valuers Association of Thailand (VAT)	Promoting and supporting educational seminars as well as establishing rules, regulations, and etiquette for the valuation profession including IP
3	Malaysia	Royal Institution of Surveyors Malaysia (RISM)	Professional body for four main professions including land surveyors, quantity surveyors, property surveyors and building surveyors
		Business Valuers Association Malaysia (BVAM)	Promotes the role of business valuers and provides support to professionals performing valuation on businesses, and connects local practitioners to the global network of IACVS members.
		Innovation and Technology Managers Association Malaysia (ITMA)	A Non-Governmental Organization (NGO) that serves as a platform for the Innovation and Commercialization Center (ICC) for universities. It aims to share best practices and explore opportunities to combine Intellectual Properties of commercialization initiatives in order to generate better technologies that have the potential to succeed in the market.

Source: Author, based on surveys and online interviews with local experts and government officials.

According to the analysis, only Singapore has designated IP valuation implementation institutes that provide IP valuation services. These include: Baker & McKenzie, Consor, Deloitte & Touche, Duff & Phelps, Ernst & Young, EverEdge Global (NZ), KPMG, PwC, Valuation Consulting. Other AMS do not have specific laws indicating a designated IP valuation implementation institute, so there are no designated IP valuation implementation institutes.

4.3. System

4.3.1. Singapore

The Intangible Disclosure Evaluation and Audit Scheme (IDEAS) is co-managed by SGX and IPOS, and is meant to raise awareness and encourage companies to undergo intangible assets (IA) evaluations and promote a robust IA disclosure environment. IDEAS ran as a pilot program throughout 2020 and only a limited number of companies were nominated as participants. IDEAS provided financial support for those companies' IP evaluation and audit process. However, it is unclear in what form financial support was given to those companies and how much was provided.

The Intellectual Property Financing Scheme (IPFS) is a Singapore Government initiative to help Singapore-based IP-rich companies monetize their IP for business growth and expansion. The Singapore Government shares the risk of the IP loan with the Participating Financial Institution (PFI) to encourage financial institutions to accept IP assets as collateral in support of the loan. PFIs undertake the due diligence process in assessing the credit worthiness and the business case of the applicants.

IP valuation services (as provided by the panel of appointed valuers) will therefore be crucial in quantifying the worth of the companies' IP in that the valued IP may be taken as security for any loan disbursements by the PFIs. The maximum quantum of the loan that may be disbursed under the IPFS is SGD 100 million (approx. USD 72 million). During the valuation process, IPOS will also be able to set the guidelines to which the IP valuers are bounded. This is to ensure the quality of the valuation services to be provided to the IPFS applicants.

A valuation subsidy will also be provided to the successful applicants by IPOS to defray the costs of preparing the IP valuation report under the IPFS, as follows: 50% of the IP valuation costs, 2% of the value of the IP, or SGD 25,000 (approx. USD 18,050), whichever is the lowest. However, it is to be noted that the IPFS scheme commenced in 2014 was discontinued in 2018. A total loan amount of SGD 12 million was disbursed from the various PFIs to only three different companies. It was observed that the IPFS was discontinued for three key reasons: the high upfront valuation costs were a deterrent to potential applicants; PFIs lacked familiarity with IP as security for loan disbursements; and the absence of secondary markets for IP assets meant that there were no clear avenues for disposal of the IP and recovery of value.

As a conclusion, given that both the IDEAS and IPFS have been discontinued, currently Singapore does not seem to have any government financial support offered to enterprises specifically for IP valuation. Hence, enterprises seeking to undergo IP valuation (whether for IP disposal, licensing and/or disclosures) will have to do so at their own costs.

4.3.2. Philippines

In general, there is no standard IP valuation system being practiced in Philippines. At the moment, there are a few IP valuation guidelines or models being introduced and practiced in Philippines.

1) Guidelines on IP Valuation, Commercialization, and Information Sharing of the Philippine Technology Transfer Act of 2009 (2013)

The Act stipulates guiding principles set by DOST-TAPI on technology-based intellectual property valuation. It includes valuation principles, premise for estimation of value, valuation approaches as applicable to IP valuation, and contents of the valuation report.

2) Philippine Valuation Standards (PVS) - Adoption of the IVSC Valuation Standards under the Philippine Setting

Guidance Note 4 (GN4) of the PVS includes guidelines provided by DOF-BLGF for valuing intangible assets. It also includes definitions, concepts, processes and methods to be applied in valuing intangible assets, including IP rights.

4.3.3. Thailand

In practice, there is an established system for applying for loans using IP as collateral. In doing so, the IP owner must register their IP at the DIP, and prepare their financial information and business information. Afterward, as a preliminary step, the owner must value their IP using a checklist and lastly, contact the financial institution for loan approval.

At the stage of the financial institution, if the financial institution forms the impression that the IP may be used as collateral, the institution must hire a professional valuer to formally determine the value of the IP. After the IP valuation is completed, the business collateral must be registered with the Department of Business Development/Ministry of Commerce, and finally, the loan may be issued to the IP owner.[5]

With respect to standard IP valuation systems, currently there is no such standard in Thailand. However, there are some IP valuation guidelines published by the DIP. Such guidelines introduce some IP valuation methods, including the cost approach, the market approach and the income approach.

4.3.4. Malaysia

In general, there is no standard IP valuation system being practiced in Malaysia. At the moment, there are a few IP valuation systems, guidelines or models being introduced and practiced in Malaysia.

1) IP Valuation Model (IPVM)

In 2013, the IP Valuation Model (IPVM) was developed with the help of a number of foreign IP valuation experts and local IP experts. The purpose of the IPVM is to provide a standardized, Malaysia-specific and widely accepted valuation method for valuing IP that may be used as collateral in lending. The IPVM is developed for use by potential lenders in the Malaysian financial sector when considering the feasibility of lending to SMEs with low tangible asset backing.

The IPVM focuses on the identification of suitable businesses and IP, the accepted process for valuation of the IP, as well as the standard reporting process for an IP valuation that is performed for lending purposes. The IPVM is intended to be consistent with internationally accepted accounting standards including IFRS, IVS, and ISO.

The IPVM's identification process is designed to assist the lender in identifying businesses for which a Relief-From-Royalty (RFR) approach might be suitable as a primary valuation methodology. The RFR is an income-based valuation approach and is commonly used in the valuation of IP for lending purposes. The RFR approach determines the present value of the IP by applying the market royalty rate to a projected future income stream, which is based on the hypothetical advantage that the business is relieved from paying because it owns

5 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

the IP. In order for the IPVM to be used, the business and the subject IP must be screened appropriately to ensure that an RFR method is appropriate.[6]

2) Guidance Notes to Intangible Asset Valuations Published by RISM in 2017

A few MyIPO-certified IP valuers have been accepted as members of RISM. The valuers have developed 'Guidance Notes to Intangible Asset Valuations' published by RISM in 2017. The guidance notes can be purchased from RISM with a prescribed fee.

3) Business Valuation Guidance Notes by BVAM

As explained in the previous section, a guidebook titled 'Business Valuation Guidance Notes' as contained in the Malaysian Valuation Standards Sixth Edition 2019 has been introduced by BVAM.

4) SIRIM Standard: Guidelines for Technology Commercialization (SIRIM 34:2020)

SIRIM Berhad is a premier industrial research and technology organization in Malaysia, and is a wholly owned company of the Malaysian Government under the Ministry of International Trade and Industry (MITI). SIRIM Berhad is a premiere total solutions provider in quality and technology innovations that helps industries and businesses to compete better through every step of the business value chain.

SIRIM Berhad is a center of excellence in standardization, facilitating industries and businesses in their efforts to enhance their production and competitiveness, protecting consumers' health and safety, and giving them the choice to select quality products and services.

As a standards development organization, SIRIM Berhad has extensive expertise in standards research and consultancy to help industries and businesses meet local and international requirements and practices, through the development of SIRIM Standards.

SIRIM Standards are developed according to SIRIM standardization procedures, which are in line with international practices that ensure appropriate notification of work programs and participation of interested parties. SIRIM Standards are developed through consensus among committees, which consist of experts in the subject matter. The use of SIRIM Standards is voluntary, and it is open for adoption by regulators, government

6 IP Valuation Model by MyIPO

agencies, associations, industries, professional bodies, etc.[7]

SIRIM STS Sdn Bhd, one of SIRIM Berhad's subsidiary companies, is the leading one-stop resource center for services related to the development of SIRIM Industry Standards. In 2020, SIRIM STS developed the Guidelines for Technology Commercialization (SIRIM 34:2020).

This SIRIM Standard provides guidance for the commercialization of technology. It is applicable to organizations seeking to:

a) Initiate and implement technology commercialization practices in their organization;

b) Offer their technology/product/process to other organizations for further development and commercialization; and

c) Adopt technology/products/processes from other organizations for further development and commercialization.

This standard is intended to be used by the public and private sectors, institutions of higher learning, research institutions, industry-specific research organizations and any other interested organizations, regardless of sector, size or type, which are aiming to implement technology commercialization practices.[8]

4.3.5. Other Countries

According to the analysis, other AMSs currently do not have IP valuation methods and manuals related to IP valuation.

4.3.6. Summary

Regarding the IP valuation system, IP valuation methods and manuals have been developed and utilized only in three countries among AMS (see Table 1-13).

In Philippines, the Philippine Valuation Standards (PVS) was released in 2009 by DOF-BLGF, and the Guidelines on IP Valuation were developed and started to be utilized in 2013 according to the Philippine Technology Transfer Act of 2009 by DOST-TAPI. In Thailand, IP valuation guidelines were developed and started to be utilized by DIP in 2018. In Malaysia, the IP Valuation Model (IPVM) was introduced by MyIPO in 2013. The IPVM provides a

7 SIRIM STANDARD Guidelines for Technology Commercialization (SIRIM 34:2020)

8 https://standards.sirimsts.my/catalog.php

standardized, Malaysia-specific and widely accepted valuation method for valuing IP. Following this, Guidance Notes to Intangible Asset Valuations were released by RISM in 2017, and subsequently, Malaysian Valuation Standards Sixth Edition which is Business Valuation Guidance Notes for 2019 was introduced by BVAM. And finally, in 2020, SIRIM Standard: Guidelines for Technology Commercialization was developed by SIRIM STS. Other AMSs currently do not have IP valuation methods and manuals related to IP valuation.

<Table 1-13> IP Valuation Methods and Manuals in AMS

#	Name of AMS	Name of Manuals	Issuing Agency	Contents
1	Philippines	Philippine Valuation Standards (PVS) (2009)	DOF-BLGF	Includes definitions, concepts, processes and methods to be applied in valuing intangible assets, including IP rights.
		Guidelines on IP Valuation, Commercialization, and Information Sharing of the Philippine Technology Transfer Act of 2009 (2013)	DOST-TAPI	Includes valuation principles, premise for estimation of value, valuation approaches as applicable to IP valuation, and contents of the valuation report.
2	Thailand	IP Valuation Guidelines (2018)	DIP	Introduces some IP valuation methods, including the cost approach, the market approach and the income approach.
3	Malaysia	IP Valuation Model (IPVM) released in 2013	MyIPO	Provides a standardized, Malaysia-specific and widely accepted valuation method for valuing IP.
		Guidance Notes to Intangible Asset Valuations released in 2017	RISM	Includes definitions, concepts, processes and methods to be applied in valuing intangible assets, including IP rights.
		Business Valuation Guidance Notes in 2019	BVAM	Malaysian Valuation Standards Sixth Edition 2019 have been introduced by BVAM.
		SIRIM STANDARD: Guidelines For Technology Commercialization (SIRIM 34:2020)	SIRIM STS	Elaborates on the Guidelines for Technology Commercialization

Source: Author, based on surveys and online interviews with local experts and government officials.

4.4. Education

4.4.1. Singapore

Several education programs were launched over the past few years to build a steady pipeline of IP professionals to support the country's IP manpower needs. For example, the

Intellectual Property Office of Singapore (IPOS) and Workforce Singapore (WSG) launched the IP Professional Conversion Program (PCP) in 2017 to equip mid-career professionals with IP knowledge and enable them to take on new job roles in this area. IPOS also collaborated with the Singapore University of Social Sciences (SUSS) to roll out the Master of IP and Innovation Management (MIPIM) program. This multidisciplinary graduate program integrates IP knowledge and skills from the legal, business, and technology domains. In 2019, IPOS, SkillsFuture Singapore (SSG), and WSG jointly launched a first-of-its-kind Skills Framework (SFW) for IP to map out the career pathways for IP professionals.

Specific to IP valuation, there are several courses available in Singapore (see Table 1-14).

<Table 1-14> IP Valuation Related Education Courses in Singapore

No.	Name of Course / Name of Institution	Remarks
1	IP Valuation Course /Singapore Management University	2 Day Course, Course Fees are SGD 2,140 (approx. USD 1,550) and government subsidies are available. Source: https://academy.smu.edu.sg/ip-valuation
2	Valuation: A Corporate Perspective / Singapore Management University	5 Day Course (IP Valuation is only covered in part on Day 3), Course Fees are SGD 5,350 (approx. USD 3,900) and government subsidies are available. Source: https://academy.smu.edu.sg/valuation-corporate-perspective-2751
3	Monetizing Innovation: Valuation / Singapore University of Social Sciences	6 Month Course, Course Fees are SGD 3,000 (approx. USD 2,200) and government subsidies are available. Source: https://www.suss.edu.sg/courses/detail/ipm558
4	IP Valuation / IPOS International, IP Academy	2 Day Course, Course Fees are SGD 2,140 (approx. USD 1,550) and government subsidies are available. Source: https://iposinternational.com/academy/enterprises-individuals/ip-valuation_416
5	Chartered Valuer and Appraiser Programme / Nanyang Technological University Singapore	6.5 Day Course (over a period of 3-4 months), Course Fees are about SGD 18,000 (approx. USD 13,050 USD) and government subsidies are available. It is unclear if IP valuation is covered specifically in this course, however in light of IVS210, it may be possible and/or relevant to this course. Source: https://www.ntu.edu.sg/business/admissions/NEE/public-programmes-for-professionals/finance-and-valuation/CVA#Content_C015_Col00
6	IP & Patent Valuation [Certified Patent Valuation Analyst (CPVA)] / IP Alpha*	2 Day Course, Course Fees are SGD 4,500 (approx. USD 3,500) and no government subsidies are available. Source: http://ipasingapore.com/e2t/

Note: * Private educational institute.

Source: Author, based on surveys and online interviews with local experts and government officials.

4.4.2. Philippines

There is no current law/policy that stipulates an IP valuation education/human resources development program in the Philippines, as of July 2021. While there are now six Certified Patent Valuation Analysts (CPVA) in the country: two from DOST-TAPI, two from IPOPHL and two from other organizations, the Philippines does not have an accreditation program for IP valuation.

However, the Philippines has developed a mid-term National Intellectual Property Strategy (NIPS) (2020 - 2025).

- Active participation from the highest level of all branches of government, including government agencies, academia, industry sectors, creators, and innovators, is of utmost importance to the realization of the NIPS's ambitions.
- The envisioned IP system, under the NIPS, is required to be more systematic, comprehensive, and effective to deliver reliable IP valuation service for Philippine creators and innovators. For this to be realized, the NIPS sets out a realistic and positive strategic direction for the Philippine IP system.

4.4.3. Thailand

With regard to education related to IP Valuation, the DIP's Guidelines on Intellectual Property Valuation serve as an important resource. There are two versions of the DIP's Guidelines, published in 2008 and 2017 respectively. The 2008 Guidelines were developed in collaboration with Chulalongkorn University, while the 2017 Guidelines were developed in collaboration with the Thailand Development Research Institute Foundation (TDRI), which is a non-profit, non-governmental public policy institution that focuses on various social and economic development issues of the country. Thus, the Guidelines are educational in nature and assist in the creation of awareness about IP valuation among members of the Thai public.[9]

Furthermore, the Valuers Association of Thailand (VAT) is considered to be a prominent entity, which was organized to support and coordinate with the ASEAN Valuers Congress to generate quality resources and to further the development of the Thai valuation industry as well.

9 Thailand Development Research Institute, "About TDRI," [https://tdri.or.th/en/about/mission/] (accessed on May 31, 2022).

4.4.4. Malaysia

In terms of training and education on IP valuation, there is no standard training module used by the organizations in Malaysia. Currently, there are a few organizations including MyIPO, RISM and BVAM that provide IP valuation training in Malaysia.

1) IP Valuation Training by MyIPO

In 2013, the government allocated RM19 Million to MyIPO to develop training programs for local IP valuers. Based on this budget, a few foreign IP valuation experts were invited along with some local IP experts to help MyIPO to plan and develop an IP valuation training module and further participate as speakers and trainers. MyIPO also engages the World Trade Institute (WTI), University of Berne, Switzerland in conducting the training program.

The training program consists of a few weeks of training, in particular six weeks. The following diagram shows the week 1 and 2 training programs:

<Table 1-15> MYIPO's IP Valuation Training and Certification Program (Week 1, 2 Program Overview)

WEEK 1-LOCAL EXPERTS	Opening Remarks and Course Brief
	Overview to IP
	Building a Brand-Trade Marks
	Common Law Marks & Passing Off
	Inventing the Future-Parents
	Innovating the Future-Utility Innovation
	Creative Expressions-Copyright
	Looking Good-Industrial Designs
	Keeping it Confidential-Confidential Infomation/Trade Secrets, Layout Designs of IC
	Other IP Rights: Geographical Indications and Plant Varieties
	IP Filing Prodedures & Searches - Patent & Industrial Design
	IP Filing Procedures & Searches - Trademark & Copyright
WEEK 2-LOCAL EXPERTS	IP Monetization & Commercialization
	IP Licensing & Franchising
	IP Valuation & IP Financing
	Basic Financial Accounting
	Basic Financial Accounting
	Basic Corporate Finance
	IP Collateralisation and Securitisation

Source: Author, based on surveys and online interviews with local experts and government officials.

Referring to the diagram above, in the first week, the participants are given lectures and trainings by local IP experts on IP in general, the various types of IP (e.g. Patent, Trademark, etc.) and also the IP filing procedures and searches. Given that the participants are coming from various technical fields and some of them are non-IP practitioners, this training is quite crucial in order to build their basic understanding of IP.

In the second week, the participants are exposed to concepts of IP commercialization, which includes IP licensing, IP valuation and IP financing. Basic Financial Accounting courses are also given to participants as not all of them have an accounting background. Finally, at the end of the week, the participants are introduced to basic corporate finance and basics of IP collateralization and securitization courses.

<Table 1-16> MYIPO's IP Valuation Training and Certification Program (Week 3 Program Overview)

WEEK 3-LOCAL EXPERTS	Introduction to IP Valuation Methods 1. Reasons for Valuing 2. Valuation Methods - Market Approach - Income Approach - Cost Approach
	3. Issues in IP Valuation 4. Issues affecting IP Values 5. International Experience
	Valuation Methods: Method 1-Market Approach (Theory & Case Study)
	Method 2-Cost Approach (Theory & Case Study)
	Method 3-Income Approach (Theory & Case Study)
	Valuation Report - Preparation of Valuation Report

Source: Author, based on surveys and online interviews with local experts and government officials.

In the third week as appears in the table above, foreign IP valuation experts are invited to deliver the presentations and trainings on IP valuation matters. The presentations are supported by hands-on case studies and exercises to give the participants confidence in conducting IP valuation. Finally, the lecture is concluded with a presentation on preparing the valuation report, which is the most important element of the IP valuation exercise.

<Table 1-17> MYIPO's IP Valuation Training and Certification Program (Week 4, 5 and 6 Program Overview)

WEEK 4-FOREIGN EXPERTS	Case Study on Report Writing
	Recap with Case Studies
	Valuation Assessment (1 hour)
	IP Negotiations
WEEK 5 & 6-FOREIGN EXPERTS	Case Studies and Recap
	Presentation on Group Assignment
	Group Assignment & Valuation Assessment Analysis

Source: Author, based on surveys and online interviews with local experts and government officials.

In the fourth week, the participants are divided into groups and each group is given a case study on report writing. They are given two weeks to complete the valuation exercise and submit a complete valuation report to the foreign IP experts. In the sixth week, each group is required to present the group assignment to a panel of IP valuers and IP experts. The report and the presentation are assessed by foreign experts and constitute 20% of the passing marks. Another 80% will be based on the results of an examination that the participants would need to attend in a month's time.

2) IP Valuation Training by RISM

The Intangible Asset Sub-Committee under the Property Surveyors Division organized an IP valuation training from 15th to 17th February 2020. The title of the course was 'Value Determination of Intangible Assets Course'. The three days course managed to attract about 20 participants among members and non-members of RISM. The trainers of the training program were selected among certified IP valuers. The training covers the topic of IP in general, their components, the income approach using the Relief from Royalty method and also report writing. Since then, no other IP valuation training program has been held other than short webinars on the importance of IP valuation.

3) IP Valuation Training by BVAM

As mentioned in the previous sections, BVAM conducts a 'Professional Business Valuation Course,' which is organized jointly by the BVAM with the International Association of Certified Valuation Specialists (IACVS). Based on the information provided on the BVAM's website, the course has been conducted seven times since 2017. The latest was held from 9th to 11th October 2021.

4) IP or Technology Evaluation Training via the Enabling Innovation Environment (EIE) Program - Collaboration Program between the World Intellectual Property Organization (WIPO) and MyIPO

Since 2018, several workshops have been organized for local participants. The workshop emphasizes using the "Ten-Point Technology Scoring Template" (10-Point Score) in carrying out technology assessment (technology evaluation). The 10 Point Score is a method of assessment that needs to be performed at the initial stage of any technology creation process. The method was introduced by Dr. Richard Carhoon of Cornell University and Ashley Stevens of Boston University.

4.4.5. Other Countries

According to the analysis, currently other AMSs do not have training or education programs related to IP valuation.

4.4.6. Summary

Regarding IP valuation education program, only two countries have been developing and operating education program related to IP valuation among AMS.

In Singapore, several education programs were launched over the past few years to build a steady pipeline of IP professionals that can support the country's IP manpower needs. About seven national and public and private certification programs are currently in operation (5 public, 1 private) (see Table 1-18).

<Table 1-18> IP Valuation Education Programs in Singapore

No.	Program	Institution	Remarks
1	IP Valuation Course	Singapore Management University	2 days course with government subsidies available
2	Valuation: A Corporate Perspective	Singapore Management University	5 day course with government subsidies available
3	Monetizing Innovation: Valuation	Singapore University of Social Sciences	6 months course with government subsidies available
4	IP Valuation	IPOS International, IP Academy	2 days course with government subsidies available
5	Chartered Valuer and Appraiser Programme	Nanyang Technological University Singapore	6.5 days course (over a period of 3-4 months) with government subsidies available
6	IP & Patent Valuation (Certified Patent Valuation Analyst (CPVA)	IP Alpha	2 days course with no government subsidies

Source: Author, based on surveys and online interviews with local experts and government officials.

In Malaysia, even though there is no standard training module used by the organizations, there are a few organizations including MyIPO, RISM and BVAM that provide IP valuation training (see Table 1-19).

<Table 1-19> IP Valuation Education Program in Malaysia

No.	Program	Institution	Remarks
1	IP Valuation Training	MyIPO	One-time training programs for local IP valuers
2	Value Determination of Intangible Assets	RISM	3 days one-time course for 20 participants among members and non-members of RISM
3	Professional Business Valuation Course	BVAM with the International Association of Certified Valuation Specialists (IACVS)	Conducted 7 times since 2017
4	IP or Technology Evaluation Training via the Enabling Innovation Environment (EIE) Program	Collaboration Program between the World Intellectual Property Organization (WIPO) and MyIPO	Since 2018, several workshops have been organized for the local participants. The workshop emphasizes using the “Ten-Point Technology Scoring Template” (10-Point Score) in carrying out technology assessment (technology evaluation).

Source: Author, based on surveys and online interviews with local experts and government officials.

Other AMSs do not have training or education programs related to IP valuation.

5. Policy Recommendations

According to the analysis on the development status of IP valuation infrastructure in AMS, most of the valuations are concentrated on ‘technology business feasibility evaluation’ such as IP evaluation guarantee and venture company confirmation evaluation. The demand for IP valuation, which requires specialized IP expertise, is still low. In other words, the demand for technology business feasibility assessment exists mainly in the field of national policy projects, but IP value assessment is not activated due to the immaturity of the IP trading market and the inadequacy of social institutions. In this regard, this research team intends to study the method for efficient system operation through the establishment of infrastructure related to IP valuation. Several factors can be derived by analyzing the reasons why the AMS’s IP valuation market has remained in its infancy so far, but it has been condensed into four factors as follows.

First, legislation and operation of a dedicated organization are required. In developed countries, there are institutions that develop valuation tools or are exclusively responsible for IP valuation, and while public and private institutions are carrying out various corporate / IP valuation activities suitable for their respective roles, in the case of AMS, there is no dedicated valuation agency that specializes in IP evaluation, and almost no IP valuation activity is carried out at the private level. Therefore, in order to overcome these issues, considering that most IP valuation institutions are in the public sector, it is necessary to prepare a specialization plan suitable for the policy base through rational restructuring under the government's leadership, and it is time to review the plan comprehensively.

Second, it is necessary to create demand for IP valuation. Before the market entered the mature stage, a large number of valuation agencies were established, mainly public institutions, and quantitative expansion was achieved to some extent, but quality improvement has been insufficient. In other words, IP valuation in specialized fields is relatively insufficient and is applied only to certain fields with a focus on government-led suppliers. A plan will have to be devised.

Third, it is necessary to develop an IP valuation model. The current IP valuation system of ASEAN Member States lacks a standardized IP valuation model, and valuation is made based on each valuation institution's own know-how and different evaluation criteria points. Of course, there are bound to be differences in the positions and viewpoints of the company that requests the valuation, the institution that utilizes the result, and the institution that conducts the valuation, so a valuation method that satisfies all cannot actually exist. In some cases, an appropriate combination of external expert valuation and valuation by an expert group is performed. Therefore, if a standardized IP valuation model is developed/ introduced and operated for each field, fairness and reliability of valuation results can be secured, and it will be easy to update valuation criteria according to the times and environment. Furthermore, DB construction and the use of information will also be easy.

Fourth, education programs are to be developed. The lack of professional knowledge among the valuation personnel and the decrease in the reliability of valuation results due to evaluation based on subjective judgment can also be factors hindering the development of the IP valuation market. In order to solve this problem, it is necessary to develop a differentiated educational program for nurturing IP valuation experts, and as mentioned above, it is advisable to introduce a standardized objective valuation model. Mutual support on infrastructure and exchange system should be activated.

5.1. Necessary to Enact Legislation and Operate a Dedicated Organization to Revitalize IP Valuation

In order to vitalize IP valuation, it is necessary to work systematically towards a long-term policy rather than a short-term support policy.

First, if there is no control tower to operate the policy for IP valuation, it is necessary to designate a relevant organization or to integrate and operate multiple organizations as one (Ex. The formation of an 'IP Valuation Cooperation Group'). Through this, it will be possible to enjoy the synergistic effect of integrated operation by integrating IP valuation-related functions and concentrating the scattered IP valuation capabilities.

Second, initially, it is necessary to create public demand for IP valuation by measures such as expanding the targets of IP valuation, providing incentives for IP valuation, developing a manual for IP valuation, and developing an IP valuation curriculum. After that, private institutions must be encouraged to enter the market by providing various incentives such as financial support and cost support.

5.2. Measures to Increase the Demand for Technology Evaluation

In order to expand the IP valuation market, it is necessary to create demand for valuation. The direction of the method to expand the utilization of IP valuation is of great interest to domestic small and medium- sized enterprises (SMEs)/venture companies. This research will focus on 'financing', a crucial aspect, and seek ways to expand the IP valuation market in connection with financing. To do that, there are two proposals to increase the demand for IP valuation: 1) expanding the targets of IP valuation to the registration examination in the securities market and 2) expanding the financial support system for IP valuation.

5.2.1. Expanding the Targets of IP Valuation to the Registration Examination in the Securities Market

This research team proposes institutional arrangements to expand the scope of IP valuation in the registration examination of the securities market, which plays a very important role as a direct financial market for SMEs/venture companies. If the registration review function is strengthened as a result of the IP valuation of the companies requesting examination, it can revitalize the securities market by restoring investors' confidence in the registered companies. In order to do so, two detailed implementation plans are proposed.

As the first measure, IP valuation marketing activities for the Securities Commission, companies scheduled to request preliminary examination, and registered lead underwriters (security companies) should be strengthened to enhance the utilization of evaluation. In other words, for companies wishing to be registered, it is advisable to develop the advantages of using IP valuation- for example, secure specific measures such as granting additional points when examining registration in the stock market through IP valuation. In case of granting benefits, measures such as deduction of guarantee fee for companies using guarantee institutions and various linkage support measures should be established and promotional activities carried out.

The second is mid-to-long-term measures related to registration in the stock market, such as making it mandatory for companies claiming to be subject to IP valuation within the scope of current venture companies, or making it mandatory to issue certificates using the current ‘IP Valuation and Certification System’. It is necessary to promote the expansion of the targets of IP valuation continuously.

In addition, if IP valuation is conducted regularly and the valuation results are disclosed to strengthen follow-up management of companies that have undergone IP valuation, not only can investors’ trust in registered companies be secured, but the soundness of the securities market and the foundation of the IP valuation system can be strengthened. It is hoped that these measures will lay the foundation for enhancing simultaneous expansion.

5.2.2. Expanding the Financial Support System for IP Valuation

This research team proposes that the development of financial support systems and products be expanded through IP valuation as part of a plan to increase the utilization of IP valuation. For example, it is advisable to introduce 1) an ‘IP transaction evaluation guarantee’, a financial support product that links IP valuation and IP transfer, and 2) ‘IP valuation cost or expert support’ to provide support with part of IP valuation costs or services of valuation experts. In addition, various financial products linked to IP valuation should be developed continuously, and it is expected that the revitalization of the IP valuation system and the growth and development of SMEs/ venture companies will be carried out in parallel.

5.3. Measures to Develop and Advance the IP Valuation Model/ Manual

At present, the AMS 1) lacks standardized IP valuation models or 2) lacks development of various valuation models that reflect the characteristics of each country and each industrial technology.

Therefore, it is necessary to develop and improve the IP valuation model by discussing the model's utilization from various angles with the government, academia, and research institutes for the development and advancement of the IP valuation model. Through this, if a standardized IP valuation model is developed/introduced for each field and operated, fairness and reliability of the valuation result can be secured.

In addition, to improve the IP valuation model, it is proposed that a 'financial information DB for each industry and growth stage' of SMEs/venture companies be constructed and used for IP valuation. In addition, it is desirable to identify IP valuation items for each valuation institution and establish a government-wide DB to gather and organize information necessary for valuation.

5.4. Measures to Develop Education Program for Nurturing IP Valuation Experts

In order to enhance the quality of IP valuation, it is necessary to expand the market according to the enhanced utilization of IP valuation, to research and develop objective evaluation models, and to foster experts related to IP valuation.

Currently although some of AMS have developed and operated IP valuation specialist training courses, the operating institutions or programs are not institutionalized or standardized, and there are difficulties in nurturing experts because an objective valuation model has not been developed. Therefore, the following are necessary: 1) designate an institution for nurturing experts related to IP valuation, 2) develop and operate a standardized curriculum, and 3) the curriculum may later be converted into a nationally/ private accredited certification program. However, the integration of the qualification system is not easy due to conflicts of interest among institutions and the policy direction of the relevant ministries.

In addition, as a mid/long-term task, the curriculum for nurturing IP valuation experts should be expanded/installed at financial training institutes, universities, and graduate schools to practice the plan for the development of the IP valuation qualification system. The curriculum must be designed to nurture specialized "IP valuation analysts" along with analysts specializing in securities analysis, centered on professionals who have acquired IP valuation qualifications. The trained experts should have the capabilities to analyze the prospects of the IPs possessed by venture companies registered in the stock market, and analyze the economic value of IP for IP transfer, etc. It is suggested that efforts should be made concurrently with the strategic expansion of the IP valuation system by investing in various specialized fields.

5.5. Limitations and Future Challenges

There are limitations to this research related to the proposal of a plan for revitalization of the IP valuation system revitalization and review of future tasks. First, in relation to the measures presented in this study, the limitations of the law amendment procedure for each AMS, differences in policy directions among related government ministries, difficulties in securing government finances and financial resources, and conflicts of interest among each institution could not be investigated thoroughly when presenting the policy proposal. One point that has not been taken into account is the view that developmental alternatives for system improvement should be researched continuously at the pan-government level, taking advantage of the purpose of promoting the efficiency of supporting SMEs/venture businesses through the activation of the IP valuation system.

Second, during the review of the development and advancement of the IP valuation model, an empirical analysis of the IP valuation linked with financial information was not conducted in parallel, so the reliability of the proposal is insufficient. Therefore, it is emphasized that multi-faceted research is needed to advance the valuation model in the future.

Thirdly, this research team has had limitations in accessing details of the IP valuation infrastructure in AMS in that it had to rely entirely on surveys and interviews with local experts and practitioners due to data limitations and language barriers. Therefore, additional verification of the collected data and additional investigation into countries for which this research team did not collect information are needed.

Lastly, due to COVID-19, the business report meeting, fact-finding survey, and training for policy officers were conducted only through the online mode. In the future, it is necessary to implement additional projects, such as conducting a field survey on the establishment of IP valuation infrastructure in each country through a visit program to each major country's

IP valuation institutions. In addition, it is necessary to develop a program to invite those in charge of IP valuation of each AMS to Korea to provide training, such as introducing Korea's IP valuation status, visiting related institutions, and providing basic education. It is also necessary to develop additional projects so that it can lead to practical results such as joint research on improvement and advancement of the IP valuation methods or licensing of IP valuation platforms and so on.

6. Conclusion

Intellectual Property (IP) as an intangible asset has had limitations in its value compared to tangible assets due to its rapid development and the high uncertainty surrounding IP. It is true that it has been difficult to expand and develop a business based on technology. The concept of IP evaluation (IP evaluation and valuation), encompasses IP evaluation, which allows those who possess IP to capitalize on it, and IP valuation, which evaluates the economic value of the IP itself. The former can express the value of the IP as a grade score, and the latter can be expressed as a value. The scope of application of IP valuation is very wide, ranging from IP transfer transactions to investment in kind, establishment of security rights, calculation of liquidation value upon corporate restructuring, and calculation of damages in case of IP disputes or litigation.

In this study, the current status of IP valuation infrastructure in Korea and ASEAN Member States (AMS) was identified through literature reviews, expert surveys, interviews, and fact-finding. Through this, our research team intended to suggest a plan for the establishment and development of IP valuation infrastructure in AMS. The current development status of the IP valuation infrastructures in Korea and AMS were analyzed under four categories (laws/policy, organization, system and education). After that, based on results of the above analysis, policy measures for the successful establishment of IP valuation infrastructure and activation of IP valuation in AMS are presented as follows.

First, it is necessary to come up with a reasonable plan for 'structuring the IP valuation institution'. This is a plan to integrate / operate functions related to IP valuation temporarily by forming a single valuation organization, the 'IP valuation Cooperation Group' for major public IP valuation institutions. In the future, when the IP valuation market enters the mature stage, it is desirable to disband the organization and introduce a competition system based on market principles. In addition, if the formation of the 'IP valuation Cooperation Group' is difficult for various reasons, as an alternative, an entity tentatively named 'IP Valuation Cooperation Network' that promotes a strong cooperative system among IP valuation-related institutions may be formed to expand IP valuation-related information sharing. Both proposals have differences in operation as measures to develop the current IP valuation market, which is in an immature state; however, the purpose of maximizing synergy effects by concentrating the scattered IP valuation functions through a cooperative structure is the same.

Second, 'plans to increase the utilization of IP valuation' should be devised. The study focused on 'financing' and presented step-by-step directions to 'expand the target of technology evaluation during the registration examination in the stock market' and strengthen the IP valuation system by enhancing the utilization of IP valuation and selecting high-quality companies. These measures are intended to lay the foundation for the soundness of the stock market. In addition, while researching 'expansion of the financial support system and product development through IP valuation' with a focus on the IP valuation guarantee support system, the study proposes guidelines to establish an IP valuation guarantee support system for each growth stage.

Third, continuous efforts are needed for 'improving and advancing the IP valuation model'. As a research direction for the improvement of the IP valuation model, it is advisable to build a 'financial information DB by industry / growth stage' of SMEs and venture companies and use them for IP valuation. The procedure for DB construction and examples of construction and application methods are presented.

Fourth, a plan for 'nurturing IP valuation experts' is required. Based on review, the direction for fostering is to centralize the functions by unifying the scattered IP valuation qualification system, and to promote the nationally recognized qualification system. Plans to improve expert training, such as nurturing IP valuation analysts and introducing a real-name IP valuation system, and mid / long- term action tasks are suggested.

This study comprehensively reviewed the measures to revitalize the IP valuation system of AMS, and create an environment in which the IP valuation market and system operation of AMS can develop into a more mature state and SMEs/venture companies with excellent IP can grow. IP valuation agencies and related government ministries should work together to prepare effective and reasonable measures in this direction.

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Appendix

List of Participants

1. Korean Side

#	Name	Affiliation	Position
1	Tae-Keun RHEE	Korea Institute of Patent Information (KIPI)	Former CEO
2	Kyoungdoug KWON	Korea Development Institute (KDI), Division of Policy Consultation	Director
3	Seung Hyun KIM	Korea Development Institute (KDI)	Senior Research Associate
4	Tae-Eung SUNG	Yonsei University	Professor
5	Eungdo KIM	Chungbuk National University	Professor
6	Jongtaik LEE	Korea Institute of Science & Technology Information	Principal Researcher

2. ASEAN Secretariat

#	Name	Affiliation	Position
1	LOOI Teck Kheong	ASEAN Secretariat, Competition, Consumer Protection and IPR Division (CCPID)	Head
2	MASLINA Malik	ASEAN Secretariat	Senior Officer – IPR
3	FIKA Hakim	ASEAN Secretariat	Officer - IPR
4	NUGRA Febrian Pramuda	ASEAN Secretariat	Officer - IPR

3. Local Experts

#	Name (Country)	Affiliation	Position
1	Mitchel Chua (Singapore)	BYTEDANCE	Manager
2	Mary Jade Roxas (Philippines)	PwC	Managing Partner
3	Ikhwan Bakri (Malaysia)	-	IP Consultant
4	Alan Adcock (Thailand)	Tilleke & Gibbins	Director

02
CHAPTER

Introduction to IP Valuation in Korea and Its Current Status

Tae-Eung Sung (Yonsei University)

1. Introduction
2. Current Status of IP Valuation in Korea
3. IP Valuation Models and Web-based IP Valuation System in Korea
4. Current Status of IP Valuation in Four Countries of ASEAN Member States
5. Conclusion and Policy Recommendations

Keywords
IP Valuation, Discounted Cash Flow (DCF) Model, Relief-from-Royalty (RR) Model, Web-based IP Valuation System, Reference Information Database

Introduction to IP Valuation in Korea and Its Current Status

Tae-Eung Sung (Yonsei University)

Summary

As part of the international development cooperation projects within the 2021/22 Knowledge Sharing Program (KSP) set up by KDI, this study conducted by Korean researchers and ASEAN Member States under the title of "IP Valuation Best Practices for ASEAN Member States" is intended to provide the ASEAN countries and administration with best practices for IP valuation and strategies and policy recommendations for feasible establishment of IP valuation infrastructure. The ultimate goal is to equip micro- and small and medium-sized enterprises (MSMES) with stronger innovation capacity in IP valuation models and framework and thereby enhance their competitiveness.

ASEAN Member States (AMS) are deeply interested in strengthening cooperation on IP rights among those countries according to AEC Blueprint 2025. AMS wish to promote commercialization of IP and inter-agency coordination in the IP rights market, in line with the expanding awareness of the necessity of IP valuation support programs or relevant infrastructures to assist SMEs or startups with IP consultancy services.

Our research group, with in-depth expertise in IP valuation theory, models, and best practices, aims to expand awareness of AMS regarding the importance of IP valuation, by introducing IP valuation models and the web-based valuation systems in Korea. Furthermore, we intend to demonstrate the value of IPR as financial assets and present methods to apply valuation results to the fields of commercialization with various goals (e. g. IP transfers, financial loans). We will support the officers in charge of IP valuation and commercialization in AMS and provide substantial mentoring to establish and/or customize the IP valuation framework best suitable for their current situations in ASEAN IP markets.

Over the last couple of years, we have been experiencing unprecedented economic

recession and unavoidable setbacks due to the spread of COVID-19 and the emergence of new virus variants. Amid the devastation, we realize the significance of developing new, disruptive IP or technology than ever so that we could find a way out from the global crisis that obstructs the survival or growth of businesses worldwide. Therefore, it is imperative that startups in the early stage or on-going companies retrieve novel ideas for technology innovation and develop value addition strategies for business development towards the next round.

To bring a certain level of business profitability to a technology-based firm, the CEO or the top management of the firm needs to decide which business model will be best appropriate, e.g., whether to make profits by IP transfer or directly commercialize goods or merchandise implemented by the firm's own efforts from the R&D stage to the production and distribution stages. The government-led finance support programs for technology transaction and IP guarantee/collateral have been making positive effects, which have been found to be much effective for small-and-medium firms and startups, etc. in Korea.

However, the excessively long time and excessive cost for completing the valuation of a technology make it difficult for IP owners or a firm to get direct benefit in a timely manner for commercialization outcomes, since the valuation process takes normally 8 to 12 weeks and requires the fee of about 1,500 USD or so. In addition, in order to be eligible to practice as IP valuators, potential valuators should pass a series of written tests and hold a non-public certificate issued by KVA. They should fully understand how the valuation models are processed and how each variable for IP valuation is determined with metadata or reference information, and then complete a practitioner course for being equipped with the practical ability and knowhow to provide commercialization support in the industry fields.

To make the IP valuation environment easier and accessible through the web-based valuation system and associated databases, public institutions such as Korea Technology Finance Corporation (KIBO), Korea Invention Promotion Association (KIPA) and Korea Institute of Science and Technology Information (KISTI) have developed their own unique software for either IP valuation or evaluation. In order, KIBO, KIPA and KISTI operate KPAS (AI-based patent valuation system), SMART (IP-rating system), and STAR-Value (patent- and financial data-based valuation system), where each is utilized distinctly for applicable purposes. When each was released officially, the users or IP consultants welcomed those as auxiliary assessment tools in that each expedites fast-track online valuation/evaluation. However, there exists a limitation that a large volume of input data is required, and the valuator should fully understand the technological characteristics and business circumstances of an IP.

As of August 2022, totally 31 institutions and firms are certified by Korea Institute for Advancement of Technology (KIAT) and in 2021, about 3,400 cases were valuated by both public and private valuation institutions/firms. It is known that the number of valuation cases have been growing steadily for the past three or four years. In terms of law/policy regarding the IP Valuation Act, web-based system and databases, training programs (for fostering IP consultants), practices/valuation reports or templates, the current position of Korean IP valuation is placed at the developed or matured stage world-wide. We will delve into the detailed explanation regarding law/policy, training, and cases studies of IP valuation in the preceding or following chapters, and investigate the web-based infra and valuation models that are mainly in use.

Lastly, we will introduce Korean leading web-based valuation systems (STAR-Value, KPAS) and the various types of reference information databases. Further, we will describe both the structures and features of the web-based services and the utilization cases for business development in Korea. In addition, we will provide an analysis of IP valuation situations of four AMS countries (Singapore, Philippines, Thailand, and Malaysia), based on the data and information collected by local field specialists or consultants. We will also perform mentoring and provide directions to establish the support infrastructure or framework for IP valuation that is the best fit for each country's IP market status, if necessary, after receiving feedback from AMS regarding the issues where support is desired. Alternatively, we will propose ways to import the Korean IP valuation framework and utilization practices for future benchmarks. Further, we would move toward assisting the other ASEAN countries besides the four above, if we are able to develop guiding strategies and comments in establishing an IP valuation framework and transferring practices and knowhow for countries such as Viet Nam, Cambodia, Indonesia, etc.

1. Introduction

To strengthen cooperation and consultancy ability on Intellectual Property (IP) rights among ASEAN Member States (AMS), we would like to introduce Korea's IP valuation systems and support programs induced by Korean government ministries, and share information on the status of IP valuation utilization in the private sector in Korea. In addition, various utilization purposes and major models (Income approach, Relief-from-Royalty method) of IP valuation used in Korea will be introduced, and both the IP valuation model or methodology and web-based IP valuation infrastructure of major ASEAN partners will be analyzed. Finally, throughout the introduction of the web-based IP valuation system used in Korea, we analyze the possibility of whether each country in AMS can import or customize the system, and draw the implications regarding its application strategies.

1.1. Background and Purpose of Research

The ASEAN Economic Community Blueprint 2025 (AEC Blueprint 2025) emphasizes that for the strengthening of cooperation in the area of intellectual property rights among ASEAN Member Countries (AMS), it is essential to promote the commercialization and linkage of the intellectual property market. In addition, the ASEAN IPR Action Plan 2016-2025 intends to provide intellectual property valuation services or relevant infrastructures to raise the value and awareness of intellectual property rights as financial assets.

By analyzing the Korean IP valuation models and understanding the extent to which IP valuation is applied to commercialization outcomes, ASEAN member states could recognize the significance of IP valuation and derive practical application strategies or plans so that they can be used as potential tools to participate and compete in IP-based business and as a support infrastructure for the promotion of IP-initiated business development.

1.2. Composition of Research

This study analyzes and introduces Korea's IP valuation status, valuation models, and web-based valuation system that major ASEAN partner countries can refer to or customize suitably for each country's status. It includes the purpose of IP valuation and its utilization, major valuation techniques and key variables, reference information DB, and description on a web-based IP valuation system in use.

Next, based on the results of the data/information survey and analysis by local experts, the status of IP valuation models and infrastructures in major ASEAN partner countries is identified, and the possibility of introducing Korean IP valuation infrastructure is analyzed. Data research and analysis support to date have been focused on efforts to understand the use of IP valuation models in the four ASEAN countries (Singapore, Philippines, Thailand, and Malaysia) and we would be able to help establish the support directions by identifying whether the four countries have a web-based evaluation system.

Subjects and the scope of the analysis are not limited to the above. We also investigated fundamental IP valuation models and the associated key factors applied to valuation cases in Korea, and further examined what the IP valuation programs in AMS cover within the extensive fields of valuation applications such as IP transfer, investment, loans and IP guarantee/collateral.

We will delve into methods to assist AMS with establishing the support infrastructure or framework for IP valuation best fit for each country's IP market status, if necessary, after receiving feedback from AMS regarding the areas in which support is desired, or propose ways to import the Korean IP valuation framework and utilization practices for future benchmarks.

2. Current Status of IP Valuation in Korea

2.1. Purpose and Valuation Agency in Charge of IP Valuation

2.1.1. Purpose of IP Valuation

In general, in the process of technology commercialization, the importance of IP valuation, which can evaluate the economic utility value of IP fairly for the promotion of technology transfer, transaction, investment-in-kind, and investment/loan, guarantee/collateral, is increasing day by day. In providing IP finance support for technology innovation-focused SMEs, the government policy to utilize IP valuation is finding wider acceptance.

IP Valuation is a type of technology evaluation that evaluates the economic value created by one or more converged IPs for commercialization, based on the valuation principles and methodologies accepted in the IP-related market. It follows the operational guidelines for technology evaluation standards that the Korean Ministry of Trade, Industry and Energy (MOTIE) regulated and officially released in February 2021.

Since the value of IP as a valuation subject is not objective or absolute, it must be estimated by applying an appropriate valuation method depending on the purpose or situation of the valuation. Currently, IP valuation is being conducted domestically in Korea for various purposes and uses, such as IP transactions, investment-in-kind, finances (investment, loan, guarantee, collateral, etc.), and establishment of strategy, taxation, litigation, and liquidation.

<Table 2-1> Purpose and Utilization of IP Valuation

Valuation Purpose	Utilization
IP transactions	Buying and selling IPs, determining the pricing of a license
Investment-in-kind	Capitalization of IPs (for establishment of a corporation)
Finances (investment, loan, guarantee, collateral, etc.)	Setting up a security right or attracting investment
Establishment of strategy	Enhancement of enterprise value, commercialization of IP or technology, spin-off, establishment of long-term strategic management plans
Taxation	Tax planning and tax payment for IP donation, disposal and amortization
Litigation	Litigation related to intellectual property infringement, default, and other disputes
Liquidation	Corporate bankruptcy, asset evaluation by restructuring, establishment of debt repayment plan
Etc.	Special listing

Source: MOTIE/KIAT (2021).

2.1.2. Valuation Agencies

To enhance and revitalize the professionalism of IP valuation, Korea has annually designated specialized IP valuation institutions since early 2000s and ensures that IP or technology valuation with public confidence is conducted through these specialized institutions. In Korea, IP or technology valuation institutions are mostly designated based on the Act on the Promotion of Technology Transfer and Commercialization (hereinafter referred to as the ‘Promotion Act’)’, the ’Venture Act’ for the promotion of venture businesses, and the ‘Invention Promotion Act’. In other words, each IP or technology valuation institution is designated and established based on one of the three acts or more, as marked by ‘O’ in <Table 2-2>.

First, the ‘Promotion Act’ aims to promote the transfer or licensing of technologies developed in public research institutes and to establish support policies or regulations associated with companies or organizations in private sector such that technology commercialization is accelerated, and the technological competitiveness of national economy is enhanced further.

Next, the ‘Venture Act’ is enacted to facilitate the smooth restructuring of industry and to promote the firm type conversion of the existing companies towards venture companies so that they are eligible for more benefits given to venture companies.

The ‘Invention Promotion Act’ is enacted to enhance companies’ awareness regarding the significance of inventions and associated intellectual property rights, and to promote various types of commercialization such as IP transfers, licenses, IP finances or investment from inventions.

As of April 2022, IP or technology valuations are currently being conducted by 39 certified valuation institutions in Korea. Strictly speaking, the number includes the institutions that only perform IP evaluation for assessing the corporate technology ability. Hence, we will limit the number to 31 certified institutions that primarily conduct the quantitative valuation of IPs.

<Table 2-2> Current Status of IP Valuation Institutions

No.	Institutions	Promotion Act	Venture Act	Invention Promotion Act
1	Defense Agency for Technology and Quality	○		
2	Korea Technology Finance Corporation	○	○	○
3	Korea Agriculture Technology Promotion Agency	○		○
4	Korea Electronics Technology Institute	○		
5	Korea SMEs and Startups Agency	○		
6	Korea Institute of Science and Technology Information	○	○	○
7	Korea Invention Promotion Association	○		○
8	Korea Health Industry Development Institute	○		
9	Korea Institute for Advancement of Technology	○	○	○
10	Korea Development Bank	○		○
11	Korean Agency for Technology and Standards		○	
12	National IT Industry Promotion Agency		○	
13	Korea Institute of Science and Technology	○	○	
14	Korea Evaluation Institute of Industrial Technology		○	
15	Korea Environment Corporation		○	
16	Korea Conformity Laboratories			○
17	Korea Testing Certification Institute			○
18	Korea Testing Laboratory			○
19	Korea Testing & Research Institute			○
20	Korea Agency for Infrastructure Technology Advancement	○		
21	Korea Credit Guarantee Fund	○	○	○
22	Korea Innovation Foundation	○		

<Table 2-2> Continued

No.	Institutions	Promotion Act	Venture Act	Invention Promotion Act
23	Korea Institute of Machinery & Materials	○		
24	Electronics and Telecommunications Research Institute	○		
25	Korea Institute of Industrial Technology	○		
26	Korea Research Institute of Bioscience and Biotechnology	○		
27	Korea Institute of Marine Science & Technology Promotion	○		
28	Knowledge & Tech Group	○		○
29	T-Value	○		
30	WIPS Corporation	○		○
31	E-credible	○		○
32	Darae Law & IP Group	○		○
33	Dana Patent Law Firm	○		○
34	Dodam IP Law Firm	○		○
35	KoDATA	○		○
36	NICE Dun & Bradstreet	○		○
37	NICE Information Services	○		○
38	Korea Institute of Energy Technology Evaluation and Planning	○		
39	YOU ME Patent & Law Firm	○		
Total		31	9	20

Source: Compiled by the author from the collected data.

To help stakeholders understand the application of standardized IP valuation models and variables, 'Technology Valuation Manuals' by the Ministry of Trade, Industry and Energy, and 'IP Valuation Practical Guidelines' by Korea Invention Promotion Association have been officially released and utilized. In addition, the IP valuation Quality-of-Control (QoC) Management Committee is annually held based on the 'Promotion Act' to enhance the quality of IP valuation outcomes. Each valuation agency above has its own distinct valuation models and infrastructure, and their characteristics are as follows.

- (Defense Agency for Technology and Quality) In the first stage, expert evaluation is conducted using Delphi technique, AHP, and peer review; in the second stage, the Defense Agency evaluates the factors of depreciation or decreasing of the value using Net Present Value (NPV) and then calculates the final value of IP.
- (Korea Technology Finance Corporation) It has an influential evaluation method, referred to as AiRATE (AI-based KTRS), with a novel technology rating methodology

that uses algorithms to assess the high-growth and risk prospects of technology-based business. Its calculation process is based on advanced regression technologies, such as AI and big data analysis that consider check-listed components of tech-based business, internal-external factors around corporates and data accumulated over 15 years of statistical evaluation.

- (Korea SMEs and Startups Agency) Using the Analytic Hierarchy Process (AHP) technology feasibility evaluation model, the evaluators' judgments are segmented into grades.
- (Korea Institute of Science and Technology Information) The Institute uses the KISTI model, which consists of three steps, including the analysis of market and cost structure, the estimation of an IP or technology's contribution profit, and the estimation of IP or technology value through profit volatility analysis, and the DCF model that utilizes the Net Present Value (NPV) of future cash flows growth, multiplied by the adjustment factor of IP or technology factor (T.F.).
- (Korea Invention Promotion Association) After selecting and extracting useful elements for patent evaluation using patent information, results of natural language processing, key words, and similar patents, the weight coefficient for each evaluation element generated by the machine learning algorithm is obtained, and through this, an automatic evaluation score is graded, and the relative evaluation rating is visualized.
- (Korea Health Industry Development Institute) An evaluation committee, made up of experts from each side of industry, academia, and research institutes, evaluates IP or technology through an online/offline evaluation system. Evaluation is conducted considering the stability of IP or technology rights, progress of technology) and marketability (marketability, promise, and profitability of technology).
- (Korea Agriculture Technology Promotion Agency) The Agency has been using the 'Technology Evaluation Model for Supporting Commercialization of Excellent Technology', developed by Korea Agriculture Technology Promotion Agency and Korea Invention Promotion Association. It is based on totally 21 items for evaluation in four areas, viz. technology management ability (three items), technology characteristics (seven items), marketability (six items), and business feasibility (five items).

In addition, each of the government agencies or private firms mentioned above has been conducting either profitable or non-profitable programs for IP valuation practices and businesses suitable for their unique research fields or institutional program purposes.

As of August 2022, according to Korea Institute for Advancement of Technology (KIAT), about 3,400 cases were valuated by both public and private valuation institutions/firms. It is known that the number of valuation cases has been growing steadily for the past three or four years. In terms of law/policy regarding the IP Valuation Act, web-based system and databases, training programs (for fostering IP consultants), practices/valuation reports or templates, the level of Korean IP valuation infrastructure is positioned at the developed or matured stage. We will delve into the detailed explanation regarding law/policy, training and case studies of IP valuation in the preceding or following chapters, and investigate the web-based infrastructure and valuation models mainly in use.

2.2. Diffusion towards Private Fields of IP Valuation

2.2.1. Korea Valuation Association

The Korea Valuation Association (KVA) was established in 2000 for the purpose of contributing to scientific technology and industrial development, including the training of IP valuation experts in the private sector. The Association performs various functions including the establishment of internationally compatible valuation standards, case analysis and research related to valuation, provision of training related to valuation, and training and management of corporate and technology appraisers, and is a Charter Member of the International Valuation Association (IACVA) in Korea, etc. Its history is as follows:

- Registered as a private valuation training association under the Ministry of Commerce, Industry and Energy, and started regular training programs on technology valuation in 2000
- Published the corporate technology valuation criteria 2000 in 2001
- Joined IACVA (International Association for Valuation Association) and started CVA training programs, and developed fundamental models for IP/technology valuation by industry in 2002
- Proposed the introduction of IFRS and strategies for the application of valuation in 2010
- Completed coaching of about 5,500 trainees for IP/technology valuation as of March 2022

2.2.2. Korea Association for Intellectual Property Services

The Korea Association for Intellectual Property Services has recently pushed ahead with the establishment of a private qualification system for IP value appraisers. The Association has initiated system improvement activities such as proposing legal amendments based on the judgment that the current law acts as a monopoly ground for IP evaluation by patent attorneys and appraisers. The IP Service Association applied for the establishment of a private qualification system to the Vocational Competency Development Center in August 2019. At that time, when the Vocational Competency Development Institute requested the Korean Intellectual Property Office for opinions on the establishment of qualifications, the Korean Intellectual Property Office responded that it was impossible to register private qualifications.

At that time, the Korean Intellectual Property Office interpreted that, based on Article 2 of the Patent Attorney Act, the job of an IP value appraiser overlapped with that of a patent attorney, and this was an area where the establishment of private licenses was prohibited.

The Legislative Investigation Agency suggested a plan for improvement of intellectual property valuation, such as the enforcement of IP valuation qualifications, in relation to issues arising from disputes due to differences in the positions of ministries and stakeholders. It is expected to affect the revision of related laws and the establishment of government policies. An official from the IP Service Association pointed out that the reliability and professionalism of IP valuation is ultimately predicated on the improvement of the expert's ability to perform it.

Besides the two associations mentioned above, the Ministry of Trade, Industry and Energy (MOTIE) has been enacting laws and regulations for IP valuation while designating IP valuation agencies annually, and the Korean Intellectual Property Office (KIPO) has been launching or assisting multiple IP valuation and commercialization programs for promoting the growth of on-going SMEs and startups in the initial stage in Korea.

3. IP Valuation Models and Web-based IP Valuation System in Korea

3.1. IP Valuation Models in Korea

IP or technology valuation is an in-depth analysis of an IP or technology to represent its economic value as monetary amount by applying one of income-, market-, or cost-based approaches. Out of the three valuation approaches, income approach for the Discounted Cash Flow (DCF) method and market approach for Relief-from-Royalty (RR) method are utilized for most IP valuation cases; thus, we mainly intend to explain these two models, the primary variables (economic lifespan, sales estimates, discount rate, IP/technology contribution and royalty rates) applied in these models and the overall procedure for IP valuation.

3.1.1. Income Approach

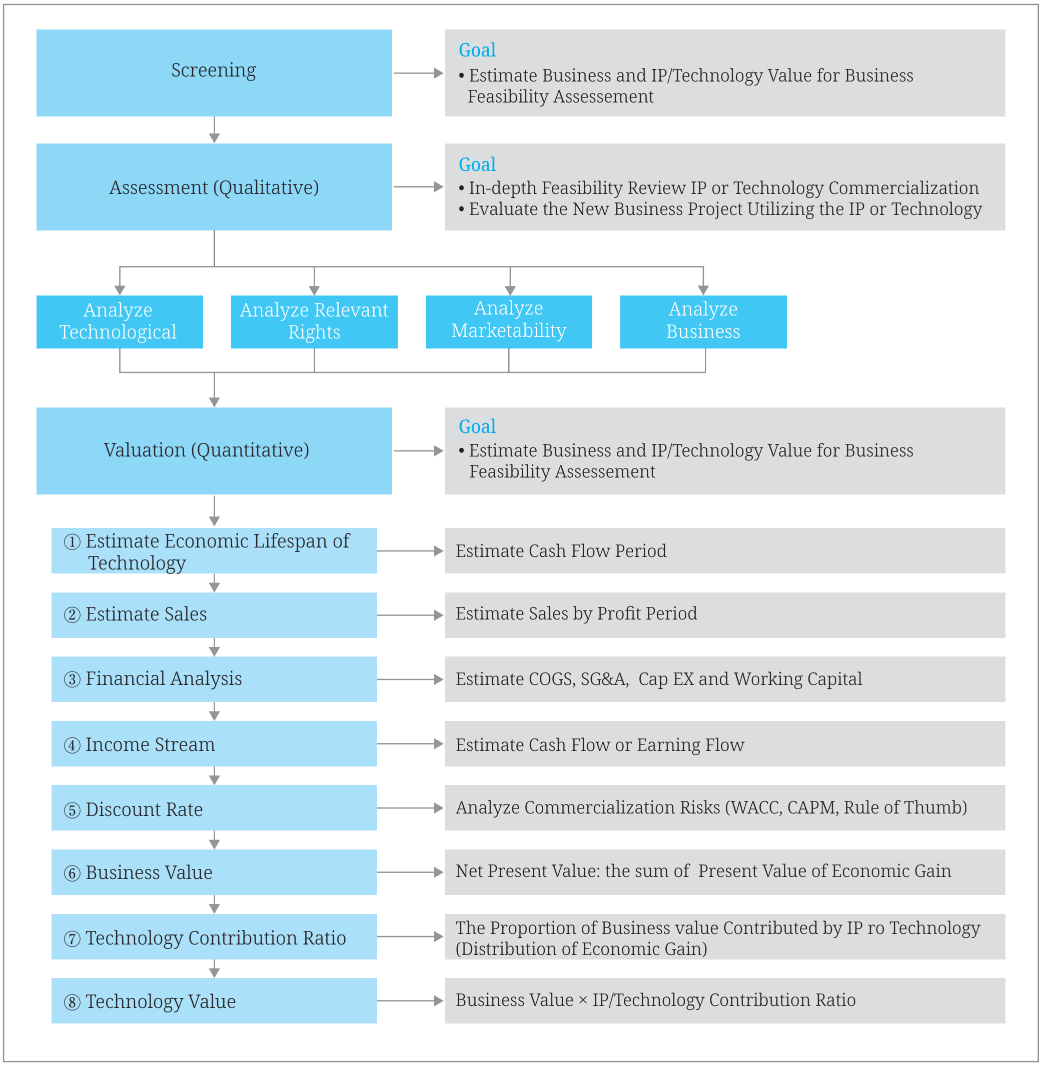
The income approach calculates the market value of an IP or technology by first estimating cash flow from the IP or technology during its economic lifespan, and then converting the cash flow into the present value by applying discount rate and lastly weighing the IP or technology's contribution to cash flows. The income approach requires financial information such as estimated sales, estimated operating profit or net profit, investment amount, depreciation cost, and working capital, followed by free cash flows and its discounted present values.

Valuation based on the income approach starts with estimation of sales from IP or technology commercialization, which requires input from the client seeking valuation. Provided that a reasonable way is available to distinguish the subject IP or technology from others, the incremental revenue approach may also be used.

The income approach is a highly logical and systematic valuation method that requires clear and objective basis in estimating the economic factors used for valuation. The main economic factors estimated under the approach include the IP or technology's economic lifespan (period of cash flow), earnings flow (market size, sale, cost, capital expenditure, net working capital, etc.), discount rate based on business risk analysis and IP or technology contribution ratio. Other approaches also call for the estimation of similar factors, but the income approach requires the largest number of factors to be analyzed and a particularly close study of each factor.

The income approach focuses on future profits expected from the subject technology and converts it into present value. The process requires estimation of future profits from the subject IP or technology, duration of cash flow, working capital expenditure, cost structure, discount rate, and IP or technology contribution ratio.

[Figure 2-1] Income Approach Flowchart for IP Valuation



Source: MOTIE/KIAT (2021).

As a representative technique of the income approach, we introduce Discounted Cash Flow (DCF) model. DCF model is by far the most widely used company valuation method. The model estimates cash flow for a set period and applies discount to it to derive a present value with risk factors. The same model can be applied in IP or technology valuation by discounting cash flow expected from a subject IP or technology to determine business value and adjusting it with the IP or technology contribution ratio.

In other words, the DCF model calculates IP or technology value as the present value of Free Cash Flow (FCF) during the subject IP or technology's expected economic lifespan multiplied by Technology Factor (TF). The basic formula is as follows:

$$V=\sum_{t=1}^{T}\frac{FCF_t}{(1+r)^t}\times T.F.$$	V : IP or Technology value T : Profit period (IP or technology's economic lifespan) r : Discount rate $T.F$: Technology Factor (IP or technology contribution ration)

Free Cash Flow (FCF) is equal to Net Operating Profit After Tax (NOPAT) and depreciation of less capital expenditure and the net change in working capital.

CapEx: Capital Expenditure
COGS: Cost of Goods Sold
SC&A: Seling, General and Administrative Expenses

- FCF_t = NOPAT + Depreciation cost - CapEx - Net change in working capital
  (NOPAT: Sales - COGS - SG&A - Income Tax)
- Depreciation cost: (Depreciation in SG&A and Amortization) + (Depreciation on the Schedule of Cost of Goods Manufactrured)
- CapEx: Net change in Tangible and Intangible Asset + Depreciation
  → Residual value is to be recovered at the end of technology's economic lifespan.
- Net Change in Working Capital: Net change in (Accounts Receivable + Inventories - Accounts Payable)
  → To be recovered in full at the end of technology's economic lifespan.

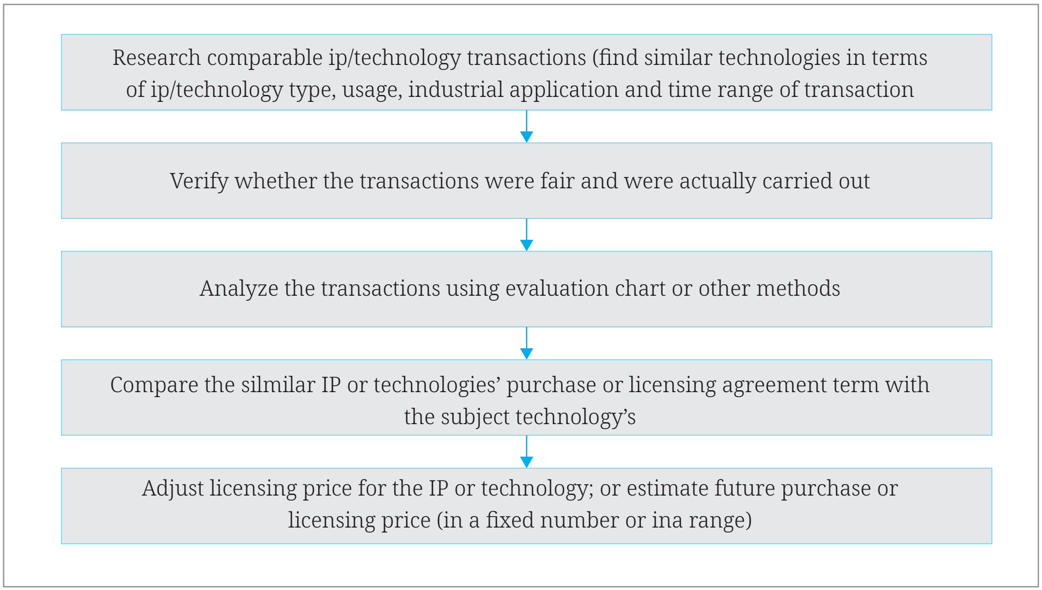
Cash flow can be estimated largely in three ways. It is possible to (1) enter associated values directly that best suit the business plan of the commercialization entity; (2) estimate cash flow using financial information of similar companies; or (3) do so using financial information of similar industries. Both (2) and (3) are useful when some or all the figures affecting cash flow are not available because the subject technology is in its initial stage, or the commercialization entity does not have appropriate financial or business records as is common with startups within three years or so after the launch of the business.

3.1.2. Market Approach

The market approach compares and analyzes the data and statistics on similar or comparable IPs or technologies transacted in the market to estimate an IP or technology's value. The estimation must be adjusted properly for differences with the subject IP or technology.

Generally, it is recommended that the market approach be applied first because it is the market that provides best evidence of fair transactions between independent parties and therefore best reflects the value of IP or technologies. A careful study of sales and licensing records relevant to the subject IP or technology is needed for credible valuation.

[Figure 2-2] Market Approach Flowchart for IP Valuation



Source: MOTIE/KIAT (2021), reorganized.

As a representative of market approach, we introduce Relief-from-Royalty method, often referred to as the Royalty Payment Saved model. It first estimates the saved royalty amount that would otherwise have been incurred if the subject IP or technology's owner had to obtain license from a third party. It then converts the amount into the present value. The model requires a certain number of comparable license agreements in the market. Alternatively, data on royalty rates by industry or rates from customary market practices may be used (MOTIE Operating Instruction, Article 40). Royalty rates in license agreements over comparable investment risks and profitability is used to estimate the subject technology's value. The model is also viewed as an income approach-based model because it converts the flow of royalty income, expected during the IP or technology's economic lifespan, into the present value.

The model estimates IP or technology value based on royalty rates for the compared IP or technologies, which means that the selected licensing deals must be comparable to that of the subject IP or technology in terms of investment risks and profitability. The model then multiplies estimated sales from the IP or technology during its economic lifespan by royalty rate. The result is the estimated royalty amount that would be incurred in case the business had to purchase a license for the subject IP or technology.

[Figure 2-3] Royalty Payment Saved Flowchart for IP Valuation

Analyze economic value of IP or technology (technological features, marketability, business prospect)

↓

Research agreements on IP or technologies similar to the subject IP or technology

↓

Evaluate the current situation of the industry and relevant markets and their future prospects

↓

Estimate economic lifespan of the IP or technology as well as its sales and royalty rate

↓

Estimate discount rate and calculate adjusted IP or technology value

Source: MOTIE/KIAT (2021), reorganized.

The estimated amount is the amount of royalty cost saved by acquiring the title for the subject IP or technology. Its present value may be viewed as the IP or technology's value. The model requires assurance that the IP or technology will generate profit as a precondition. Here the user may apply the royalty payment methods used in the reference licensing agreements of similar IPs or technologies (e.g., x % of sales, x % of gross profit). In case the volume of sales is used, apply the below formula.

IP or Technology value = Present value of (sales x royalty rateof compared IP or technologies x (share of IP or technology) x adjustment factor x commercializstion cost factor x (1 - tax rate))

Source: MOTIE/KIAT (2021), reorganized.

3.2. Web-based IP Valuation System in Korea

3.2.1. Overview of the STAR-Value System

In Korea, systematic infrastructure is required to evaluate the economic value of an IP or technology to date. The utilization of IP valuation results is essential to facilitate technology or IP-based commercialization through IP/technology transfer, investment in kind, IP- or technology-based financing, M&A, venture investment, etc. IP valuation also assists the decision making of either the top management or researchers by providing objective information on numerical values of IPs or technologies.

Therefore, Korea recognizes the necessity of web-based IP valuation infrastructures, and the KISTI STAR-Value system is currently in use for over 39 institutions (universities, government-supported research institutions, business firms, etc.), and corporations in Korea, leading to fast-track valuation for more than 2,000 cases annually.

It utilizes reference databases (DBs) such as patent information, remaining useful life of the IP or technology, the firm's financial statement or profitability data, discount rate (required rate of return), technology licensing cases, etc.

3.2.2. DCF Model of STAR-Value System

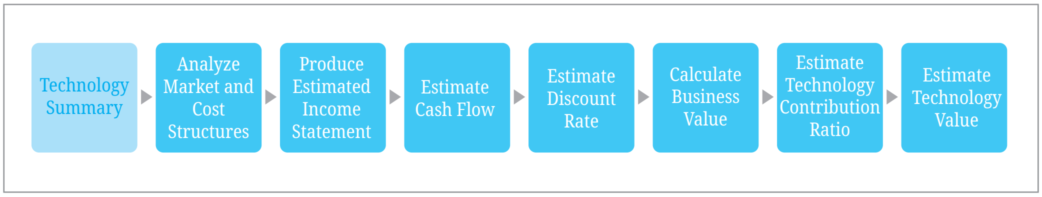
The STAR-Value system is cost-and-time efficient, and is a fast-track valuation system for quick support and validation of the economic feasibility of a business. It enables reasonable decision-making for successful commercialization by IP or technology.

Compared to offline valuation of an IP or technology by experts, which takes quite a large amount of time (two to three months) and effort, the STAR-Value system provides not only the Discounted Cash Flow (DCF) model that is widely used in the valuation of a business or technology but also various other models including the Real Options model, royalty-based model (Relief from Royalty and Value by a Profit Split), Transactions Comparison model, and Market Replacement Cost model.

The STAR-Value system recommends an optimal or semi-optimal valuation model considering how to determine input parameters depending on the range the finalized value of a technology falls under, based on valuation cases that have already been performed with specific conditions from the technology, market, and business aspects.

The STAR-Value system applies various valuation models based on the business environment and enterprise status. For most commercialization purposes, DCF model and Relief-from-Royalty model are widely used in Korea.

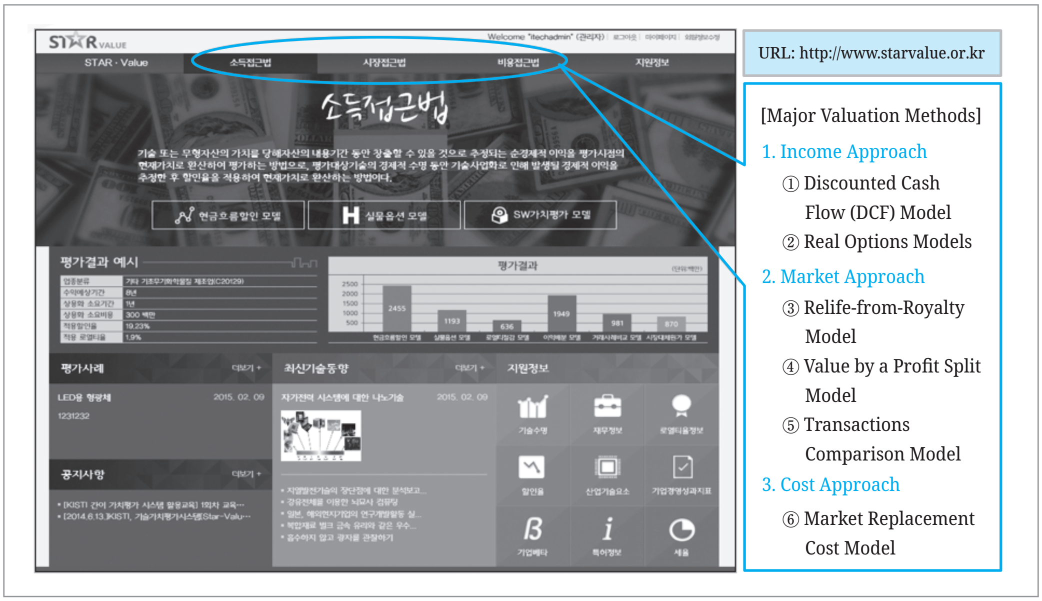
[Figure 2-4] The Eight Steps of DCF Model for IP Valuation



Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

The DCF model in STAR-Value system has eight steps, in which entering the input (IP title, associated industry category, sales estimates over economic lifetime, etc.) is required for each step. The data is analyzed to yield technology value in the final step. The chart below is an overview of each step in the DCF model.

[Figure 2-5] Models Structure of the STAR-Value System for IP Valuation



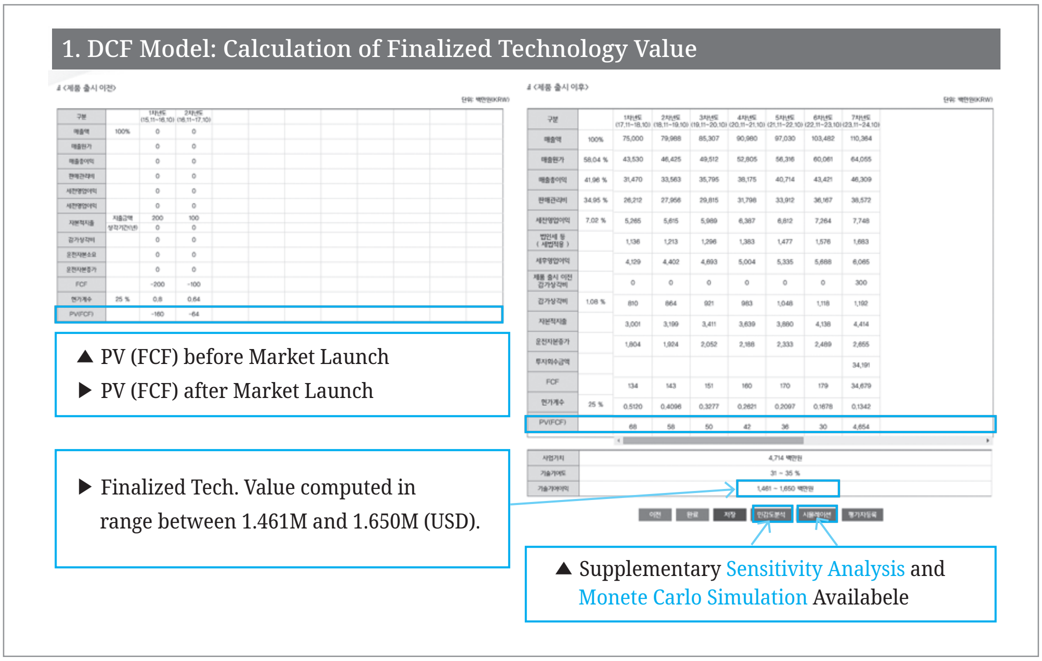
Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

The STAR-Value system has six models implemented for various business situations or technology characteristics: Discounted Cash Flow model, Real Options model, Relief-from-Royalty model, Value by Profit Split model, Transactions Comparison model, and Market Replacement Cost model. In cases where a representative model of DCF requires a specific step of estimating future cash flows, it is done based on financial analysis of the commercialization subject or a firm that holds the IP. The present value of FCF is returned considering and determining all the primary variables.

The DCF model comes with least input values and returns the weighted business value, i.e.

IP or technology value where the IP/technology contribution is considered. If the valuation analysts desire in-depth simulation to confirm the validity of the IP value at the last step, they can apply sensitivity analysis and Monte Carlo simulation.

[Figure 2-6] DCF Result Visualization of the STAR-Value System for IP Valuation



Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

3.2.3. RR Model of the STAR-Value System

The Relief-from-Royalty (RR) model is applied when there exist similar IP/technology transaction cases or royalty in license contracts known from similar cases. It involves the royalty-reflected revenues over the entire sales period.

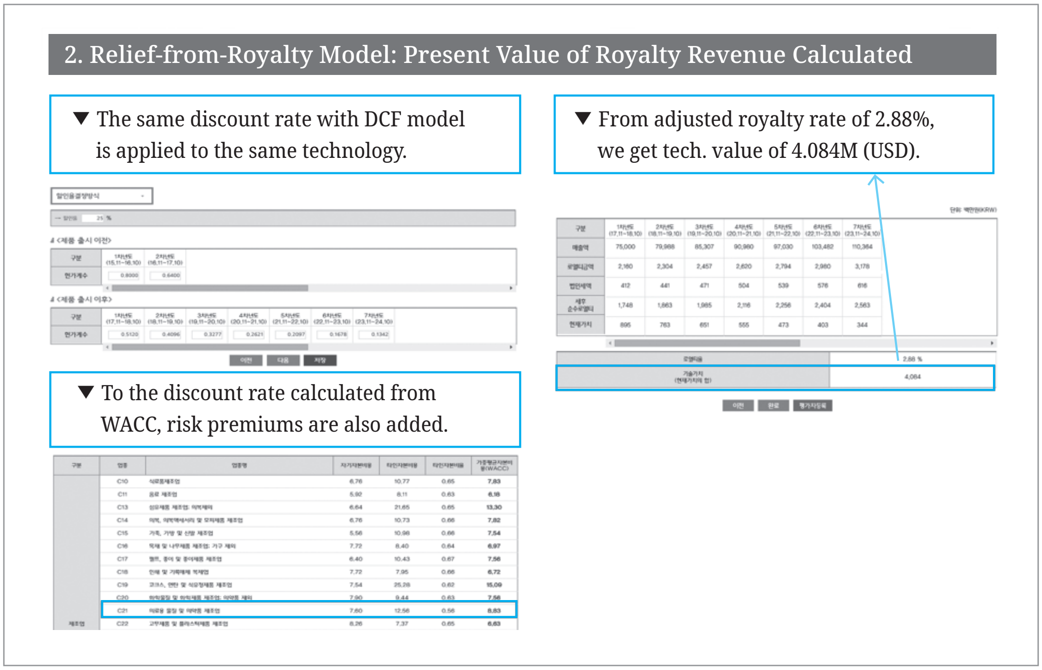
$$V = \sum_{t=1}^{n} \frac{S_t \times R - C_t}{(1+r)^t}$$

V : Technology value
n : Economic life of the technology
S_t : Sales during t
r : Discount rate
R : Royalty rate
C_t : Corporate tax during t

Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

Often, Relief-from-Royalty model is regarded as one of market approaches, because it involves the specific value of royalty rate corresponding to the IP or relevant cases of industry licenses. As expressed in the formula above, the analyst can apply the annual sales estimates multiplied by royalty rate and after considering corporate tax, arrive at a finalized present value in the RR model.

[Figure 2-7] RR Result Visualization of the STAR-Value System for IP Valuation



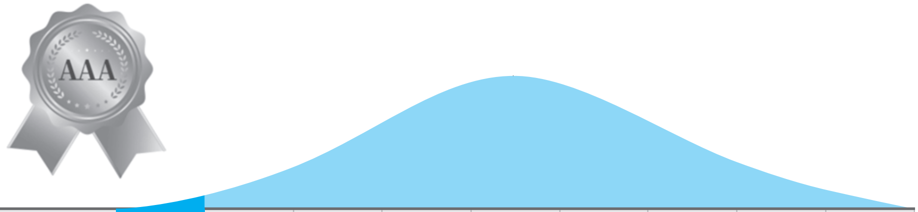
Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

By classification of the industry to which the subject IP/technology belongs, the analyst can retrieve the appropriate royalty statistics to apply the annual sales estimate under the assumption of license contracts. Next, the weighted average capital of cost is applied to annual after-tax royalty revenue, and finally the IP/technology value can be obtained.

3.2.4. Overview of the Web-based Technology Assessment System in Korea

In Korea, there have been several trials to develop an automated valuation system for returning an IP or technology's monetized value, while accumulating a volume of valuation cases in the database. One of the principal IP valuation agencies/institutions, KIBO, has over years developed the patent rating model, originated by KTRS (KIBO Technology Rating System). It has been using KPAS-I at present, which integrates the qualitative assessments of expertized evaluators from each R&D field, and it plays an influential role to promote IP guarantee/collateral-related finance programs at inexpensive evaluation fees. KPAS-I is a time-efficient IP rating model, which measures the relative scoring of a subject patent with all the comparable IPs regrouped. The theory of rating an IP involves the application of Artificial Intelligence (AI) learning algorithms over a population of application and registered patents collected within a specific number of years. It is often mentioned as a fast-track, DNN-embedded IP valuation model, which reflects the latest, state-of-the-art technique of deep learning, outperforming other traditional statistical models.

[Figure 2-8] Result of Grade Distribution by KPAS-I



GRADE	AAA	AA	A	BBB	BB	B	CCC	CC	C
Percentage (%)	4%	7%	12%	17%	20%	17%	12%	7%	4%

Source: https://kpas.kibo.or.kr (KIBO, 2019), reorganized

KIPA's SMART system quantifies patent indicators that represent rights, technicality, and usability, and returns a specific grade, e.g., 'AAA' or 'CC', which is obtained by integrating the individual scores for criteria indicators and positioning the relative excellence on percentile scale. Although the SMART uses embedded logics similar to the KPAS-I model, the latter one is different from the former in that the latter extracts the key words for an IP's statement with text mining techniques or Natural Language Processing (NLP) as wells as numeric data within the IP. Meanwhile, the SMART system only makes use of structured formulas rather than deep learning with distinct evaluation factors.

The final grade by the SMART system is score-sensitive because it applies text data indicators for input to determine the relative superiority of the subject IP by the sum of featured variables' scores, but there exists a constraint or challenge in that the output for target data does not come simultaneously with the numeric values for the subject IP.

<Table 2-3> Structure of SMART System by KIPA

Category	Features
Evaluation Indicators	Rights, Technology, Usability
Evaluation Elements	Objectivity, Quantitative Output, Completeness
Evaluation Model	Structural Equation Evaluation Model
Rating	Stanine 9 Ratings

Source: https://smart.kipa.org (KIPA, 2021), reorganized.

STAR-Value system, operated by KISTI, is a web-based valuation software that considers an IP's strength over other IPs and financial data of the IP owner or the commercialization subject, and returns a finalized economic value for the target IP. It utilizes metadata from the accumulated database, which includes formatted data under categories of patent information, and financial ratios over the industry classification of the IP. In the preprocessing of accumulated raw data such as patent information and a firm's financial and non-financial data, the formatted table for metadata is established in advance.

STAR-value system is embedded with totally seven valuation models: Discounted Cash Flow (DCF), real options, Relief-from-Royalty (RR), Value-by-a-Profit-Split (VPS), Transactions Comparisons, Market Replacement Cost and Software Pricing Decision model. It intends to exclude any inference based on artificial intelligence, targeting to minimize the subjective bias and enhance the reliability or precision of logical procedure to induce an estimate of IP value for any model assessed therein, thanks to its transparent process to calculate both free cash flow and its present value, beginning from future sales estimates over the entire valuation period.

In the popular DCF model, the valuator should directly input the necessary items at minimal level and reduce the calculation time using the meta data tables established in advance, e.g., residual lifetime DB by IP classification, financial ratio DB by industry classification, discount rates DB, or IP contribution ratio DB.

As one of the principal IP valuation variables, the valuator has to determine a sales estimation period that implies the number of years for which sales estimates will be considered to calculate the present value of annual free cash flows. The economic lifetime of an IP is determined by first looking up for the metadata table established by International Patent Classification (IPC) code, often referred to as the Technology Cycle Time (TCT) database. Next, a tentative economic lifetime for the subject IP is deduced by the experts' input for the 10 influence factors, which consist of the indicators for technology-, IP-, market-, and business-associated characteristics, ranging from -2 to 2 in a scale of integer value based on the experts' subjective judgment.

Once a sales estimation period is determined through the above steps, annual sales estimates for each year will be predicted by the bottom-up approach, where market size with growth rate reflected incorporates the feasible market share ratio of the business entity for each year.

Let us consider an example of a startup founded in the last few years. In such instances, there is a chance that it is not easy to acquire the entity's financial information or business profitability for the last three or five years. In this case, the analyst would have to utilize the financial ratio of either similar firms' or similar industry classification as a proxy. This yields the annual free cash flow, followed by applying discount rate and the IP or technology factor (sometimes referred to as the IP's or technology contribution). The discount rate and IP's contribution toward the commercialized product are normally determined by the valuators or experts participating in the valuation process by integrating Weighted Average Cost of Capital (WACC) and industry IP factor with qualitative commercialization risk premium and the IP's relative competitiveness, respectively.

[Figure 2-9] An Exemplary Screenshot for FCF Calculations in STAR-Value

Post-Lanch

Year	Sales 100%	COGS 84.94%	Gross Margin 15.06%	SG&A 11.71%	EBIT 3.35%	Income Tax (Companies)	NOPAT	CAPEX	Depreciation /AM 0.77%	Working Capital Input	Growth in working	Recovered Investment	FCF	Present Value 11.71%	PV (FCF)
Y1	70	59	11	8	2	1	2	0	1	1	1		2	0.8952	2
Y2	83	71	13	10	3	1	2	0	1	2	1		2	0.8013	2
Y3	99	84	15	12	3	1	3	0	1	2	0		4	0.7173	3
Y4	118	100	18	14	4	1	3	0	1	2	0		4	0.6421	3
Y5	141	120	21	17	5	1	4	0	1	3	1		4	0.5748	2
Y6	169	143	25	20	6	1	4	0	1	3	0		5	0.5146	3
Y7	202	171	30	24	7	2	5	1	2	4	1		5	0.4606	2
Y8	241	205	36	28	8	2	6	1	2	5	1		6	0.4123	2
Y9	287	244	43	34	10	2	7	1	2	6	1		7	0.3691	3
Y10	342	291	52	40	11	3	9	1	3	7	1		10	0.3304	3
Y11	58	50	9	7	2	0	1	1	0	8	1		-1	0.2958	0
Y12	70	59	10	8	2	1	2	2	1	10	2	3	0	0.2648	0

Business Value	24
Technology Contribution Ratio	29%~33%
Technology Value	7~8

Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

STAR-Value system has been regarded advantageous in that it helps startups to overcome the limitations of excessive cost and long-term valuation that traditional IP valuation methods hold, and that it offers a realistic estimate value by a time-efficient embedded logic and further reflects the economic effects of R&D. On the other hand, there still exists the constraint that a valuator's intervention is inevitably required, since it necessitates direct input for qualitative influence indicators. For example, scoring an IP's commercialization risk premium factor applied to the calculation of discount rate is not an easy task, because even valuation experts with years of experience might encounter difficulties in analyzing technological, IP rights, market, and business situations comprehensively. Usually, a firm, e.g., an IP holder, has a tendency of applying a constant value of Compound Annual Growth Rate (CAGR) regarding either annual market size or sales estimate, anticipating a steadily growing revenue stream. However, a business might face many unusual cases with non-linear growth or slowdown, which happens irregularly.

Next, we introduce a novel approach with the implementation of Artificial Intelligence (AI) learning models to predict the economic value of an IP. The AI-based patent appraisal system (KPAS-II), developed and upgraded by KIBO and Kunkook University (Prof. Jang-hyuk Yoon), Yonsei University (Information System Laboratory run by Prof. Tae-Eung Sung), has ushered in a paradigm shift with the concept of machine/deep learning over valuation cases, compared with the existing STAR-Value, which involves a sequence of IP valuation procedures consisting of financial analysis for FCF calculation, followed by the valuator's subjective assessment regarding four influence factors (technology, IP right, market, and business features).

KPAS-II is well operated in environments with significant amounts of valuations cases data to establish AI valuation models. Consider an instance where the pre-processed dataset of about multiples of thousand valuation cases for 2013 to 2019 is available for access. Out of the overall dataset, 80% may be used for training a DNN model, and then 20% may be used for testing the detailed DNN model in thousands of epochs (i.e., iterations of randomly sequenced test dataset). As upcoming valuation cases get accumulated in the dataset, better AI learning models with high reliability of prediction performance are formed. Even non-experts in the fields of AI or deep learning might not encounter difficulties in feeding input data and in grasping what the model's output for the target data implies, although they do not learn the full theory behind AI or deep learning beyond the precise user's guide.

3.2.5. Structure of AI-based KPAS-II System

The KPAS-II system, which has been explained in functional differentiation before, utilizes IP-related information and the IP-holder's financial data at minimal input, and the automatic calculation of key valuation factors is performed in association with the pre-built databases (DBs), i.e., financial metadata by industry, IP database, and a collective database of valuation cases.

First, the IP database has bulk data with both IP-intrinsic and IP-extrinsic characteristics, and is affiliated to the Korea Intellectual Property Rights Information Service (KIPRIS) in real time update. The IP database includes types of raw data or metadata pre-processed from about 4.5 million IPs applied for or registered since 1948. The term 'IP-intrinsic' applies to information such as IP-bibliographic and IP specifications, claim index, abstract, etc., and 'IP-extrinsic' refers to information like an IP or technology's environment and business situation beyond the intrinsic numeric data.

Second, financial metadata is established by extracting the necessary numeric data or compound ratios out of the income and financial statements for about 370,000 firms. This information can be purchased through either Korea Rating & Data (KoData) or NICE Information Service. As of August 2022, the financial metadata is accessible in real time for in-house valuators, providing cash flow statements, income statements (I/S) and balance sheets (B/S), non-finance information of a firm, etc.

Third, the database for valuation cases consists of about 6,000 valuation cases that have been collected and pre-processed since 2010 and are automatically fed to the input data, bringing three scores for IP lifetime, IP commercialization risk premium, and IP contribution factors at the output side, which have been evaluated by experts' judgments taking one or a few weeks generally. The database for valuation cases is utilized in both training and validation processes, which accords with cutting-edge AI theory.

[Figure 2-10] Structure of Various Databases for KPAS-II

Patent DB	Financial DB	Technology Valuation DB
• Patent Instrinsic Indicator - Bibliographic Information - Etc. • Patent Extrinsic Indicator - Patent Activity Index - Cities per Patent - Patent Impact Index - Etc.	• Statement of Financial Position • Statement of Cash Flow • Income Statement of Profit and Loss • Financial Ratio • Etc.	• Technology Value • Patent Information • Economic Life of Technology • Free Cash Flow • Discount Rate • Technology Factor • Scores of Technology Valuation Factor
1948~2019	~2018	2013~2019

Source: https://www.starvalue.or.kr (KISTI, 2018), reorganized.

During the entire steps for IP valuation, the degree of reliability obtained in annual sales revenue over the calculation period is a critical, dominant factor that influences the finalized economic value for the subject IP. Hence, future sales and corresponding free cash flows are said to depend on how much they reflect the IP's technological, market and business circumstances as well as the entity's entering industry trends.

Top-down approach, one of the typically, most often used schemes for estimation of future sales by the DCF and RR methods, is calculated by multiplying annual market size numbers by the business entity's feasible market share ratio, while in the bottom-up approach calculations are made by multiplying unit price of the commercialized product or service by annual demand estimates. Annual demand estimates can be also obtained by either the past sales records of the entity or sales patterns of similar competing firms, if available.

Aforementioned top-down approach is determined by either reliable data presented in reputational market analysis reports or years' statistics offered by associations with which the IP-applied product or service is affiliated. It is possible to acquire objective data from market analysis materials or the association's distributed release of sales records to the best, but data on actual market size and growth rate might not be accessible, especially for an IP-commercialized product that has not been launched yet nor has any possibility of market uncertainty.

Regarding the bottom-up approach, the prediction for future sales records is conducted by the valuators or an expert's comprehensive judgment as in a situation where there exists no activated market regardless of the business entity's first trial market entrance through the IP-commercialized product. If the quantitative estimation from clearly accumulated past data to the moment is possibly applicable, the prediction of future sales may be easily processed.

A method to predict sales growth rates in consecutive years is embedded in KPAS-II as follows, given that both a reference sales record for a specific year and sales growth rate for Korea Standard Industry Classification (KSIC) like ISIC are numerically offered.

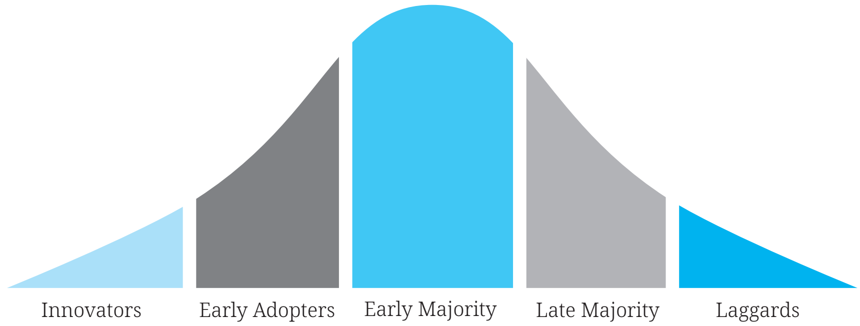
$$\begin{aligned} S_t &= S_{t-1} \times (1 + Sales\ growth\ rate_{KSIC}{}^{t-3}) \quad (if\ t \leq PSG_{KSIC}) \\ &= S_{t-1} \times (1 - Sales\ growth\ rate_{KSIC}{}^{t-3}) \quad (if\ t > PSG_{KSIC}) \end{aligned} \tag{1}$$

$where\ t\ is\ applied\ from\ the\ 4th\ year,$

$PSG_{KSIC}\ represents\ the\ percentage\ of\ sales\ growth\ based\ on\ KSIC$

As represented in Equation (1), two intervals for increasing and decreasing sales might be considered. From literature review, the theory of Technology Adoption Life Cycle (TALC) shown in [Figure 1-10] is well-known for the typical pattern of a consumer's 5-staged technology adoption with inclined S-curve, and it is often applied in fields of consumer behavior analysis.

[Figure 2-11] A Consumer's 5-staged Technology Adoption Theory over the Life Cycle



Source: Rogers' technology adoption model (1995), reorganized.

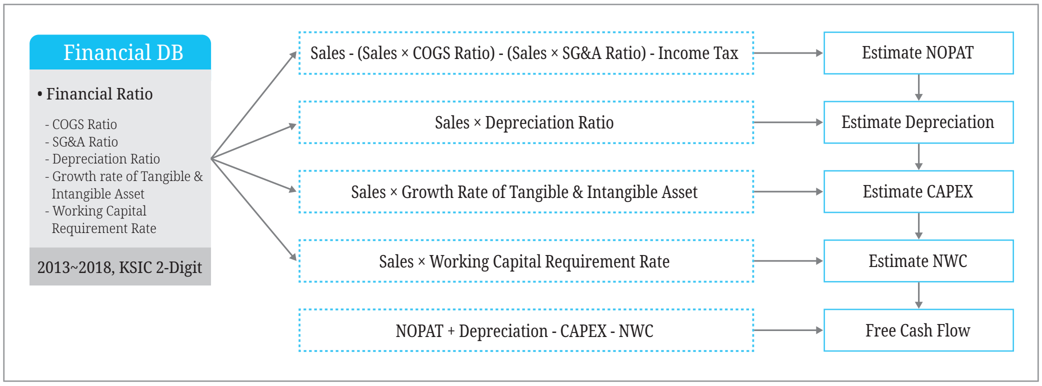
In Equation (1), Percentage of Sales Growth (PSG) is in general calculated by 2-digits KSIC after comprehensively analyzing free cash flow data of the IP valuation cases database.

$$PSG_{KSIC} = Median_{KSIC}\left(\frac{Sales\ increase\ segments}{Economic\ life\ of\ technology}\right) \tag{2}$$

The PSG data by KSIC in Equation (2) is calculated from seed data, which comes with sales increase increments over an IP's specific economic life cycle so that it provides an estimate of Compound Annual Growth Rate (CAGR) for consecutive five years from the already established financial databases. The number of similar firms used for estimation or a size-based company type (large, SME or startups) could affect the calculation of sales growth rate; thus, it is necessary to iteratively perform the CAGR calculation for the combination of all feasible cases with the size or type of the company. Then, it is saved in the metadata.

Finally, for sophisticated estimation of sales over the estimation period, business plans of a commercialization entity with a concretized investment strategy are informative, especially for early-stage entrance through IP utilization. If the sales estimation over the initial three years becomes determined, the stage of FCF calculation is consecutively conducted by highly reliable prediction.

[Figure 2-12] Steps for Estimating Annual FCF in KPAS-II



Source: Kim, M-.S, *et al*. (2021), reorganized.

[Figure 2-12] demonstrates how KPAS-II makes automatic estimation to the last stage of FCF calculation possible with minimal input such as KSIC 2-digits to which the business entity belongs, where financial data is retrieved and NOPAT (Net Operating Profit After Tax), CAPEX (capital expenditure), and NWC (Net Working Capital) are then estimated.

In IP valuation, an IP's contribution ratio implies a relative proportion of IP contribution over both tangible and intangible assets in business development through the IP's implementation to develop a product or service. The IP contribution is calculated by multiplying industry factor in the pre-built database, the experts' subjective judgment regarding technology and market/business competitiveness by IP proportion towards a completed product or service. The formula for industry factor is as follows.

$$
\begin{gathered}
Industry\ factor = \\
Maximal\ feasible\ intangible\ asset\ value\ ratio \times \quad Average\ technology\ asset\ ratio \\
where, \\
Maximal\ feasible\ intangible\ asset\ value\ ratio = \frac{Intangible\ asset\ value}{Firm\ market\ value + Total\ debt}, \\
Intangible\ asset\ value = Firm\ market\ value - Net\ asset\ value, \\
Average\ technology\ asset\ ratio = \\
\frac{R\&D\ expenses}{R\&D\ expenses + Advertising\ expenses + Education\ and\ training\ expenses}
\end{gathered}
\tag{3}
$$

In Equation (3), industry factor is obtained by multiplying the maximal contribution ratio of the IP-holder firm by the IP proportion relevant to the entire intangible asset. Next, the experts' subjective judgment regarding technology and market/business competitiveness is decided by totally 20 factors rated on a five-point scale, reflecting the qualitative strength of the IP technology and market/business status. The detailed qualitative index for IP or technology factors is listed in <Table 2-4>.

<Table 2-4> Qualitative Index for IP or Technology Factors

Classification	Index
IP's Technology Factors	IP's degree of innovation
	IP's technological impact
	IP's usability
	IP's technology strength
	Differentiation from other IPs
	Possibility of emergence of alternative IP
	Degree of difficulty in imitation
	IP's technology life cycle
	Scope of IP rights
	Stability of IP rights
IP's Market and Business Factors	Market demand of the IP
	IP's market entry potential
	Ease of producing the IP-embedded product
	IP-embedded product's economic life
	Sales growth potential of the IP-embedded product
	Derivative sales by the IP-embedded product
	IP's technical maturity
	Capital required for IP-initiated commercialization
	Profitability of IP-embedded product

Source: MOTIE/KIAT (2021), reorganized.

The composite formula for IP contribution ratio is obtained by considering both industry factors and IP or technology factors as follows.

$$Technology\ contribution\ ratio = Industry\ factor \times Technology\ rating\ factor \qquad (4)$$

KPAS-II system by KIBO includes an automated calculation module for IP contribution ratio, where it derives the industry factor by KSIC 2-digits and generates an estimate of the integrated score for IP or technology factor by the deep learning process. The procedure of generating a totally aggregated estimate of the IP or technology factor is an automated module of extracting feasible, most reliable scores by AI learning.

3.2.6. Deep Learning-based Scoring Module for IP Valuation

The core factors for IP valuation (i.e., IP's economic life cycle, IP-embedded product's commercialization risk premium factor, IP contribution factor) play the role of reflecting the external market/business situations. On the other hand, there exists the hassle of the valuators' intervention through arbitrary judgment, which diminishes the possibility of reaching an objective, reliable economic value for the subject IP.

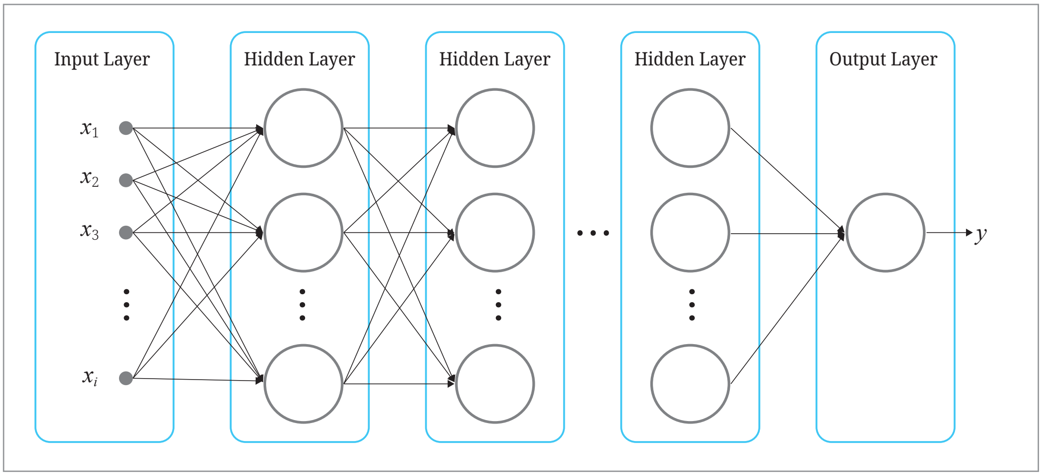
Valuators who do not have expertise in IP valuation careers might not be skilled to assess unprecedented market and business situations, where KPAS-II will be a milestone or guidance to help the valuators so as not to lose objective standpoints. It is a principal contribution of KPAS-II to the real world of IP valuation.

To help the expert group cope well with the constraints of traditional in-depth IP valuation, KPAS-II serves as a ready source offering a series of estimates for core variables through machine assistance by the novel algorithms of deep neural networks.

Recent advancement in computing power and the ease of securing big data has helped to create an efficient, intelligent inference environment through the widely spread utilization of state-of-art schemes, i.e., machine learning and deep learning, and well discriminates machine-side and human-side roles for distributed or parallel processing.

To determine the qualitative factors that are not scored mechanically by data-driven query module, the valuators need to consider a business entity's capability to commercialize the IP-embedded product. KPAS-II can adjust those subjective considerations neutrally or with less intervention of bias, where the DNN (Deep Neural Networks) structures nonlinear patterns with the internal module of weighting factors hidden. As shown in the [Figure 2-13], a set of input variables x_i at the input layer is fed into each of consecutive hidden layers, where the model learns and updates the matrix-typed weighting factors. As the learning model becomes processed, hyper-parameters are tuned automatically to improve the model's prediction performance.

[Figure 2-13] Internal Structure of DNN

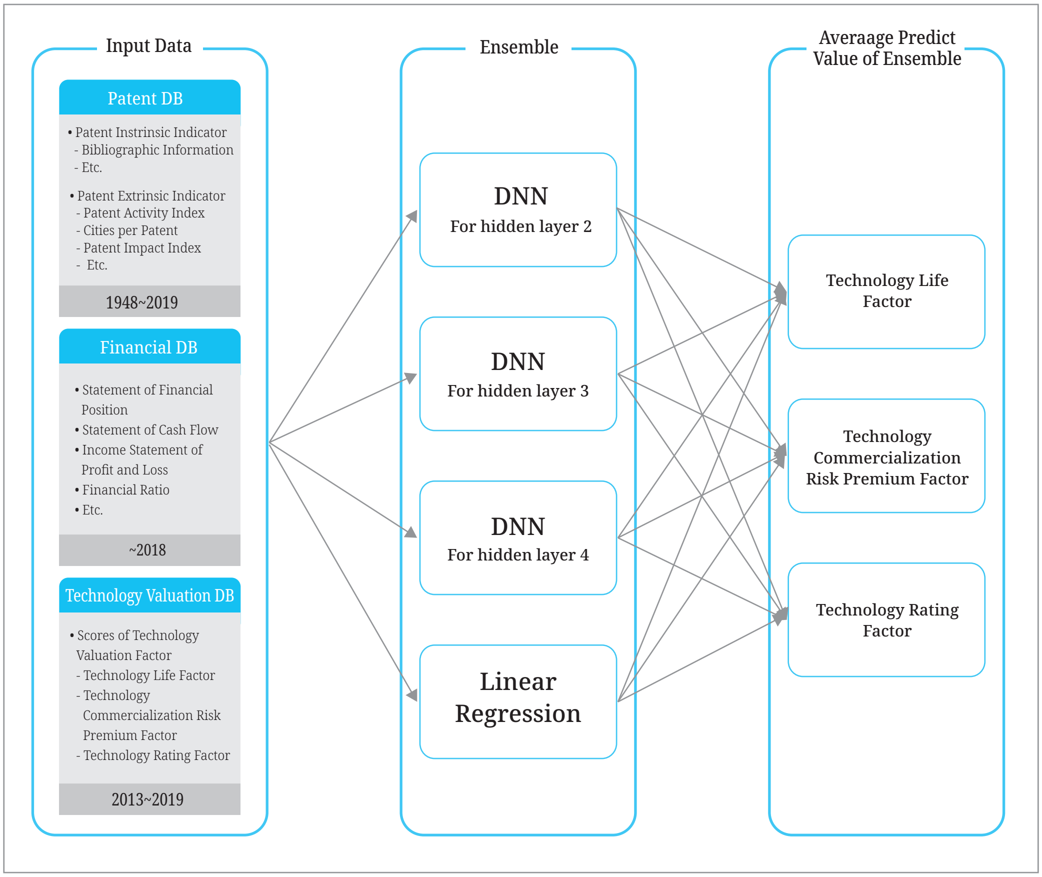


Source: Kim, M.-S, *et al*. (2021), reorganized.

In [Figure 2-13], a hybrid type of ensemble model, which obtains estimates for high probable scores, is structured with three different DNN models in number of layers two to four and a linear regression model. If either the averaged representative value over multiple models or the majority rule-based decision in binary classification is applied, there exists the possibility of maximizing the reliability based on the elaborate model. The ensemble model has the advantage of maximally excluding any feasible subjective bias which differentially influences scores for qualitative factors according to the valuator's judgment.

In [Figure 2-14], KPAS-II has conducted the learning using over 6,000 train and test data from IP valuation cases collected since 2013 in a formatted, structured database. As input data, a total of 36 variables x_i in terms of technology, market, and business environment have been fed into each model in the ensemble type, and the model output consists of three types of target data yi in estimates of scores regarding three qualitative factors. In terms of model performance, mean absolute error (MAE) is utilized as a metric of loss or cost function.

[Figure 2-14] Structure of the Ensemble Model for Predicting Three Output Scores



Source: Kim, M-.S, *et al*. (2021), reorganized.

In case of linear regression model, excessive input variables might cause over-fitting and serious degradation of performance. <Table 2-5> identifies the comparison results of model performance evaluation among three distinct factors, where at the 5%-significance level the analysis is statistically significant and acceptable.

<Table 2-5> Comparison Results of Performance Evaluation for IP Valuation Factors

Model/Factor	Performance Evaluation		
	MAE	MSE	MAPE
Ensemble	4.93	85.80	0.08
IP's economic life factor	6.22	105.71	0.09
IP-embedded product's commercialization risk premium factor	2.89	26.47	0.08
IP contribution factor	5.68	125.23	0.08

Source: Kim, M-.S, *et al*. (2021), reorganized.

As shown in [Figure 2-15], once the valuator makes an input of either the publication or application number, the associated metadata or databases such as patent DB or financial DB retrieve most similar cases and provide appropriate query results.

[Figure 2-15] Input Screenshot of IP Information in KPAS-II

Source: https://kpas.kibo.or.kr (KIBO, 2019), reorganized.

As seen in [Figure 2-16], the finalized result screen for IP valuation shows an economic value estimate of the subject IP and the summary of principle variables through the overall process applied in KPAS-II, where the three qualitative factors for the DCF scheme are presented in scores that had been determined by the valuators' manual judgment for the subject IP's technological, market and business status.

[Figure 2-16] Finalized Result Screen for IP Valuation in KPAS-II

Patent Information

Publication No.	10-1234567-0000		
Application No.	1020200012345		
Title	KPAS II SYSTEM		
Application Date	2020.11.01	Applicant	Korea Technology Finance Corporatioon
Publication Date	2020.12.01	Registration Right Holder	Korea Technology Finance Corporatioon
IPC Code	F25C 1/22, F25B 39/04		
Ligal Status	Publication		

Patent Valuation Results

Technology Value	179 million won

Output data

Evaluation purpose	For IP guarantee	Evaluation base date	2020.11.15
Listing	Unlisted	Company scale	Small business
Industry classification	Cooling, air conditioning, filtration, distillation and gas generator manufacturing (29171)	Business Number	607-55-63499
IPC4	F25C	discount rate	11%
Economic life	12 years	Technology contribution	47%
Sales (Unit: Million)	1st: 500 / 2nd: 600 / 3rd: 700 / 4th: 884 / 5th: 1,118		
Net Present Value (Unit: Million)	386		

(In millions of Korean won)

Estimated sales

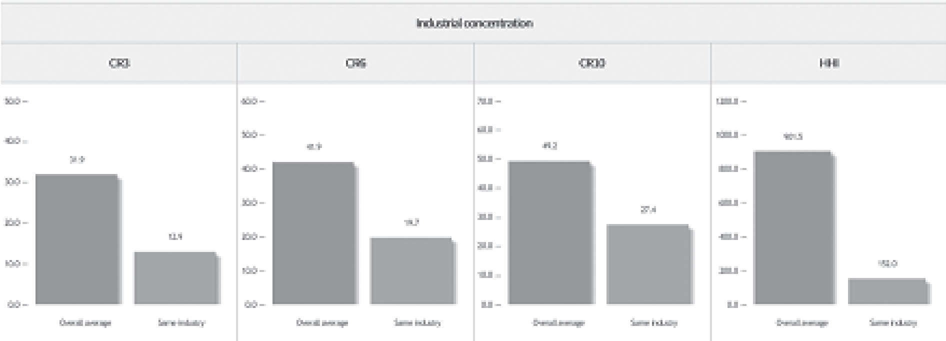
Source: https://kpas.kibo.or.kr (KIBO, 2019), reorganized.

[Figure 2-17] Visualized Reference Information for IP Valuation in KPAS-II

■ Corporate financial capability data (for reference)

(Unit: KRW 1,000, %)

data						
designation	all	ratio	Same industry	ratio	The company	ratio
Sales	16,966,746	100	8,876,245	100	8,876,245	100
Cost of sales	13,752,880	81	7,416,336	84	7,416,336	84
Sales and management expenses	2,478,875	15	1,033,525	12	1,032,525	12



※ CR index (Concentration ratio) refers to the sum of the market share of the top n companies in a market.
The CR index is mainly used as a data to intuitively check whether a company has market power and monopoly.
In general, if the CR3 index is 75% or higher, the industry can be interpreted as an oligopoly, and the CR6 and CR10 indexes can be used as auxiliary indicators for interpretation.
※ HHI (Herfindahl-Hirschman Index) refers to the sum of squared market shares for all companies participating in a market.
In general, if HHI is less than 1,500, it can be interpreted as 'unconcentrated market', 1,500-2,500 as 'a little-concentrated market', and if it is above 2,500, it can be interpreted as 'very concentrated market'.

■ Patent evaluation grade reference data

Source: https://kpas.kibo.or.kr (KIBO, 2019), reorganized.

As shown in [Figure 2-17], KPAS-II provides corporate financial capability data including the list of competitors within the same industry, market complexity indicator, etc. Market complexity indicator is often represented as either CR (Concentration Ratio) index or HHI (Herfindal- Hershman Index) for a specific industry in which the IP-embedded product is launched. Meanwhile, in KPAS-I, a patent rating system for an IP's relative positioning, both intrinsic and extrinsic indexes for an IP are integrated in scores and quantized within the range of 'AAA' and 'D' ratings for the sector to which the result rating corresponds.

KPAS-II differs from other IP rating schemes in that the minimal input of IP information and the IP-holder's size/type is automatically fed to DNN model to obtain AI-based inference scores for three qualitative factors, followed by a finalized economic value of the subject IP, arrived through applying the machine learning algorithm to the IP valuation cases from 2013 to 2019. With the accumulation of more cases, the model becomes more elaborate and returns much reliable estimates for IP valuation.

4. Current Status of IP Valuation in Four Countries of ASEAN Member States

4.1. International Standards and Current Status of IP Valuation

4.1.1. International Valuation Standards Council

The International Assets Valuation Standards Committee was initially established in 1981, and it was renamed and advanced to International Valuation Standards Council in 1994, representing the valuation councils of 46 countries. International Valuation Standards was initialized in public in 1975, and is being updated and announced regularly.

<Table 2-6> International Valuation Standards 2017

General Standards	IVS 101 Scope of Work IVS 102 Investigations and Compliance IVS 103 Reporting IVS 104 Bases of Value IVS 105 Valuation Approaches and Methods
Asset Standards	IVS 200 Businesses and Business Interests IVS 210 Intangible Assets IVS 300 Plant and Equipment IVS 400 Real Property Interests IVS 410 Development Property IVS 500 Financial Instruments

Source: IVSC (2017), reorganized.

4.1.2. International Association of Certified Valuation Specialists

In addition, the valuation standards offer information regarding general and ethical standards, scope of services, development standards, reporting standards, and IVSC & international glossaries.

<Table 2-7> IACVS Valuation Standards 2011

I. INTRODUCTION	A. Preamble
II. GENERAL AND ETHICAL STANDARDS	A. Integrity and Objectivity B. Professional Competence C. Due Professional Care D. Understanding and Communications with Clients E. Planning and Supervision F. Sufficient Relevant Data G. Confidentiality H. Discreditable Acts J. Financial Interest
III. SCOPE OF SERVICES	A. Applicability B. Valuation Services C. Other Services D. Jurisdictional Exceptions
IV. DEVELOPMENT STANDARDS	A. General B. Expression of Value C. Reliability of Data D. Limitations of Scope E. Use of Specialists F. Approaches and Methods G. Identification H. Fundamental Analysis I. Documentation
V. REPORTING STANDARDS	A. General B. Form of Report C. Contents of Report D. Standards for Reporting Litigation Engagements
VI. IVSC AND INTERNATIONAL GLOSSARIES	Both the ICVS Glossary and the International Glossary of Business Valuation Terms were developed by the valuation organizations identified in the Glossary. These definitions should be used by members unless preempted by the regulatory authority.

Source: IVSC (2017), reorganized.

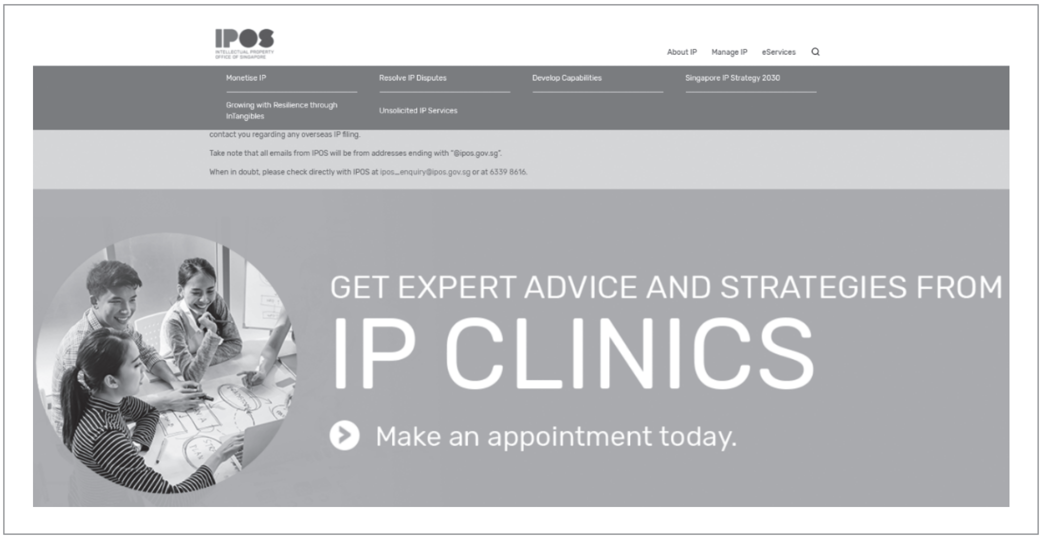
4.2. Current Status of IP Valuation in AMS

4.2.1. Singapore

The Intellectual Property Office of Singapore (IPOS), a government IP agency, provides information on Singapore's IP rules, patents, trademarks, and statutes governing registered designs. IPOS not only provides information on the filing and registration of patents, trademarks, and registered designs, but also provide guidelines for each.

The association for patent attorneys in Singapore is the ASEAN Patent Attorney Association. An annual meeting for the development of patent law is held every year, and individuals or institutions in the IP industry can interact with each other at the meeting. APAA members meet and organize local events and activities to share and promote IP-related knowledge. The IP issues are addressed through specialist discussions and seminars related to the discussion forum held by IPOS. In addition, publications of all patent and trademark cases adjudicated are available to APAA members.

[Figure 2-18] Landing Pages of IPOS



Source: https://www.ipos.gov.sg, reorganized.

- **(Support Policy)** Given the retirement of IDEAS and IPFS, currently Singapore does not offer any government financial support to enterprises specifically for IP valuation. At present, enterprises that wish to undergo IP valuation have to do so at their own costs.

However, government support is available in relation to training for IP Professionals and IP valuers. As mentioned previously, multiple modes of government financial aid are available, such as:

a) Enhanced Training Support programs for SMEs[1] (partial discount applied if sponsored

1 SME refers to a Small and/or Medium-sized Enterprise, which does not have an annual sales turnover of SGD 100 million or above, or does not employ more than 200 workers.

by an SME)

b) Skills Future Mid-Career Enhanced Subsidy programs (partial discount offered for eligible and self-funded Singapore citizens)

c) Skills Future Credit (up to SGD 500, for eligible and self-funded Singapore citizens)

d) Workfare Skills Support Scheme (WSS) (income supplement and training allowances provided, for eligible and self-funded Singapore citizens)

- **(Standards/Guidelines)** According to the SIPS2030, the Singapore Government's plan is to create standardized IP valuation guidelines that can be used internationally. Until such IP valuation guidelines are published, IP valuation in Singapore will remain quite varied in terms of the methodologies and/or standards used and applied by the different valuers. Each valuer will use the methodology and/or standard that they are most familiar and comfortable with, according to their individual preferences. It is understood that IP valuers in Singapore generally follow the IVS210 on IP Valuation.

- **(Web-based Valuation Systems and Reference DBs)** Not applicable

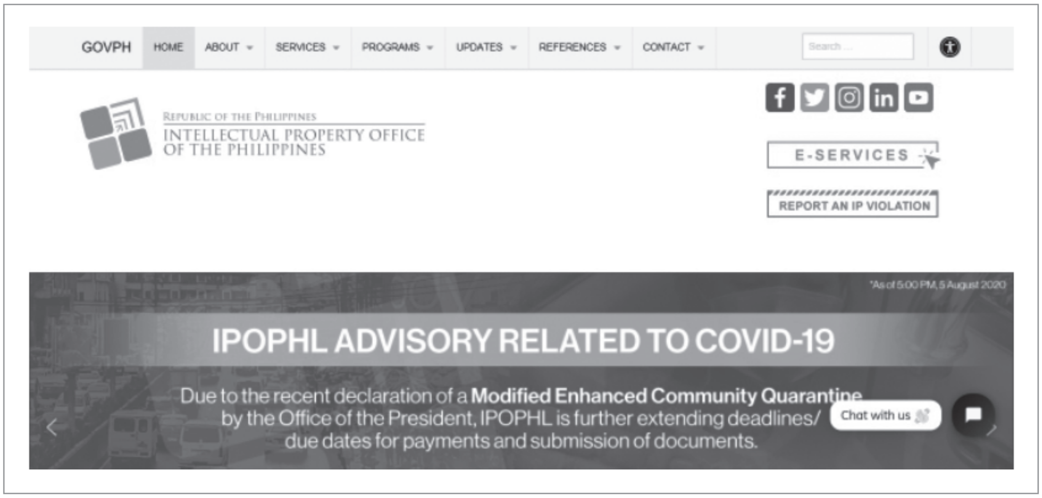
- **(IP Valuation Models)** Several IP valuations models
  - Income approach (RR, MPEE), Cost/Market Approach
  - Others (Premium Pricing, Avoided Costs, Option-based)

Singapore wishes to "develop a credible and trusted IA/IP valuation ecosystem". As described in SIPS2030, Singapore intends to do so by supporting IA/IP transactions through credible IA/IP valuation guidelines and practices; and support IA/IP transactions with better IA/IP disclosures (i.e. in SGX notifications, listed and/or soon-to-be listed companies will be able to disclose the value of their IA/IP more accurately through better IA/IP valuation services available in Singapore). One key thrust of Singapore's strategy is therefore to also provide a better pool of IP valuers, and this is why the country emphasizes and provides financial support for IP professionals to undergo IP valuation training and/or courses through established tertiary education institutions and/or the IPOS's IP Academy.

4.2.2. Philippines

The Philippines operates the National Committee on Intellectual Property Rights ("NCIPR" for short), which consists of intellectual property-related organizations. The Intellectual Property Rights Committee is an institution chaired by the Ministry of Trade and Industry with the Intellectual Property Office in the vice-chair position.

[Figure 2-19] Landing Pages of IPOPHL



Source: https://www.ipophil.gov.ph, reorganized

The Philippine Intellectual Property Office is an institution like the Korean Intellectual Property Office, and Article 5 of the Intellectual Property Act (RA. 8293) stipulates the functions and powers of the Intellectual Property Office. IPOPHL manages and implements policies to streamline patent, trademark, and copyright registration procedures in the Philippines through the Intellectual Property Office, liberalize registration in relation to technology transfer, and enhance the enforcement of intellectual property rights. The head office of the Philippine Intellectual Property Office is in Manila, with branches in Cebu, etc.

- **(Support Policy)** While the TAPI has allocated 12% of its annual operations funds to assist inventors in the stages of initial experiments and prototype development, there is no funding specifically to assist inventors in the stage of IP valuation.
- **(Standards/Guidelines)** While the Philippines has prepared an IP valuation manual through APEC and by DOST-TAPI, it still does not have adequate IP valuation infrastructure.
- **(Web-based Valuation Systems and Reference DBs)** Not applicable, but according to a representative (Ms. Brianne Nicole Sanchez) from the IPOPHL, they are open to collaborate if a similar web-based system is given to or made available to the Philippines.
- **(IP Valuation Models)** An appropriate valuation approach is selected depending on the type and stage of development of the IP asset. DCF, RR and MEEM (or MPEE) are used according to the level of the information provided.

Philippines government's support programs and policy status for conducting IP valuation are summarized as follows. While the TAPI has allocated 12% of its annual operations fund to assist inventors in the stages of initial experiments and prototype development there is no funding specifically to assist inventors in the stage of IP valuation. DOST-TAPI, however, can assist inventors in approaching Government Financial Institutions (GFI) to raise funds for the venture where "ownership of a valid IP" is one of the requirements. According to DOST-TAPI, banks no longer extend loans with IP as collateral. In this situation, the inventor will have to obtain a fairness opinion supported by an IP valuation report to submit an application to the GFI. The DOST-TAPI convenes independent third-party experts that usually include (1) IP expert or IP lawyer, (2) expert in finance and (3) industry or technical expert.

Specifically on IP valuation, both the DOST-TAPI and IPOPHL conduct capacity building activities.

4.2.2.1. DOST-TAPI

The article below mentions the recent activities in 2019 and 2020 for the Philippine Council for multiple ministries, including the DOST NCR office (14 July 2021) http://tapi.dost.gov.ph/news/74-dost-tapi-expands-ip-valuation-services-with-dost-500.

Hosted a knowledge-sharing webinar on IP valuation on 26 July 2021 to discuss topics on IP rights, freedom-to-operate, IP valuation, and valuation methods (17 July 2021) http://www.tapi.dost.gov.ph/news/95-dost-tapi-to-hold-webinar-on-ip-valuation.

4.2.2.2. IPOPHL

In 2020, IPOPHL invited guest speakers and conducted the Licensing, Audit, and Valuation IP 101 seminar series for business and IP owners. The IPOPHL conducts regular webinars/training sessions such as:

- Beyond IP Master course, which includes a section on IP Valuation: Theory and Practice on Valuing IP Assets;
- IP Academy – WIPO-IPOPHL Summer school;
- The IP Academy will hold an upcoming seminar in July 2022 on Intellectual Property and Technology Laws, and Monetization of IP Assets and IP Valuation Techniques will be part of the curriculum.

Meanwhile, this research team investigated the status of commercialization support achievements through IP valuation programs (e.g., number of beneficiary agencies, number of loans, guarantees, securities, investments, and successful startups).

DOST-TAPI completed two special projects in 2021, which are the Support for the Commercialization of 500 DOST-Generated Technologies and Strengthening the Country's IP and Technology Portfolios. Furthermore, the DOST 500 Project has accomplished the creation of an IP database management system through the System for IP Applications and Grants (SIPAG) and iSIPAG.

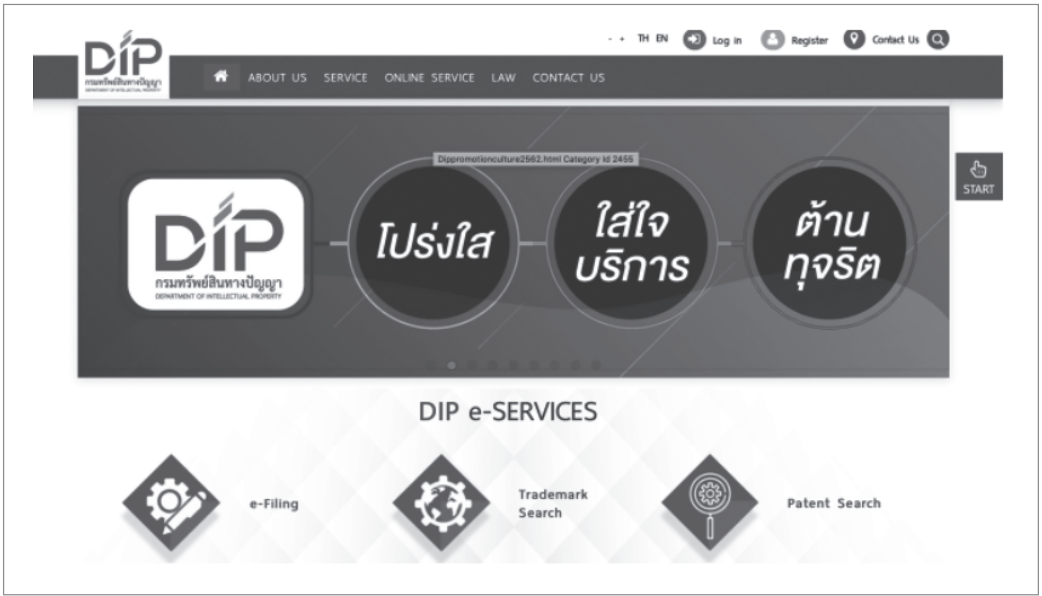
The SIPAG is an offline tool for managing, evaluating, and monitoring granted and filed IPs. On the other hand, the iSIPAG is the online version of the SIPAG that enhances accessibility and enables easier monitoring of IP applications for the clients. Moreover, the project provided initial support to the Fairness Opinion Board (FOB) for 22 DOST-generated technologies in 2016 to 2017.

The project developed and published the Freedom-to-Operate (FTO) Manual and FOB Reference Booklet in 2018, and the IP Valuation Manual, first of its kind in the Philippines, which provides brief and simplified explanations for the mechanism of IP valuation and the preparation of Fairness Opinion Reports. FTO enables the developing, making, and marketing of products without legal liabilities to third parties while FOB evaluates the fairness of a transaction from a financial point of view. Subsequently, 92 patents, 756 utility models, 227 industrial designs, 116 trademarks, three National Phase Entries, and 10 Patent Cooperation Treaties were filed, while 920 copyrights were deposited over the span of five years. For more information, please visit the source website http://www.tapi.dost.gov.ph/news/64-dost-tapi-culminates-technology-transfer-and-commercialization-projects.

4.2.3. Thailand

The Department of Intellectual Property Office (DIP) in Thailand was established in 1992 and was consolidated by transferring the responsibilities the Commercial Registration Office under the Ministry of Trade of Thailand was managing before that time. Currently, the Intellectual Property Office of Thailand oversees administrative/policy affairs for patents, trademarks, designs, copyright applications and other related laws.

[Figure 2-20] Landing Pages of DIP in Thailand



Source: https://www.ipthailand.go.th, reorganized.

- **(Support Policy)** The Thai government has been at the forefront of developing infrastructure to promote the use of IP assets for commercialization. In 2003, the Thai government set a policy to promote the use of IP assets, among other intangible assets, as security for obtaining loans.

- **(Standards/Guidelines)** IP valuation in Thailand is usually conducted when there is a business merger or acquisition, as IP valuation is required in the Purchase Price Allocation Report (PPA Report). There exist three main types of IP Valuation models that are used commonly, according to the DIP's Guidelines.

- **(Web-based Valuation Systems and Reference DBs)** Not applicable, but there had been previous initiatives by private sectors to construct DB for IP valuation with inputs such as financial information, transaction cases with royalty rates, and deal value information. Due to the confidentiality of the IP subject matter, the attempts to construct DBs for IP valuation were unsuccessful.

- **(IP Valuation Models)** Cost/Market/Income Approach

In 2004, the DIP launched a program called "IP Securitization" for IP owners to obtain loans from financial institutions. The DIP invited and signed an MOU with four financial institutions to join this program. The institutions were:

1) Industrial Finance Corporation of Thailand (IFCT)

2) Small and Medium Enterprise Development Bank of Thailand (SME Development Bank)
3) Bangkok Bank
4) Government Savings Bank

The IP owners who wished to participate in this program needed to file an application for a loan with one of the above-identified financial institutions, together with a business plan and supporting documents as required by the financial institution. One of the important supporting documents required by the financial institutions was the IP valuation report, based on analysis conducted by a credible IP valuer. Even though the DIP did not assist in conducting IP valuation, the DIP drafted IP valuation guidelines, which were published in 2008[2]. Unfortunately, the IP Securitization Program of the DIP lasted for only five years. Nevertheless, the government made efforts to promote the use of intangible assets, including IP assets, in securitization and commercialization. This led to the adoption of the Business Security Act in 2015, which allows owners of intangible assets to use their intangible assets as collateral or security.

In addition, since 2016, the Thai government has adopted a 20-year Intellectual Property Roadmap, which serves as the guideline for the development of Thailand's national IP systems. The roadmap covers six areas of IP, namely: (1) IP Creation; (2) IP Protection; (3) IP Commercialization; (4) IP Enforcement; (5) Geographic Indications (GIs); and (6) Genetic Resources (GRs), as well as Traditional Knowledge (TK) and Traditional Cultural Expressions (TCEs).

In this regard, there are developments at the policy level in relation to IP valuation infrastructure as described below.

- The DIP initiated the Smart DIP Project with the aim of providing the public with more convenient IP services. This project includes (1) the e-certificate, (2) the online dispute resolution, and (3) the analysis of technology trends and utilization of big data and the patent database. This project was expected to be launched officially in 2021.
- The DIP established IP Mart, which has consistently served as the online platform for IP owners who wish to present and sell their IP products to consumers.
- The Intellectual Property Innovation Driven Enterprise Center (IP IDE Center) was established to encourage SMEs to improve their competitiveness using innovation and technology.

2 Department of Intellectual Property, "Guidelines on IP Valuation," 2008.

- The DIP also organized IP Champions to foster the commercialization of IP and arranged annual IP Fairs to promote awareness of IP commercialization to the business sector and the general public.

Importantly, in 2017 the DIP issued the Guidelines on Intellectual Property Valuation[3] to provide comprehensive guidance and establish support policies for all aspects of IP valuation, including information related to IP-backed lending, IP securitization, IP valuation models and IP valuation systems. Additionally, the DIP and Thailand Development Research Institute's (TDRI) Study Report published on March 2017 highlights the importance of IP assets in commercialization and exploitation of business opportunities, and provides support policy recommendations to improve the IP valuation ecosystem in Thailand.[4]

IP valuation at the initial stage is being done in Thailand, although mostly in the private sector. IP valuation is usually conducted when there is a business merger or acquisition, as IP valuation is required in the Purchase Price Allocation Report (PPA Report). The frequency of conducting IP valuations has been increasing over the years.[5] The two main associations that are most often engaged in IP valuation are the Thai Valuers Association (TVA) and the Valuers Association of Thailand (VAT).

- **Thai Valuers Association**

The Thai Valuers Association serves as the center for publishing guidelines, knowledge, and related information in relation to valuation of assets, including IP. Its objective is to promote and support personnel and thereby develop the quality of valuation and the profession.

- **The Valuers Association of Thailand**

The Valuers Association of Thailand (VAT) was established with cooperation from the Land Department and other related governmental agencies, financial institutes, professional associations, and educational associations on January 30, 1986. The main objective of the VAT is to promote personnel and develop the valuation profession in cooperation with the ASEAN Valuers Association and other institutions, both domestic and international. In addition, the VAT supports the research and distribution of information, by organizing educational seminars on the topic of valuation of property, providing advice and reviewing disputes on valuation-related issues among members and related agencies, as well as

3 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

4 Thailand Development Research Institute, "Report on IP Valuation Program," 2017.03.

5 Interview with a researcher from Thailand Development Research Institute, May 2022.

establishing rules, regulations, and etiquette for the valuation profession.[6]

According to this research team's discussion with a professional valuer company in Thailand, the volume of IP valuation being conducted by the firm, when compared to other types of valuation, is assessed at around 20%, with a trademark valuation being done approximately every one to three months, and a patent valuation being done one to two times a year.[7]

However, it should be noted that the ecosystem of IP valuation in Thailand is not yet well established to facilitate IP financing. There is no publicly available IP transaction database on IP valuations conducted in Thailand. In addition, data on IP assets are not synchronized, not in real time, and are manually updated by the government authorities. Furthermore, there are insufficient incentives for IP owners or financial institutions to conduct IP valuations, which are costly for small to medium businesses. Therefore, IP valuations are conducted normally by large companies and information on the value of their IP assets is kept confidential.

4.2.4. Malaysia

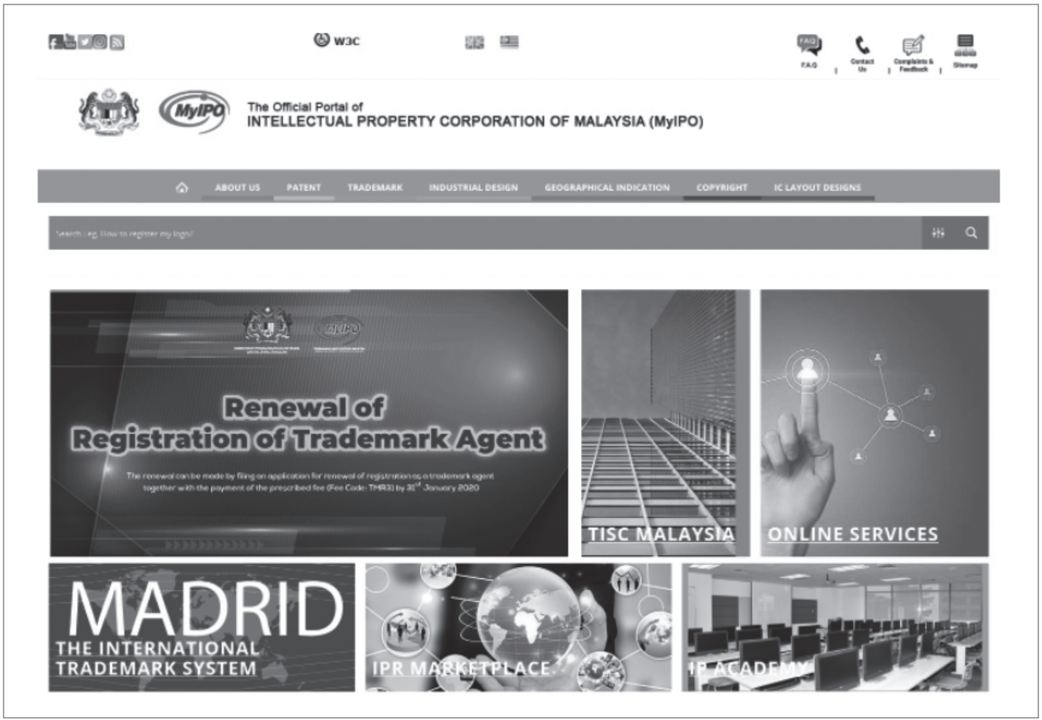
The Intellectual Property Corporation of Malaysia (MyIPO) provides consulting services for patent, design, and trademark examination and registration (including copyright and geographical indication) and conducts public relations activities on intellectual property to educate the public. It is a government organization under the Ministry of Domestic Distribution and Consumer Protection, and is a responsible operating organization such as the UK Intellectual Property Office, which has autonomy in managing personnel, finance, and accounting.

As a judicially independent institution, the institution's decisions on granting, refusal, and revocation of intellectual property rights are understood as quasi-judicial judgments, not administrative dispositions.

6 The Valuers Association of Thailand, "About Us," [https://vat.or.th/about-us/] (accessed on May 31, 2022)

7 Interview with a professional valuer company in Thailand, May 2022.

[Figure 2-21] Landing Pages of MyIPO



Source: https://www.myipo.gov.my, reorganized.

- **(Support Policy)** MyIPO has been involved in the IP valuation, IP financing and IPR marketplace initiatives. Following the announcement of the 2013 budget by the government, MyIPO received MYR 19 million to conduct the initiative.
- **(Web-based Valuation Systems and Reference DBs)** Not applicable
- **(IP Valuation Models)** In 2013, an IP Valuation Model (IPVM) was developed in collaboration with foreign IP valuation experts and local IP experts. The IPVM's identification process is designed to assist the lender in identifying business for which RR (as one of Income Approach) might be suitable as a primary valuation methodology.

In general, there is no standard IP valuation system being practiced in Malaysia. At present, a few IP valuation systems, guidelines and models are being introduced and practiced in Malaysia as in the following list:

- IP Valuation Model by MyIPO
- Guidance Notes to Intangible Asset Valuations published by RISM
- Business Valuation Guidance Notes by BVAM
- SIRIM STANDARD: Guidelines For Technology Commercialization (SIRIM 34:2020)
- Intellectual Property Valuation Manual for Academic Institutions prepared by Ashley J.

Stevens for the World Intellectual Property Organization (WIPO), Geneva, Switzerland, March 2016

From 2013 to 2016, MyIPO was engaged in the IP valuation, IP financing and IPR marketplace initiatives. Following the announcement of the 2013 budget by the government, MyIPO received MYR 19 million to conduct the initiative. The following are the initiatives and achievements during that period:

- Developed an IP Valuation Model (IPVM) to enable the valuation of IP rights. The IPVM is developed for use by potential lenders in the financial sector who are considering lending to SMEs with low tangible asset backing.
- Produced 23 trained and certified local IP Valuers (two batches of candidates with a total of 53 participants attended the training). The participants need to pass the examination and complete the group assignment to be considered Certified IP Valuers.
- Created the IPR Marketplace as a platform for IP rights transactions (Please visit http://iprmarketplace.myipo.gov.my/ for further information)
- Conducted IP valuations for SMEs that were selected and considered for funding under the IP Financing Scheme managed by Malaysia Debt Ventures (MDV).
- Conducted capability building for stakeholders about IP financing, IP valuation and IPR marketplace especially to support the idea of using IP as a source in getting financing.

Under the same initiative, Malaysia Debt Ventures (MDV) launched IP Financing Scheme (IPFS) in December 2013. Under the IPFS, MDV would provide financing of up to MYR 10 million or 80% of the value of the IP, whichever is lower, to the SMEs. In order for the SMEs to apply for this scheme they needed to have registered and valued IP and they also needed to comply with MDV's product criteria. The IPFS lasted until 2016. Under the scheme, about 20 SMEs have been accepted.

In 2018, the government introduced the Intellectual Property Guarantee Scheme (IPGS) managed by SJPP and the IPGS. The IPGS was formed in 2009 to administer and manage government guarantee schemes under the Second Stimulus Package announced in Budget 2009 that enable Small Medium Enterprise (SME) companies to gain access to financing facilities from financial institutions. However, the performance of the IPGS is unknown. For more details about the scheme, please visit https://www.sjpp.com.my/schemes/archive/intellectual-property-guarantee-scheme-ipgs.

Currently, MyIPO is in the process of developing the National Intellectual Property

Policy (NIPP) 2022-2025. Under the proposed NIPP, a strategic thrust is being developed in leveraging IP assets in the areas of financing, funding, and investments. One of the major features under the thrust is capacity development for IP valuation.

4.3. IP Valuation Models and Web-based Valuation Systems in AMS

From the literature reviews, the four countries in AMS do not hold web-based valuation systems, but it is anticipated that local analysts could carry out field studies and collect relevant data and information regarding the web-based infrastructures.

In case of Singapore, it is known that IP valuation cases are applied to IP transfers, consultancy, etc. In the other three countries of Philippines, Thailand, and Malaysia, there exist few cases of IP valuation and their utilization through each government support policy.

4.3.1. Singapore

There are several IP valuation models that are recognized in Singapore; Cost Approach, Market Approach, Income Approach (Relief from royalty, multi-period excess earnings method), and others (Premium Pricing, Avoided Costs, Option-based).

Singapore does not currently have any web-based valuation systems. The local analyst stated that having a STAR-Value System in Singapore (like the system used in Korea) would indeed be beneficial. From the above research, it is evident that the initial hesitancy or aversion companies have shown toward IP valuation is caused by the upfront costs required to engage professional IP valuers to produce their IP valuation reports. This is further exacerbated as there does not seem to be (or has already been retired) any scheme and/or grant that would assist companies to procure the said IP valuation reports.

The requirement, however, that companies using the online IP valuation system still need to engage "expert[s] to maximize accuracy of the data" could still be costly and prohibitive to the applicant companies. This research team's suggestion therefore would be to have experts associated with or directly employed by the Online IP Valuation System to provide assistance to companies at a low or nominal fee (referred to as "System Expert").

The System Expert will also have the ability and responsibility to scrutinize all the data input by the applicant companies to ensure its accuracy, and ultimately the credibility of the resultant IP valuation report (i.e., this is an effort to prevent any inadvertent or fraudulent inflation of the value of the target IP).

From the local analyst's survey in Singapore, we recognize that having a preferred/standard IP valuation model (or models, with the maximum being two preferred models) would be beneficial in Singapore. As mentioned previously, due to the independent and scattered nature of IP valuers, it is up to their discretion and familiarity when it comes to applying/using a suitable IP valuation model during the valuation process. Having guidance on which IP valuation model to use would therefore bring uniformity and certainty to the IP valuation ecosystem in Singapore. As for the exact Model(s) to use, it is necessary to assess if the Discounted Cast Flow (DCF) model and/or the Relief from Royalty (RR) model are suitable for Singapore, or whether localization or alternative models are required.

4.3.2. Philippines

In Philippines, the IP valuation reports are not currently published nor is it required to be filed with any government agency unless in support for a transaction. The DOST-TAPI requires a Fairness Opinion Report for IPs that received government funding and are for profit. In such instances, the businesses holding the IPs will have to enter the process of Fairness Opinion evaluation to ensure that the government receives its fair share in the IP commercialization and thereby recoup its investments.

The DOST-TAPI is a depository of these valuation reports and fairness opinions, but these reports are not made available to the public. According to the estimates of Mr. Caezar Arceo, there may be over 300 valuation reports and fairness opinions in their archives.

The number of "qualified" IP valuers in the Philippines is still limited. Both the DOST-TAPI and the IPOPHL regularly conduct training programs that build the capability of IP practitioners engaged in valuation.

Usually, the IP valuation specialists come from professional services organizations and appraisal companies. However, local appraisal companies are more experienced in valuing tangible assets like real estate rather than IPs. Professional services firms like PwC, Deloitte, E&Y and KPMG are more experienced and have access to specialists.

IPOPHL also plans to put together a database of IP experts. Currently, no accreditation process is in place yet.

Regarding the Status of DB construction (by private/public sectors) for IP valuation (e.

g. financial information by company/industry; transaction cases (e.g., royalty rates, deal values), there are only a couple of online databases that are available to the public. One is the patent search database where inventors can register their patents and allow other stakeholders to check if patents for certain technologies have been granted already. The second is the IP Depot, which is a digital platform for IP owners to promote their registered IP assets. Both databases do not have requirements to disclose the valuation of the IPs concerned.

The DOST-TAPI also has a database of valuation reports and Fairness Opinions reports, though this is not online and not available to the public. The database has information on the minimum/maximum value of IPs, royalty rates, upfront fee, etc.

DOST-TAPI also has an offline and online database, (System for IP Applications and Grants) SIPAG and iSIPAG, respectively. The SIPAG is an offline tool for managing, evaluating, and monitoring granted and filed IPs. On the other hand, the iSIPAG is the online version of the SIPAG that improves access and enables easier monitoring of IP applications for the clients. (http://www.tapi.dost.gov.ph/news/64-dost-tapi-culminates-technology-transfer-and-commercialization-projects)

For IP valuation in Philippines, an appropriate valuation approach is selected depending on the type and the stage of development of the IP asset that is being valued. Usually, if the IP is ready for commercialization or is generating cash flows, the Discounted Cash Flow (DCF) approach is used. The Relief from Royalty (RR) method is used particularly when valuing trademarks and brands. The Multi-period Excess Earnings Method (MEEM) is also used if sufficient information is available. Cross-checks such as the market and cost approaches are also used though usually not as primary approaches.

The Philippines currently does not have a web-based IP valuation system. It does not have any software as an auxiliary tool like Korea's STAR-Value for IP valuation and does not have plans to establish one yet. However, according to a representative (Ms. Brianne Nicole Sanchez) from the IPOPHL, they will be open to collaborate if a similar web-based system is made available in the Philippines.

4.3.3. Thailand

In Thailand, web-based valuation systems are not currently in use. There are three main types of IP valuation models that are used commonly, according to the DIP's Guidelines. 8 The three common valuation approaches include the cost approach, the market approach, and the income approach. Details for the common valuation approaches are as follows.

4.3.3.1. Cost Approach

Under the cost approach, the cost of acquiring the IP is used to determine the value of the IP asset, whether it be an invention, product, service, or brand. Factors such as costs involved for conducting research and development, labor costs, personnel costs, machinery and equipment costs, prototype costs, testing and trial costs, and legal costs must be considered. However, the DIP's Guidelines indicate that determining the value of an IP asset based on the initial costs of acquiring the IP asset may only be suitable for the early stages of the development of such IP. Therefore, although the quantitative approach is simpler compared to other valuation approaches, the final value obtained from this type of analysis carries the risk of not always being indicative of an IP asset's actual current value.[9]

4.3.3.2. Market Approach

Under the market approach, an indication of value is provided by comparing the subject IP asset (trademarks, copyrights, patents, trade secrets) with an identical or similar IP asset (trademarks, copyrights, patents, trade secrets), for which pricing information is available. The DIP deems this method to be rather complex considering the differences in each type of IP asset. In addition, as IP subject matter and related information tend to be confidential in nature, there is often a lack of disclosure of the specific details of such IP asset, which results in difficulties when seeking to compare IP assets on the market, especially for IP assets that are considered to be part of a 'niche market'. Therefore, the market approach method is not commonly used in IP valuation.[10]

4.3.3.3. Income Approach

Lastly, under the income approach, the fair value of an IP asset is measured through an analysis of the royalty-based income estimation from either a transaction or license case of similar IP assets. Since the business entity already owns the IP assets, it is waived from

8 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

9 ibid.

10 ibid.

paying a royalty or corresponding upfront/milestone fee, which it would have incurred in case of not holding the subject IP assets. The DIP opines that this method is desirable to be used in business valuations since the value reflects the benefits and results of the IP asset, rather than the initial costs of acquiring such IP. Since the information used to conduct a valuation is comprised of mainly business data, this method is simpler than other methods. However, the DIP's Guidelines recommend that the valuation should be based upon the income's net present value to mitigate any potential risks of rate fluctuation and financial costs that may arise in the future.

4.3.4. Malaysia

The IP Valuation Model (IPVM) in Malaysia was developed in 2013 with the help of a number of foreign IP valuation experts and local IP experts. The purpose of the IPVM is to provide a standardized, Malaysia-specific, and widely accepted valuation method for valuing IP that may be used as collateral in lending. The IPVM is developed for use by potential lenders in the Malaysian financial sector who are considering lending to SMEs with low tangible asset backing.

Statistics, both Malaysian and international, show that the value of intangible assets (including IP) has increasingly become the primary contributor to business value. IP is a driving force for economic growth and development and has become increasingly important to the Malaysian economy.

The IPVM focuses on the identification of suitable businesses and IP, the process accepted for valuation of the IP, as well as the standard reporting process for an IP valuation that is performed for lending purposes. The IPVM is intended to be consistent with internationally accepted accounting standards including IFRS, IVS, and ISO. The IPVM's identification process is designed to assist the lender in identifying businesses for which a Relief-from-Royalty (RR) approach might be suitable as a primary valuation methodology. The RR is an income-based valuation approach and is commonly used in the valuation of IP for lending purposes. The RR approach determines the present value of the IP by applying a market royalty rate to a projected future income stream, which is the hypothetical relief from payment that the business derives because it owns the IP. The business and the subject IP must be screened appropriately to ensure that an RR method is appropriate for the IPVM to be used.[11]

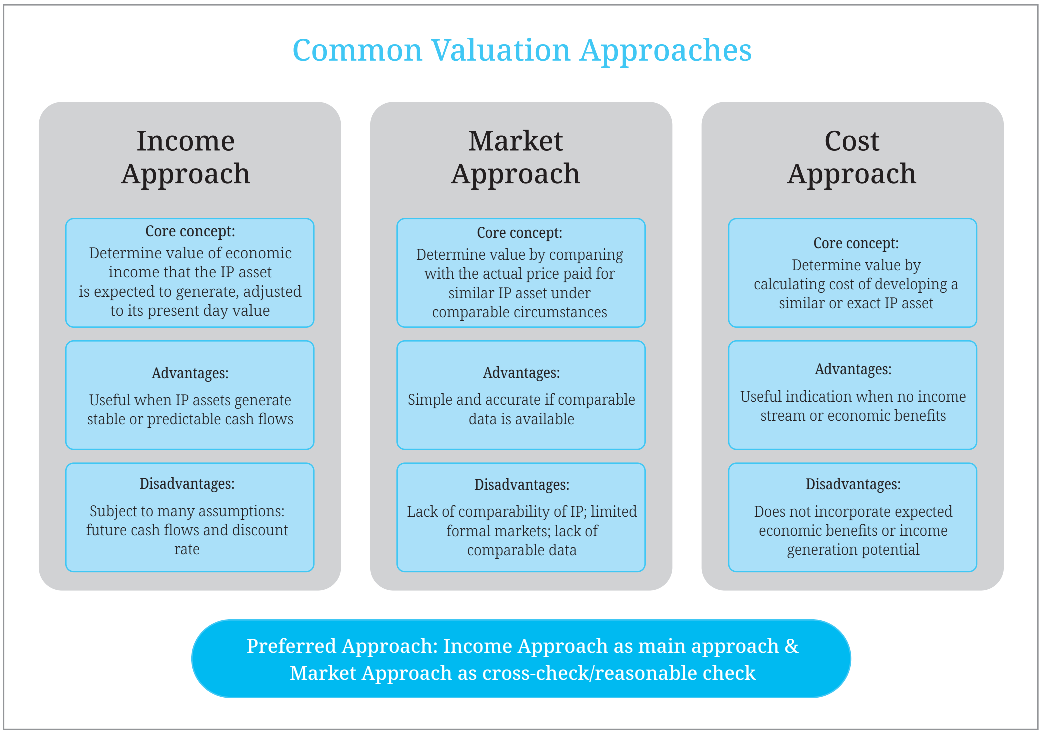
Even though the IPVM is mainly used for the purpose of lending with IP as collateral,

11 IP Valuation Model by MyIPO

the same approach and method can also be applied to other valuation purposes. Other reasons for IP valuation to be conducted include Merger & Acquisitions, rationalization and assessment of IP portfolio, taxation (including transfer pricing) monetizing IP (including licensing and franchising), collaboration, sale and purchase of businesses or IP assets, joint ventures or strategic alliances, technology transfer, donation of IP assets, collateral in financing or IP-backed securitization, insurance of IP assets, calculating damages in litigation, bankruptcy, or liquidation.

According to the IPVM, there exist three main valuation approaches in Malaysia as shown in [Figure 2-22].

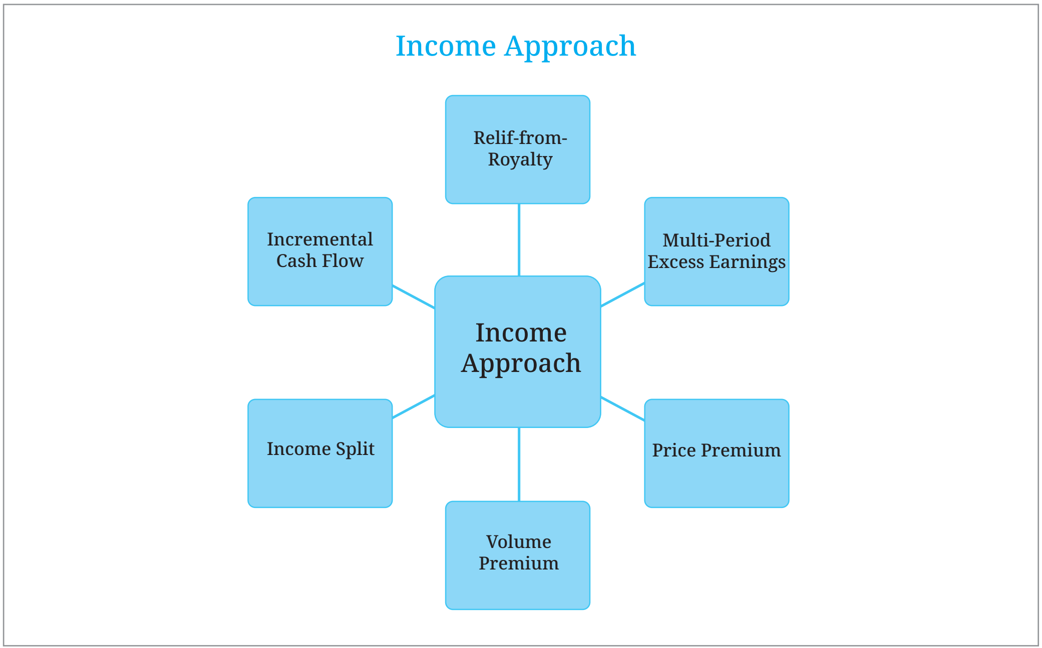
[Figure 2-22] Common Valuation Approaches in Malaysia



Source: Brochure of IP Valuation Model (MyIPO, 2022), reorganized.

However, the income approach is preferred as the main approach and the market approach is used for cross-check or reasonable check. The Income Approach is also comprised of a few techniques. The following diagram shows the list of the techniques.

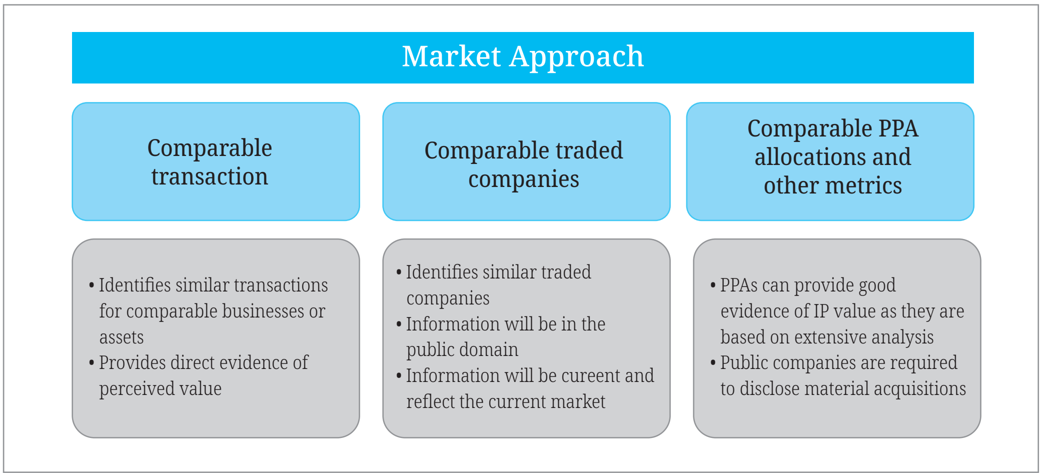
[Figure 2-23] Income Approach in Malaysia



Source: Brochure of IP Valuation Model (MyIPO, 2022), reorganized.

The market approach consists of a few techniques as described in the following diagram.

[Figure 2-24] Market Approach in Malaysia



Source: Brochure of IP Valuation Model (MyIPO, 2022), reorganized.

Local analysis for IP valuation in Malaysia revealed that 'Guidance Notes to Intangible Asset Valuations' was published by RISM in 2017. A few MyIPO-certified IP valuers have been accepted as members of RISM. The valuers developed "Guidance Notes to Intangible Asset Valuations" published by RISM in 2017. The Guidance Notes can be purchased from RISM with a prescribed fee. For further details on the Guidance Notes, please refer to the RISM website at https://rism.org.my/index.php.

In addition, 'Business Valuation Guidance Notes by BVAM' is contained in the Malaysian Valuation Standards Sixth Edition 2019, introduced by BVAM. A copy of the Guidance Notes can be retrieved from the site: https://bvam.org.my/?page_id=716.

Next, we will investigate 'SIRIM STANDARD: Guidelines for Technology Commercialization (SIRIM 34:2020)'. SIRIM Berhad is a premier industrial research and technology organization in Malaysia and a national enterprise of the Malaysian Government.

SIRIM Berhad is also a premiere service provider in quality and technology innovations that best operates and manages the business value chain. Its principal roles include regulating the standards, facilitating revival of businesses to improve the productivity and technological competitiveness, guaranteeing the consumers' health and providing flexible choices for products and services with high quality.

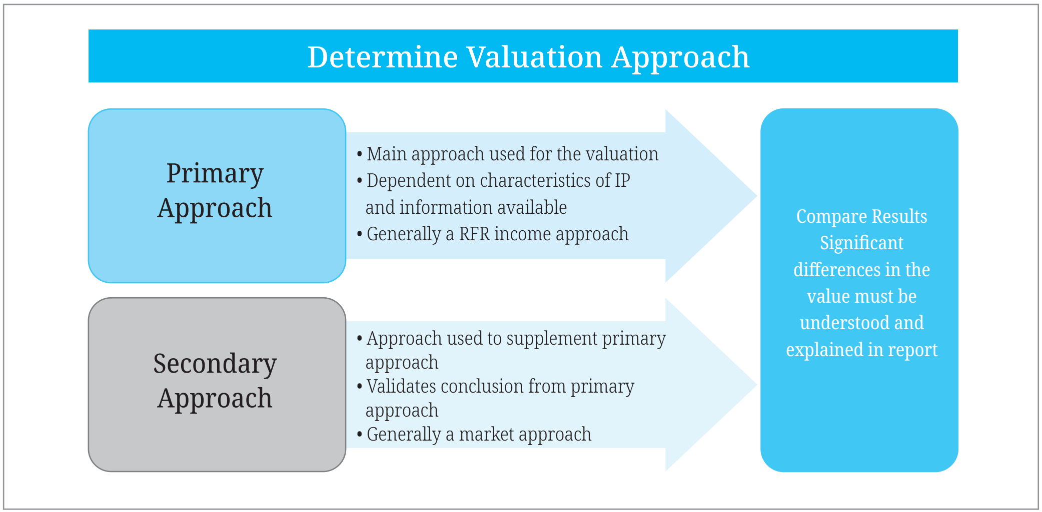
As a standards development organization with in-depth expertise in SIRIM Standards, SIRIM Berhad has years of experience in standardization and consulting for domestic and international requests.

SIRIM Standards are intended to be used by the public and private sectors, institutions of higher learning, research institutions, industry-specific research organizations and any other interested organizations, regardless of sector, size, or type, aiming to implement technology commercialization practices.[12]

As mentioned earlier, the IP Valuation Model (IPVM) uses the income approach as the main approach and uses the market approach as a cross-check. The diagram below explains the idea:

12 https://standards.sirimsts.my/catalog.php

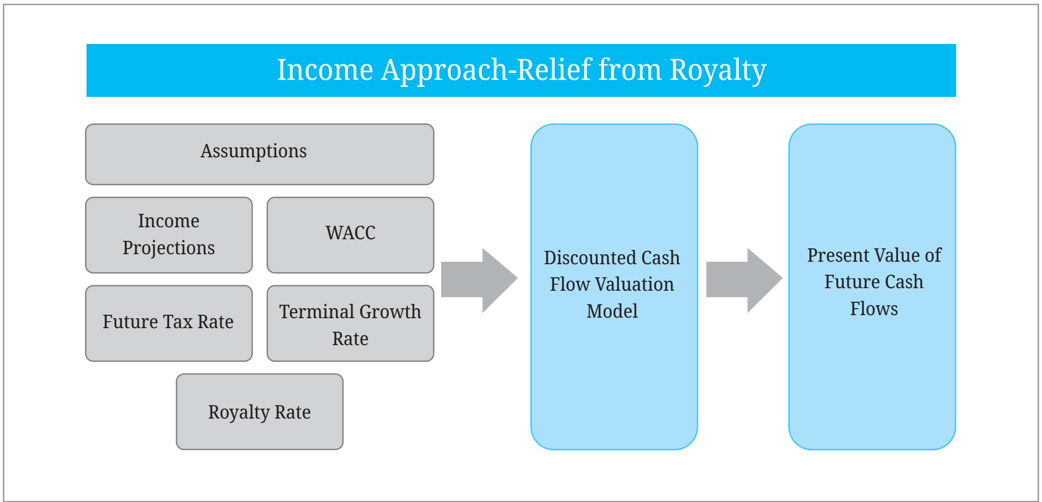
[Figure 2-25] How to Determine Valuation Approach in Malaysia



Source: Brochure of IP Valuation Model (MyIPO, 2022), reorganized.

In general, the Relief from Royalty (RR) technique is used among other techniques within the income approach. The RR approach determines the present value of the IP by applying a market royalty rate to a projected future income stream, which is the hypothetical relief from payment that the business derives because it owns the IP. The diagram below explains the parameters and assumptions used in conducting IP valuation using the RR method.

[Figure 2-26] Valuation Procedure in Malaysia



Source: Brochure of IP Valuation Model (MyIPO, 2022), reorganized.

By producing the income projections of the IP, calculating the Weighted Average Cost of Capital (WACC) of companies in the same technology domain, considering the royalty rate, the terminal growth rate and the future tax rate, a Discounted Cash Flow valuation model is generated, and the Net Present Value (NPV) is calculated based on all the assumptions. The NPV is considered to be the value of the IP on the date of valuation. A detailed explanation of the IPVM is provided in the attached copy of the IPVM. A sample valuation report is also provided in the attached IPVM in Appendix 7 of the IPVM. As mentioned before, currently there is no web-based system available in Malaysia.

5. Conclusion and Policy Recommendations

5.1. Application Feasibility of Korean IP Valuation Models and Web-based Valuation Systems

In case that the four countries in AMS mentioned above do not have web-based IP valuation infrastructures, but have patent, financial and non-financial data for preprocessing to the meta DBs, there might exist the appropriate solution to establish a new system or import the Korean web-based infrastructure in a way that is suitable for each country's business environment and IP utilization strategies.

This research team believes that the development and establishment of essential information ("Database" or "DB") would be extremely crucial for the establishment of IP valuation systems in Singapore. Parties with such information (or with the ability to obtain, collect and collate such information) should be identified in a bid to have such a DB set up. For example, the IPI, which manages an online Tech Marketplace could be identified as the right entity within Singapore for such a purpose. This is because the IPI would be privy to certain types of essential information (e.g. pricing of IP, transacted prices of IP and potentially the financial information of the disposing/purchasing companies).

Regarding the IP valuation status in Philippines, there exist no reference information databases or a web-based system for IP valuation, but the government agencies are willing to export or customize the Korean web-based IP valuation system suitable for Philippines, if available.

In case of the Thai Department of Intellectual Property (DIP), it has IP management tools, specifically, IP registration and enforcement databases on trademarks, copyrights, patents, and petty patents. Additionally, the IP&IT Court in Thailand has litigation case databases containing information on IP- and IT-related cases and court proceedings. Currently, there is no specific IP valuation database or web-based valuation system available to the public in

Thailand. However, there is a manually updated database for security contracts held by the DBD, which is used when utilizing IP assets as collateral for obtaining loans.

In Malaysia, external sources/databases are being used to obtain the royalty rates and deal values. As for the royalty rates, databases such as Royalty Source, ktMine and RoyaltyStat are being used. As for financial information, S&P Capital IQ database and Refinitiv Eikon (Thomson Eikon) are being used. However, a web-based valuation system could be more applicable and useful in Malaysia, if knowhow for the Korean system implementations would be transferred or customized or established appropriately.

5.2. Plans for Application of IP Valuation Framework among ASEAN Member States

After the local analysts' studies to gather information and online/offline conferences between our research groups and AMS parties in charge of IP valuation and consultancy, we expect that the utilization achievements of IP valuation would be enhanced for physical commercialization outcomes.

ASEAN Member States (AMS) are deeply interested in strengthening mutual cooperation in the area of IP rights according to AEC Blueprint 2025. AMS wishes to promote IP commercialization and inter-agency coordination in the IP rights market, by enhancing awareness regarding the necessity of IP valuation support programs or relevant infrastructures to assist SMEs or startups with IP consultancy services.

Our research group has in-depth expertise in IP valuation theory, models, and best practices, and aims to enhance the awareness of AMS regarding the importance of IP valuation, by introducing IP valuation models and the web-based valuation systems used in Korea. Furthermore, we intend to deliver the value of IPR as financial assets and introduce methods to apply valuation results to the fields of commercialization with various goals (e.g., IP transfers, financial loans). We will support the AMS officers in charge of IP valuation and commercialization and provide substantial mentoring to establish and/or customize the IP valuation framework best suitable for their current situations in ASEAN IP markets.

In this report, we introduced leading Korean web-based valuation systems (*STAR-Value, KPAS) and the various types of reference information databases. Further, we described both the structures and features of the above-mentioned web-based services, and demonstrated the utilization cases for business development in Korea. In addition, we provided an analysis of IP valuation situations in four AMS countries (Singapore, Philippines, Thailand,

and Malaysia), based on the data and information collected by local field specialists or consultants. Going forward, we will provide mentoring to AMS officials and guide them in establishing the support infrastructure or framework for IP valuation best fit for each country's IP market status. If necessary, after receiving feedback from AMS regarding the issues for which support is desired, or propose methods to import the Korean IP valuation framework and utilization practices for future benchmarks.

Further, we would move toward assisting the other ASEAN countries besides the four above, if we are able to develop guiding strategies and comments to establish IP valuation frameworks and transfer practices and knowhow for countries such as Viet Nam, Cambodia, Indonesia, etc.

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03

CHAPTER

Korean IP Valuation Case Studies and Implications

Jongtaik Lee (Korea Institute of Science and Technology Information)

1. Introduction
2. Korean IP Valuation Case Study
3. Implications for IP Valuation in ASEAN Member States
4. Conclusion and Suggestions

Keywords
Technology Valuation, Intellectual Property Valuation, Technology Commercialization, Valuation Case Study, Web-based Valuation System

Korean IP Valuation Case Studies and Implications

Jongtaik Lee (Korea Institute of Science and Technology Information)

Summary

The goal of this research is to deduce implications related to the development of an IP valuation framework in ASEAN countries in the future by grasping the characteristics of the published valuation reports in Korea and reflecting and incorporating them into the intellectual property management and valuation systems in ASEAN countries.

First, by referring to Korea's practical guidelines for technology valuation, an 'appropriate' in-depth report is selected and analyzed. Through the report case, the research team analyzes the procedure for valuating technology value and explains the method to determine key points (variables). Both in an in-depth valuation and in simple online valuation, the necessary information (DB) is identified and step-by-step analysis is performed.

IP valuation utilizes various models within the cost approach, market approach, and income approach. The research team tried to find cases of IP valuation reports applying the most utilized representative valuation models in Korea, viz. the Discounted Cash Flow (DCF) model and Relief from Royalty (RR) model.

Discounted Cash Flow (DCF) model is by far the most widely used company valuation method. The model estimates cash flow for a set period and discounts it to a present value with risk factors. The same model can be applied in technology valuation, by discounting cash flow expected from a subject technology to determine business value and adjusting it with technology contribution ratio. In other words, the DCF model calculates technology value as the present value of Free Cash Flow (FCF) during the subject technology's expected economic lifespan multiplied by Technology Factor (TF).

Cash flow can be estimated largely in three ways. The user can (1) enter a set value that best suits their business plan on their own; (2) estimate cash flow using financial information of similar companies; or (3) do so using financial information of similar industries.

The research team explains the valuation procedures and key points (variables) in the report and analyzes how to reflect them in the valuation process. It also describes how to apply the logic of the valuation model to the report. It is necessary to analyze the difference between the in-depth valuation report and the simple (online) valuation report, and source essential information (DB) for calculating IP values.

The Relief from Royalty (RR) model calculates a subject technology's value by estimating the appropriate royalty rate of the technology based on transaction (licensing) records for similar technologies. The model, a combination of the market approach and the income approach, revolves around the amount of royalty a licensee would pay when acquiring the rights involved, rather than developing the technology on their own. The licensor and the licensee would refer to past transactions to determine their royalty rate and apply the rate to the expected profit from commercialization of the subject product implementing the technology.

The first step of the model is to determine the royalty rate. Useful data here includes corporate internal data on past licensing, data on royalty rates by industry or technology field, as well as data from companies holding royalty rate databases. Once a rate is determined, other variables such as expected profit and relevant risks (in the form of discount rate) would also be considered.

Understanding the current status of IP management and valuation in ASEAN member states is an analysis that should be performed to derive implications for the development of IP valuation models and related systems in ASEAN countries.

Through collaboration with local experts, the local situation regarding intellectual properties in ASEAN member states was identified and related information was collected. More specifically, local consultants were requested to provide information on ASEAN member states' IP management and valuation status. In addition, the local consultants were requested to investigate the government policy related to IP valuation in the ASEAN member states and the direction of IP related support for SMEs.

After identifying the current status of local IP management and IP valuation in ASEAN member states in collaboration with local experts and analyzing IP valuation case studies of Korea, this research team proposes matters to consider when developing an IP valuation framework in ASEAN member states according to local ASEAN member states' intellectual property database, valuation model and the development status of related systems.

In order to develop models and systems to perform IP valuation effectively, it is necessary to establish the DB to be used in the model. Representatively necessary DBs include the economic life DB of technology, financial information by company, financial information by industry, and running royalty rate. In some countries, the above-mentioned data are already well organized, and some other countries may not have the data organized into DBs that are easy to access. Especially in countries that do not have well organized DB, the establishment of related DBs will be the first step toward IP valuation. The direction of development of the model is expected to vary depending on the type of DB that can be used and how well organized the DB is.

Since the DB required for valuation has already been established elaborately and various models using it have been well developed in Korea, it is expected that valuation models and DBs can be developed according to the development level of each country by referring to Korean IP valuation models and related systems.

Policy suggestions for ASEAN member states are as follows.

It is necessary to develop a government-led IP valuation practice guide.

It is also necessary to increase the reliability of the valuation results by developing the valuation model and the DB to be applied to the model at the government level. In particular, it is important to collaborate with organizations that collect and analyze DBs such as financial information and deal values to be used in applying the model. If necessary, cooperation with private companies dealing with such DBs or the establishment of public institutions that collect such DBs should be considered.

It is advisable to expedite the development of models and related essential DBs by conducting consulting projects with advanced IP valuation countries such as Korea, which has already conducted and utilized IP valuation nationwide for decades.

In addition, it may be necessary to make related parties perform IP valuation when governmental fund is provided for IP-based collateral or as part of any IP-based governmental support. In this case, active cooperation with financial institutions is essential.

In addition, if AMS countries intend to quickly support small and medium-sized enterprises using IP, it may be necessary to develop a 'quick' service system such as an online valuation system. Furthermore, in order for IP valuation to settle early in ASEAN member states, the concerned governments are required to establish an IP valuation support policy such as providing full or partial supports for valuation cost.

1. Introduction

1.1. Purpose and Background

Intellectual Property (IP) is a potential tool for ASEAN member states to participate and compete in domestic and foreign markets. Active utilization of IP-based commercialization and IP collateral can contribute to the development of the national economy and help SMEs financially, through the development of IP valuation models and the related framework and strategic cooperation with government and financial institutes.

Further, it is necessary to derive implications for the development of national intellectual property valuation framework for ASEAN Member States through analysis of IP valuation cases in Korea. Identification and analysis of valuation reports that apply Korea's representative IP valuation methodology and sharing such analysis with ASEAN countries will be helpful.

By grasping the characteristics of the valuation reports published in Korea and reflecting and incorporating the best practices into the current status of intellectual property management and valuation in ASEAN countries, implications for the development of IP valuation framework in the future are derived in this report.

1.2. Scope of Research

1.2.1. Scope of Study

Korean IP valuation cases that can serve as references in the development of the IP valuation framework for ASEAN member countries were collected and analyzed. Through case analysis, implications for the development of IP valuation frameworks for ASEAN member states were derived.

1.2.2. Subjects and Contents of Analysis

Korean IP valuation cases (reports) were collected and a couple of representative reports were selected, and the current status of IP valuation reports published by technology valuation agencies in Korea was investigated. Representative IP valuation reports were selected according to valuation models used widely in Korea that can be shared with ASEAN countries. In summary, in order to perform the analysis, IP valuation report cases applying the representative valuation model [Discounted Cash Flow (DCF) method and Relief from Royalty (RR) method] with the highest utilization in Korea were identified.

The background of application of the above two valuation models is described by model, and the characteristics of reports by valuation model are analyzed based on this.

As the first step to derive implications related to IP valuation in line with the current status of the ASEAN member states, the current status of intellectual property management/ valuation and related systems in ASEAN countries is identified.

In addition, the research team investigated the existence and characteristics of agencies in ASEAN countries demanding valuation and agencies performing valuation of intellectual property rights, and identified the existence and characteristics of valuation models and their related systems for valuation.

Furthermore, the essentials for the development of the ASEAN IP valuation framework are analyzed, and Korean valuation know-how (e.g. know-how when it is necessary to reflect the characteristics of industry) and the position of valuation demand institutions are reflected in the analysis.

Through the analysis of IP valuation cases in Korea, the characteristics of reports by model are identified, and the current status of national intellectual property evaluation in ASEAN countries is reflected to derive matters to be considered when developing the IP valuation framework in ASEAN Member States.

In addition, the research team will find out whether cooperation between ASEAN member states is possible to create synergy for the valuation model and development of related systems.

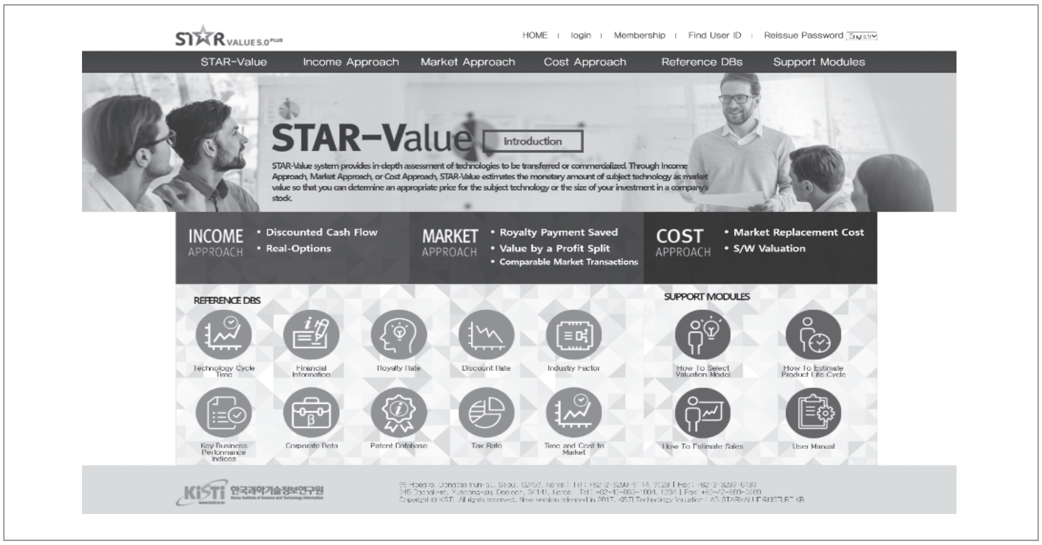
2. Korean IP Valuation Case Study[1]

2.1. Methods for Collecting and Analyzing Cases

2.1.1. How to Collect Cases

This research team identified a group of report candidates to collect IP valuation reports filed in Korea. Representative candidates for IP valuation reports in Korea include reports managed by Korea Institute for Advancement of Technology (KIAT, a public institution under the Ministry of Trade, Industry and Energy) and Korea Invention Promotion Association (KIPA, a public institution under the Korean Intellectual Property Office).[2] In addition, reports on the valuation results of the STAR-Value system (online valuation system) developed, operated, and managed by Korea Institute of Science and Technology Information can also be considered a representative case in Korea.[3] Since STAR-Value is the first online IP valuation system developed in the world and the only national IP valuation public service in Korea, the STAR-Value valuation case was selected as a target for analysis because there were no other online valuation cases or the ones available seemed inappropriate for the purpose.

[Figure 3-1] Online Valuation System of KISTI (STAR-Value System)



Source: STAR-Value Homepage, KISTI (2022).

1 Refer to the report considering that it may be somewhat difficult to fully understand the detailed contents of this case analysis due to the confidentiality of IP valuation. Please refer to the analysis components, table of contents, analysis flow, analysis techniques, and methods of deriving key factors, rather than specific contents of technology.

2 The results of the valuation status in Korea are included in topic 2 (Introduction to IP Valuation in Korea and its Current Status).

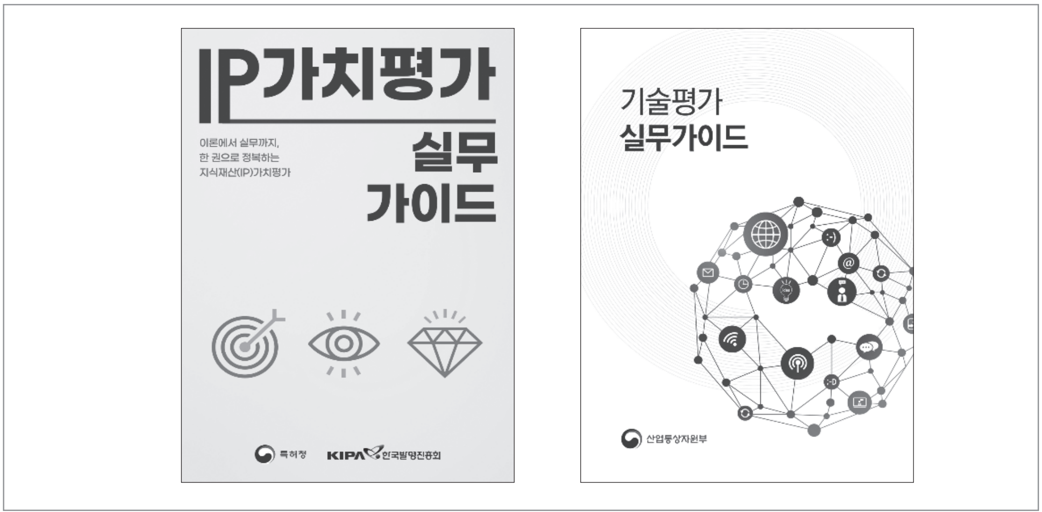
3 Refer to topic 2 (Introduction to IP Valuation in Korea and its Current Status) for the purpose, use, and status of STAR-Value develoment.

Since most of the valuation reports issued by the technology valuation agencies are confidential data, it is necessary to identify reports that can be shared with the ASEAN member states.

2.1.2. How to Analyze Cases

First, representative cases of the valuation reports in Korea are selected from both offline (in-depth) and online systems. IP valuation utilizes various models under the cost approach, market approach, or income approach.[4] This research team tried to find cases of IP valuation reports applying the representative, most utilized valuation models in Korea, viz. the Discounted Cash Flow (DCF) model and Relief from Royalty (RR) model. Through the analysis of the Technology Valuation Practice Guide published by the Ministry of Trade, Industry and Energy of Korea and the Korean Intellectual Property Office, the direction of writing technology valuation reports in Korea is identified, and the 'proper' reports are selected in compliance.

[Figure 3-2] Technology Valuation Practice Guide



Source: KIPA(left), KIAT(right) (2021).

The background for application of the representative valuation models is analyzed according to the characteristics of the two models, and report cases that reflect it the best are selected. Where possible, the valuation report provided both offline ('in-depth' valuation report) and online ('simple' valuation report) analysis. Samples of each are selected so that the ASEAN member states can refer to their model as an in-depth or a simple valuation

4 Refer to topic 1 (Introduction to IP Valuation and Current Status of IP Valuation in ASEAN Member States) and topic 2 (Introduction to IP Valuation in Korea and its Current Status) for the detailed characteristics of each approach.

model when developing valuation models. This research team analyzes the valuation reports in depth. The valuation procedure and key variables of the two representative valuation models (discounted cash flow and relief from royalty) are analyzed by referring to the Korean Technology Valuation Practice Guide.

[Figure 3-3] Discounted Cash Flow Model Procedure

Step	Main Contents
Technology Summary	0. Basic information: technology owner, purpose and date of valuation, Korean Standard Industrial Classification (KSIC), National Standard Classification of Science and Technology (NSCST), whether the technology is patented 1. Subject technology (patented/unpatented): title and description 2. Period during which profit is expected 3. Similar companies: search by product, apply industry financial ratio 4. Financial information: year range, company size and type, risk-free interest rate, anticipated level of operating profit 5. Time and cost to market: select currency of expenses and determine time and cost to market 6. Profit strategies
Analyze Market and Cost Structures	Growth trend of the market: Estimate the annual growth rate based on growth trend of the industry and similar companies Predict market size: Apply financial ratios of similar companies or similar industries, or insert data yourself Estimate profit structure: Apply the financial ratios of similar companies or similar industries, or insert data yourself
Produce Estimated Balance Sheet	Estimate profit and loss in pre- and post-launch phases Post-launch: Apply the financial ratios of similar companies or similar industries, or insert data yourself
Estimate Cash Flow	Estimate cash flow in pre- and post-launch phases Post-launch profit and loss: Apply financial ratios for similar companies or similar industries, or insert data yourself
Estimate the Discount Rate	WACC method: WACC + Technology risk premium + Size risk premium CAPM method: Cost of equity (by industry) + Rip (risk premium related to intellectual property) + Rcs (risk premium in the commercialization process) Risk-free rate method: Risk-free interest rate + risk premium Insert data
Calculate Business Value	Estimate business value in pre- and post-launch phases Determine the present value factor reflecting discount rate Estimate total business value
Estimate Technology Contribution Ratio	KISTI technology contribution ratio method: looks at the innovation stage and industry characteristics Technology factor method: looks at the industry factor and technology rating
Estimate Technology Value	Estimate present value of cash flow in pre- and post-launch phases Calculate the technology's contribution to profit using technology contribution ratio

Source: Korea Institute of Science and Technology Information (2018).

[Figure 3-4] Relief from Royalty Model Procedure

Step	Main Contents
Technology Summary	0. Basic information: technology owner, purpose and date of valuation, Korean Standard Industrial Classification (KSIC), National Standard Classification of Science and Technology (NSCST), whether the technology is patented 1. Subject technology (patented/unpatented): title and description 2. Period during which profit is expected 3. Similar companies: search by product, apply industry financial ratio 4. Financial information: year range, company size and type, risk-free interest rate, anticipated level of operating profit 5. Time and cost to market: select currency of expenses and determine time and cost to market 6. Profit strategies
Analyze Market Structure	Growth trend of the market: Estimate annual growth rate based on growth trend of the industry and similar companies Predict market size: Apply the financial ratios of similar companies or similar industries, or insert data yourself
Determine & Apply Royalty Rate	Determine royalty rate: Insert data or use Reference Database (royalty rate by industry, sector and customary market practices) Calculate the adjustment factor: Insert weight to apply, evaluate characteristics that affect royalty rates
Estimate Discount Rate	WACC method: WACC + Technology risk premium + Size risk premium CAPM method: Cost of equity (by industry) + Rip (risk premium related to intellectual property) + Rcs (risk premium in the commercialization process) Risk-free rate method: risk-free interest rate + risk premium Insert data
Estimate Technology Value	Calculate sales and royalties after commercialization Adjust for income tax and estimate final technology value as the sum of present value of royalties after tax.

Source: Korea Institute of Science and Technology Information (2018).

The research team determines the valuation procedures and key points (variables) in the report and analyzes how to reflect them in the valuation process. It also describes the method to apply the logic of the valuation model to the report. It is necessary to analyze the difference between the in-depth valuation report and the simple (online) valuation report, and essential information (DB) for calculating IP values.

2.2. Case Study of the STAR-Value Online Valuation System[5]

2.2.1. Theoretical Backgrounds of DCF Model in STAR-Value System

The Discounted Cash Flow (DCF) model is by far the most widely used company valuation method. The model estimates cash flow for a set period and discounts it to a present value

5 The main factors and their detailed meanings are explained in 2.3. in the part titled 'Case Study of an In-depth IP Valuation Report'.

with risk factors. The same model can be applied in technology valuation by discounting cash flow expected from the subject technology to determine business value and adjusting it with the technology contribution ratio. In other words, the DCF model calculates technology value as the present value of Free Cash Flow (FCF) during the subject technology's expected economic life multiplied by Technology Factor (TF). The basic formula is as follows:

$$V = \sum_{t=1}^{T} \frac{FCF_t}{(1+r)^t} \times T.F.$$

V : IP or Technology value
T : Profit period (IP or technology's economic lifespan)
r : Discount rate
$T.F$: Technology Factor (IP or technology contribution ration)

Free Cash Flow (FCF) is equal to Net Operating Profit After Tax (NOPAT) and depreciation less capital expenditure and net change in working capital.

CapEx: Capital Expenditure
COGS: Cost of Goods Sold
SC&A: Seling, General and Administrative Expenses

- FCF_t = NOPAT + Depreciation cost - CapEx - Net change in working capital
  (NOPAT: Sales - COGS - SG&A - Income Tax)
- Depreciation cost: (Depreciation in SG&A and Amortization) + (Depreciation on the Schedule of Cost of Goods Manufactrured)
- CapEx: Net change in Tangible and Intangible Asset + Depreciation
  → Residual value is to be recovered at the end of technology's economic lifespan.
- Net Change in Working Capital: Net change in (Accounts Receivable + Inventories - Accounts Payable)
  → To be recovered in full at the end of technology's economic lifespan.

Cash flow can be estimated largely in three ways. The user can (1) enter a set value that best suits their business plan on their own; (2) estimate cash flow using financial information of similar companies; or (3) do so using financial information of similar industries. Methods (2) and (3) are particularly useful when some or all of the figures affecting cash flow are not available because the subject technology is in its initial stage or its commercialization process has not yet begun.

2.2.2. DCF Model in STAR-Value System

The STAR-Value DCF model has eight steps.

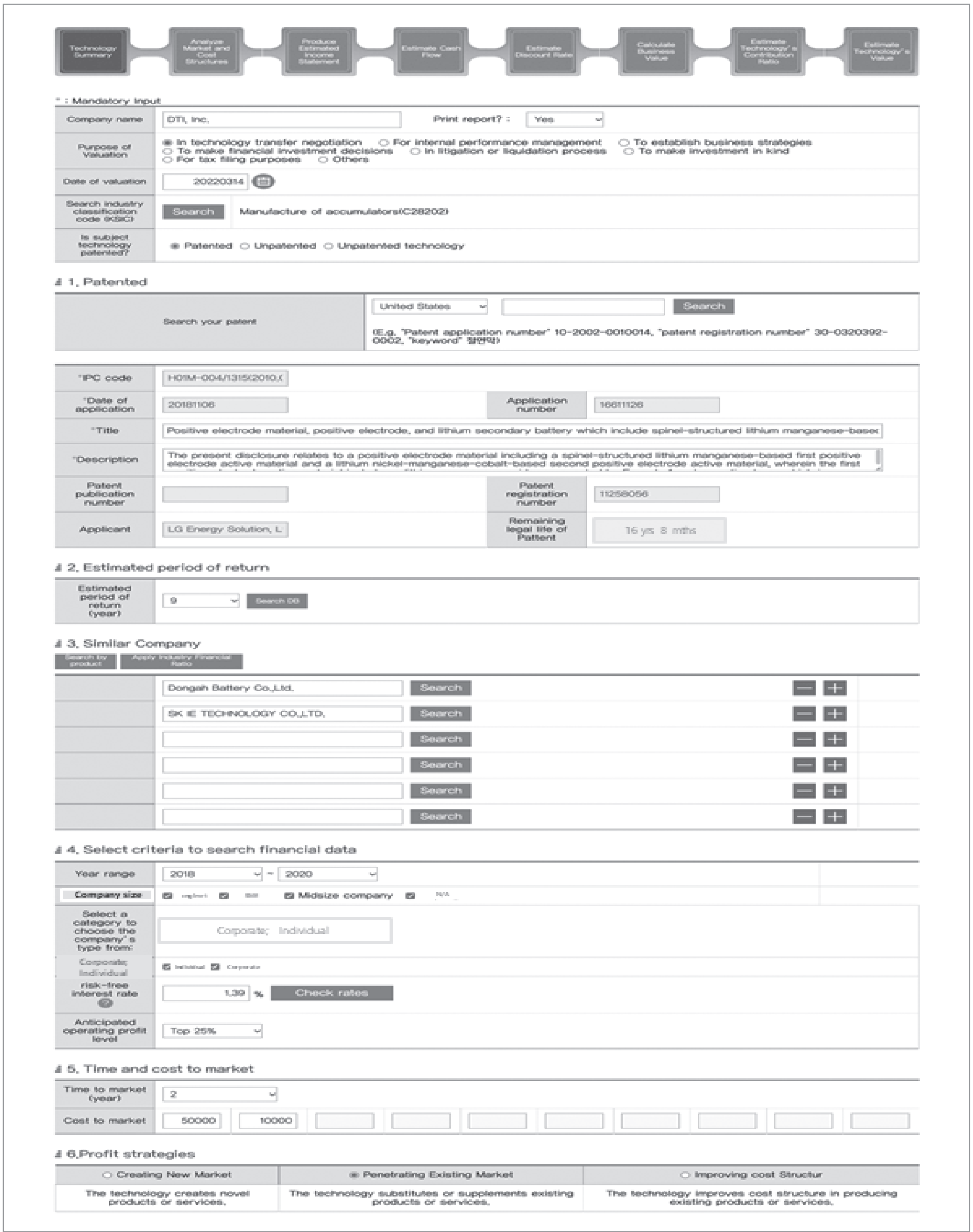
[Figure 3-5] 8 Steps of STAR-Value DCF Model

Source: Korea Institute of Science and Technology Information (2018).

Enter data as required for each step. The data will be analyzed to yield technology value in the final step. The chart shown below is an overview of each step in the DCF model.

2.2.2.1. First Step: Technology Summary

[Figure 3-6] 1st Step of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

“Technology Summary” tab is used to enter basic information that will be used to estimate cash flow. There are mainly six items as shown above.

① Basic Information

Enter data yourself or choose one of the given options for information on the company that holds the title of the subject technology, purpose of valuation, date of valuation, industry that the subject technology belongs to, NSCST (National Standard Classification of Science and Technology) code, and whether the technology is patented. The answer to the last inquiry will determine the output in the section below.

② Profit Period (period during which profit is expected)

In order to estimate cash flow, determine the expected economic life of the subject technology.

③ Similar Companies

Here you will see a list of similar companies whose information can be used as reference when estimating cash flow. Search similar companies using their product names and refer to their financial statements or use the financial ratios of similar industries.

④ Criteria to Search Other Companies’ Financial Data

Limit the search by selecting: year range for financial data, size and type of the searched companies, risk-free interest rate and level of anticipated operating profit.

⑤ Time and Cost to Market

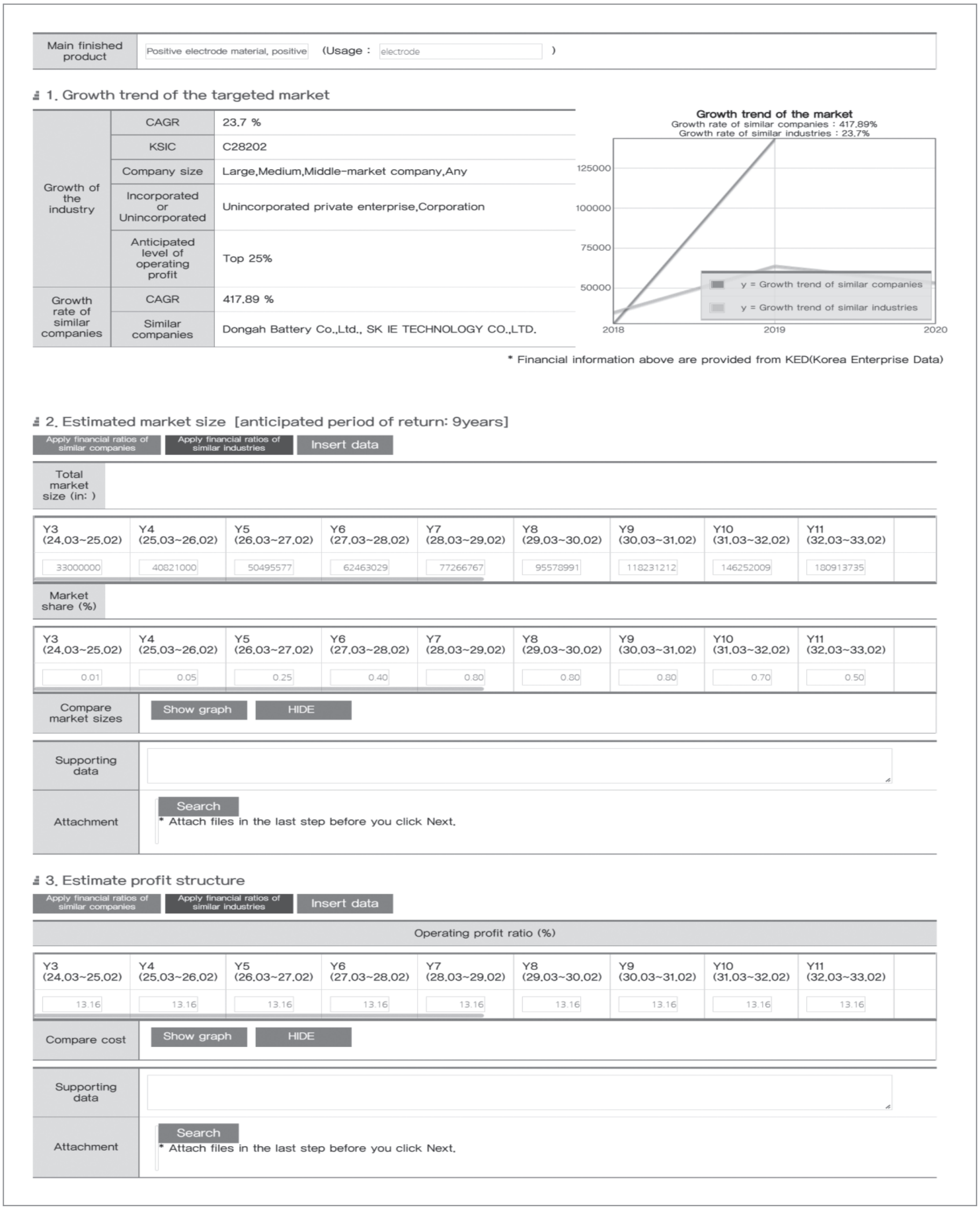
To determine the period during which cash flow is expected from sales and others, the time it takes to get the product to the market must be considered in addition to the profit period in section (2). In other words, the estimated period of cash flow is obtained by adding the time to market to the profit period, i.e. economic life of the technology. Here the user can select the currency they use; the default is set to million Korean Won (KRW). It is also necessary to enter yearly costs during the time before launch.

⑥ Profit Strategies

Select how the product or service employing the subject technology will generate profit: whether by creating a new market, penetrating into an existing one or otherwise.

2.2.2.2. Second step: Analyze Market and Cost Structures

[Figure 3-7] 2nd Step of STAR-Value DCF Model



Main finished product	Positive electrode material, positive (Usage : electrode)

1. Growth trend of the targeted market

Growth of the industry	CAGR	23.7 %
	KSIC	C28202
	Company size	Large,Medium,Middle-market company,Any
	Incorporated or Unincorporated	Unincorporated private enterprise,Corporation
	Anticipated level of operating profit	Top 25%
Growth rate of similar companies	CAGR	417.89 %
	Similar companies	Dongah Battery Co.,Ltd., SK IE TECHNOLOGY CO.,LTD.

* Financial information above are provided from KED(Korea Enterprise Data)

2. Estimated market size [anticipated period of return: 9years]

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

Total market size (in:)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
33000000	40821000	50495577	62463029	77266767	95578991	118231212	146252009	180913735

Market share (%)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
0.01	0.05	0.25	0.40	0.80	0.80	0.80	0.70	0.50

Compare market sizes	Show graph / HIDE
Supporting data	
Attachment	Search * Attach files in the last step before you click Next.

3. Estimate profit structure

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

Operating profit ratio (%)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
13.16	13.16	13.16	13.16	13.16	13.16	13.16	13.16	13.16

Compare cost	Show graph / HIDE
Supporting data	
Attachment	Search * Attach files in the last step before you click Next.

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Estimate sales using market share on "Analyze market and cost structures". You may either use financial ratios of similar companies or similar industries, or insert data yourself to estimate COGS, SG&A and operating profit. There are mainly four items that require your decision.

① Main Finished Product

You will see the name you entered in the Technology Summary tab. Enter the usage of the product below the product name.

② Growth Trend of the Market

Check the past few years' growth trend of similar companies or industries you selected in Technology Summary.

③ Estimate Market Size

Using the growth rate of similar companies or industries, the system will show estimated market size and market share during the cash flow period.

④ Estimate Profit Structure

Use the financial ratios of similar companies or industries to estimate COGS, SG&A and operating profit from the product.

2.2.2.3. Third Step: Produce Estimated Income Statement

[Figure 3-8] 3rd Step of STAR-Value DCF Model

<Pre-launch>

In

Year (YY.MM.)		Y1 (22.03~23.02)	Y2 (23.03~24.02)
Sales	100%	0	0
COGS		0	0
Gross margin		0	0
SG&A		0	0
EBIT		0	0

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

<Post-launch>

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Sales	100%	3,300	20,410.5	126,238.94	249,852.12	618,134.14	764,631.93	945,849.7	1,023,764.06	904,568.68
COGS	76.88 %	2,537.04	15,691.59	97,052.5	192,086.3	475,221.5	587,849.	727,169.2	787,069.	695,432.
Gross margin	23.12 %	762.96	4,718.91	29,186.4	57,765.8	142,912.6	176,782.	218,680.	236,694.	209,136.2
SG&A	9.95 %	328.35	2,030.84	12,560.7	24,860.2	61,504.3	76,080.8	94,112.05	101,864.5	90,004.5
EBIT	13.16 %	434.28	2,686.02	16,613.04	32,880.5	81,346.4	100,625.	124,473.	134,727.3	119,041.2
Income tax and others (Apply the legal rate)	%	73.48	568.92	3,632.86	7,495.2	19,223.7	23,889.4	29,660.7	32,141.93	28,345.9
NOPAT	%	360.52	2,117.08	12,980.14	25,385.8	62,122.27	76,736.5	94,813.2	102,585.	90,695.0

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

On “Produce Estimated Income Statement” tab, use the financial ratios of similar companies or industries, or insert data yourself to generate an estimated income statement that includes items such as sales, COGS, SG&A, Earnings Before Income Tax (EBIT) and NOPAT before and after product launch. There would be no sales in the pre-launch stage, but enter any COGS or SG&A from capital expenditure. The space for post-launch sales is automatically filled with the values estimated based on the market size in “Analyze market and cost structures”. Use financial ratios of similar companies or industries or insert data to obtain EBIT. Determine income tax to get NOPAT.

2.2.2.4. Fourth Step: Estimate Cash Flow

[Figure 3-9] 4th Step of STAR-Value DCF Model

⟨Pre-launch⟩

In

Year (YY.MM.)		Y1 (22.03~23.02)	Y2 (23.03~24.02)
NOPAT		0	0
CAPEX	Amount	50,000	10,000
	Depreciation year(s)	0	0
Depreciation/ amortization cost		0	0
Working capital input		0	0
Growth in working capital		0	0
FCF Calculate		-50,00	-10,00

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

⟨Post-launch⟩

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
NOPAT		360.52	2,117.08	12,980.14	25,385.8	62,122.27	76,736.51	94,813.29	102,585.07	90,695.08
Pre-launch Depreciation/ amortization cost		0	0	0	0	0	0	0	0	0
Post-launch Depreciation/ amortization cost	3.88 %	128	792	4,898	9,694	23,984	29,668	36,699	39,722	35,097
CAPEX		1,625	9,544	59,028	72,920	212,35	104,60	129,39	79,574	-25,87
Working capital input		766	4,736	29,294	57,979	143,441	177,43	219,48	237,56	209,90
Growth in working capital		766	3,970	24,558	28,685	85,462	33,995	42,053	18,080	-27,66
Recovered investment										732,393
FCF Calculate		-1902.	-10604	-65707	-66525	-211710	-32190	-3993	44653.	911715.

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

On “Estimate Cash Flow” tab, use the financial ratios of similar companies or industries or insert data yourself to obtain estimated cash flow for pre- and post-launch phases. Insert data for depreciation year for pre-launch capital expenditure. NOPAT in post-launch phases is automatically filled from “Produce Estimated Income Statement”. Use the financial ratios of similar companies or industries or insert data yourself to generate estimated cash flow.

2.2.2.5. Fifth step: Estimate Discount Rate

[Figure 3-10] 5th Step of STAR-Value DCF Model

WACC method

→ Discount rate 11.33 % = WACC 6.18 % + Technology risk premium 4.21 % + Size risk premium 0.94 %

주1) 기술사업화 위험 프리미엄과 규모 위험 프리미엄은 자기자본비중을 반영하여 산출된 값임

<Pre-launch>

Year (YY.MM.)	Y1 (22.03~23.02)	Y2 (23.03~24.02)
Present value factor	0.8982	0.8068

<Post-launch>

Year (YY.MM.)	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Present value factor	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Here you can estimate discount rate using Weighted Average Cost of Capital method, Capital Asset Pricing Model (CAPM) method, risk-free rate method or insert a rate as you see fit.

2.2.2.6. 6th Step: Calculate Business Value

[Figure 3-11] 6th Step of STAR-Value DCF Model

<Pre-launch>

Year (YY.MM.)	Y1 (22.03~23.02)	Y2 (23.03~24.02)
FCF	-50,000	-10,000
Present value factor	0.8982	0.8068
PV(FCF)	-44,910	-8,068

<Post-launch>

Year (YY.MM.)	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
FCF	-1,902.48	-10,604.92	-65,707.86	-66,525.2	-211,710.73	-32,190.49	-39,930.71	44,653.07	911,715.08
Present value factor	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071
PV(FCF)	-1,378.73	-6,903.8	-38,419.39	-34,939.04	-99,885.12	-13,639.11	-15,197.63	15,266.88	279,987.7

PV(Total FCF)	31,914

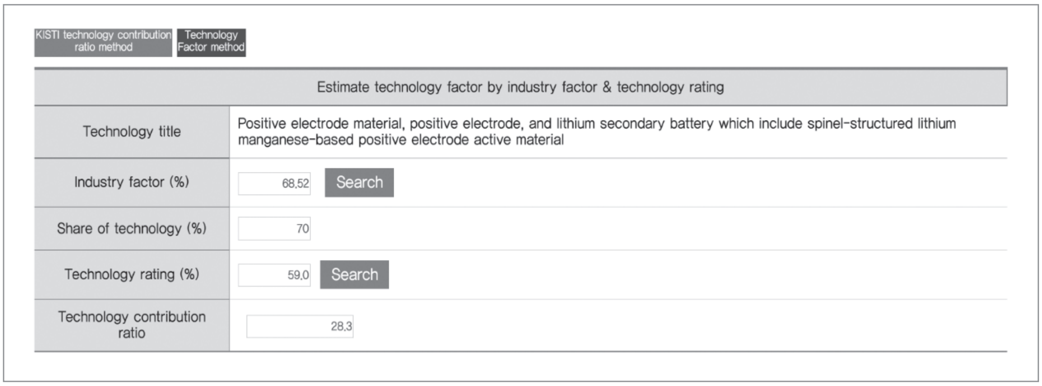
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Here, the cash flow from “Estimate Cash Flow” and the present value factor from “Estimate Discount Rate” are used to convert the cash flow into the present value.

2.2.2.7. Seventh Step: Estimate Technology Contribution Ratio

Choose either KISTI method or Technology Factor method to determine the subject technology’s contribution ratio.

[Figure 3-12] 7th Step of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.2.8. Eighth Step: Estimate Technology Value

Finally, in “Estimate Technology Value”, you will see the valuation result generated by applying the technology contribution ratio to the business value.

[Figure 3-13] Eighth Step of STAR-Value DCF Model

<Pre-launch>

In

Year (YY.MM.)		Y1 (22.03~23.02)	Y2 (23.03~24.02)
Sales	100%	0	0
COGS		0	0
Gross margin		0	0
SG&A		0	0
EBIT		0	0
NOPAT		0	0
Depreciation/ amortization cost		0	0
CAPEX	Amount	50,000	10,000
	Depreciation year(s)	0	0
Working capital input		0	0
Growth in working capital		0	0
FCF		-50,000	-10,000
Present value factor	11.33 %	0.8982	0.8068
PV(FCF)		-44,910	-8,068

<Post-launch>

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Sales	100%	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
COGS	76.88 %	2,537	15,691	97,053	192,086	475,221	587,849	727,169	787,070	695,433
Gross margin	23.12 %	763	4,719	29,186	57,766	142,913	176,783	218,681	236,694	209,136
SG&A	9.95 %	328	2,031	12,561	24,860	61,504	76,081	94,112	101,865	90,005
EBIT	13.16 %	434	2,686	16,613	32,881	81,346	100,626	124,474	134,727	119,041
Income tax and others (Apply the legal rate)		73	569	3,633	7,495	19,224	23,889	29,661	32,142	28,346
NOPAT		361	2,117	12,980	25,386	62,122	76,737	94,813	102,585	90,695
Pre-launch Depreciation/ amortization cost		0	0	0	0	0	0	0	0	0
Post-launch Depreciation/ amortization cost	3.88 %	128	792	4,898	9,694	23,984	29,668	36,699	39,722	35,097
CAPEX		1,625	9,544	59,028	72,920	212,355	104,600	129,390	79,574	-25,870
Growth in working capital		766	3,970	24,558	28,685	85,462	33,995	42,053	18,080	-27,660
Recovered investment										732,393
FCF		-1,902	-10,605	-65,708	-66,525	-211,711	-32,190	-39,931	44,653	911,715
Present value factor	11.33 %	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071
PV(FCF)		-1,379	-6,904	-38,419	-34,939	-99,885	-13,639	-15,198	15,267	279,988

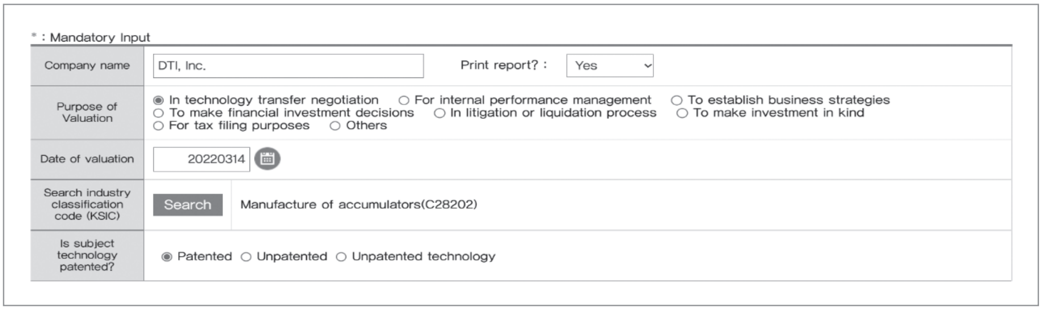
Business Value	31,914
Technology contribution ratio	28.3 %
Technology value	9,032

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3. Walk-through of DCF Model in STAR-Value System

2.2.3.1. Technology Summary

[Figure 3-14] Technology Summary 1 of STAR-Value DCF Model



* : Mandatory Input

Company name	DTI, Inc. Print report? : Yes
Purpose of Valuation	◉ In technology transfer negotiation ○ For internal performance management ○ To establish business strategies ○ To make financial investment decisions ○ In litigation or liquidation process ○ To make investment in kind ○ For tax filing purposes ○ Others
Date of valuation	20220314
Search industry classification code (KSIC)	Search Manufacture of accumulators(C28202)
Is subject technology patented?	◉ Patented ○ Unpatented ○ Unpatented technology

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

① Company Name

Enter the name of the institution that owns subject technology. Choose whether you want to print out the report later.

② Purpose of Valuation

Choose the option that best describes the purpose of valuation.

③ Date of Valuation

Click the icon to see the calendar, which is set on the current date. Select the date you want to use as the date of valuation.

Discount rate and valuation result may change depending on the date selected.

[Figure 3-15] Technology Summary 2 of STAR-Value DCF Model

* : Mandatory Input

Company name	DTI, Inc. Print report? : Yes
Purpose of Valuation	◉ In technology transfer negotiation ○ For internal performance management ○ To establish business strategies ○ To make financial investment decisions ○ In litigation or liquidation process ○ To make investment in kind ○ For tax filing purposes ○ Others
Date of valuation	20220314

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

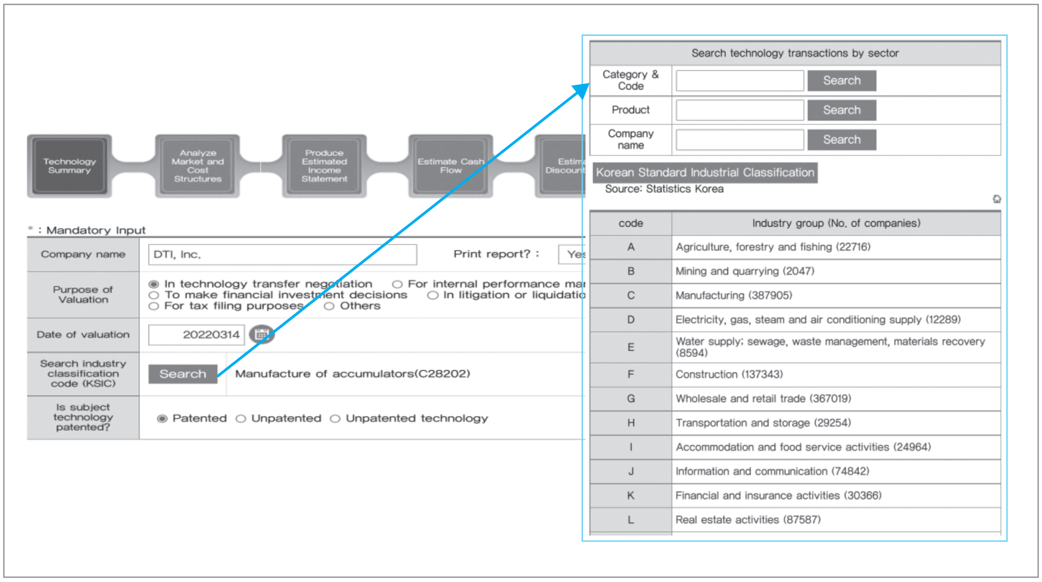
④ Search Industry Classification Code (KSIC)

Click ‘search’ and a pop-up window will appear where you can search the KSIC code.

If you already know your KSIC code, enter the code in the first box and click ‘search’. Below you will see the industry classification chart with a code for each industry. Select the industry that best fits the business based on which valuation is conducted.

If you know the product name, enter the name in the second box and click ‘search’. The industries that the product belongs to are shown below. Choose the most relevant industry.

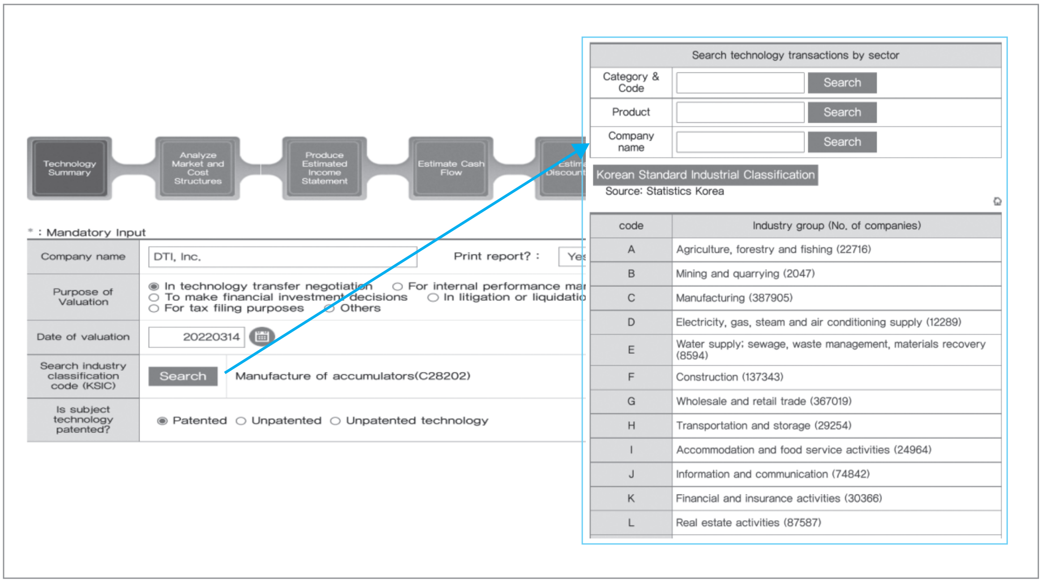
[Figure 3-16] Technology Summary 3 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

If you know a company that manufactures and sells similar or comparable products, enter the name in the third box and click ‘search’. The industries that the company belongs to will appear below. Choose the most relevant industry.

[Figure 3-17] Technology Summary 4 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

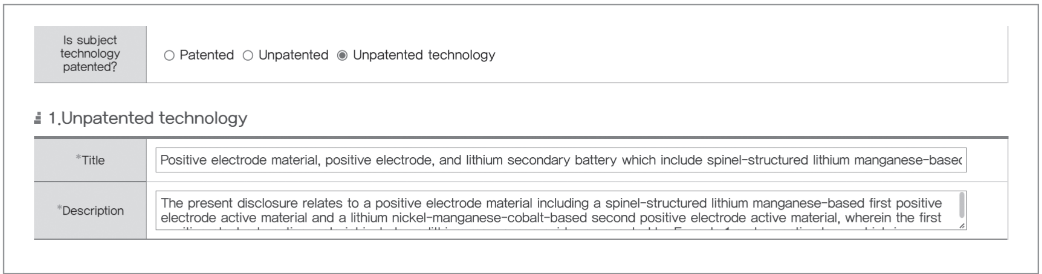
In this example, C27199 (Manufacturing of Other Medical and Surgical Equipment and Orthopedic Appliances) is chosen for the sub-class.

2.2.3.1.1. Patented Technology

① Unpatented Technology

Click No if the subject technology is not patented. You will then be asked to type in the title and description of the technology.

[Figure 3-18] Patented Technology 1 of STAR-Value DCF Model

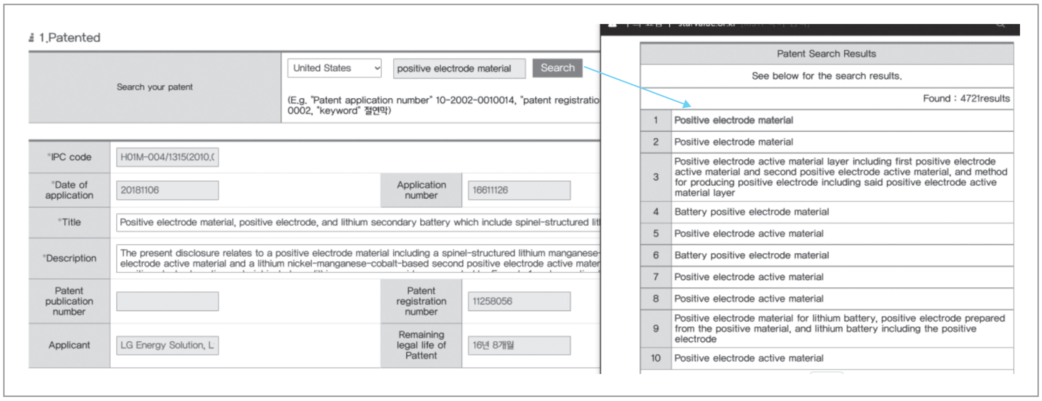


Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Patented Technology

Click Yes if the technology is patented. Choose the country of registration (e.g. Korea, U.S., Europe or Japan). Enter the patent's key words, registration number and application number, and click 'search' to open a pop-up window as below.

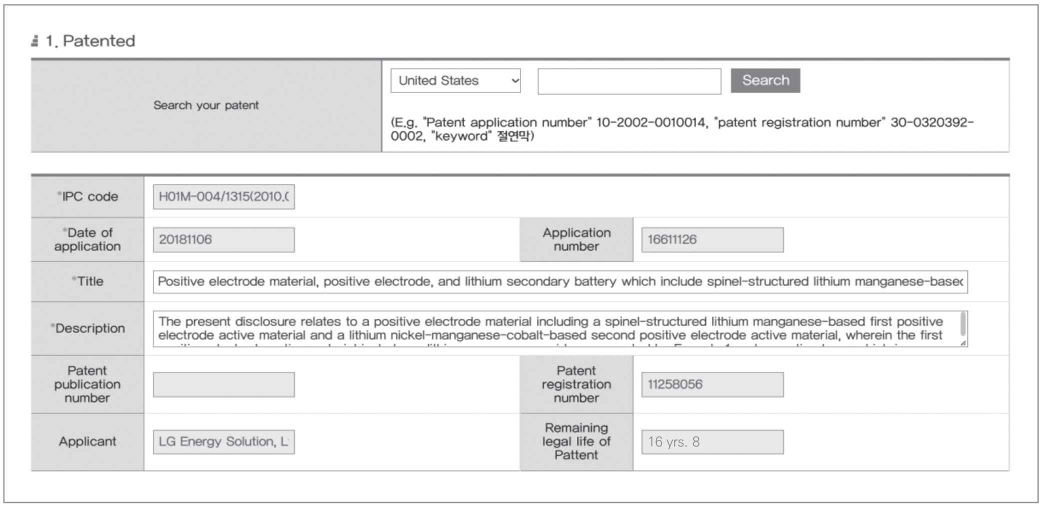
[Figure 3-19] Patented Technology 2 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Select the patent for the subject technology among the given list and click 'search'. IPC code, date of application, technology title, description, name of applicant and remaining patent life will be automatically entered into the system. The example used a patent titled 'Method of Preparing Raw Materials for Transplantation Using Biocompatible Polymers.

[Figure 3-20] Patented Technology 3 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Narrow down the search by avoiding key words that are too common or by providing the patent title and the name of applicant.

2.2.3.1.2. Estimated Profit Period

Click ‘Search DB’ to open a window as below.

[Figure 3-21] Estimated Profit Period 1 of STAR-Value DCF Model

2. Estimated period of return

Estimated period of return (year) | 5 | Search DB

기술가치평가시스템 - Chrome

www.itatech.co.kr:10880/itechvalue/wsp/lib/tct_pop.jsp?patentYear=20120619&applicationLife=15.8&publicDate=

All | IPC | C08J | Search

IPC	Description	Total number	Average	Distribution	Standard deviation	Max	Min	Q1	Q3	Median	Mode
A01B	SOIL WORKING IN AGRICULTURE OR F···	35304	16.37	220.41	14.85	151	0	6	23	12	4
A01C	PLANTING; SOWING; FERTILISING (com···	19353	15.65	204.71	14.31	160	0	6	21	12	3
A01D	HARVESTING; MOWING {(parts, details ···	73400	14.53	138.67	11.78	150	0	5	21	11	3
A01F	PROCESSING OF HARVESTED PRODUC···	7825	14.85	202.47	14.23	157	0	5	21	11	3
A01G	HORTICULTURE; CULTIVATION OF VEG···	39310	15.45	166.41	12.9	168	0	6	22	12	4
A01H	NEW PLANTS OR PROCESSES FOR OB···	71859	9.16	40.24	6.34	147	0	4	13	8	3
A01J	MANUFACTURE OF DAIRY PRODUCTS ···	11078	14.86	123.5	11.11	132	0	7	21	12	4
A01K	ANIMAL HUSBANDRY; CARE OF BIRDS,···	162479	15.28	165.58	12.87	161	0	6	21	12	4
A01L	SHOEING OF ANIMALS {(making metal ···	1284	14.58	160.91	12.68	131	0	6	20	12	8
A01M	CATCHING OR TRAPPING OF ANIMALS···	31556	15.58	255.46	15.98	159	0	6	20	11	3

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Or open the dropdown menu and choose one from A (Essential goods, Agriculture) – H (Electricity) to see the IPC categories.

[Figure 3-22] Estimated Profit Period 2 of STAR-Value DCF Model

All | IPC | C08J | Search

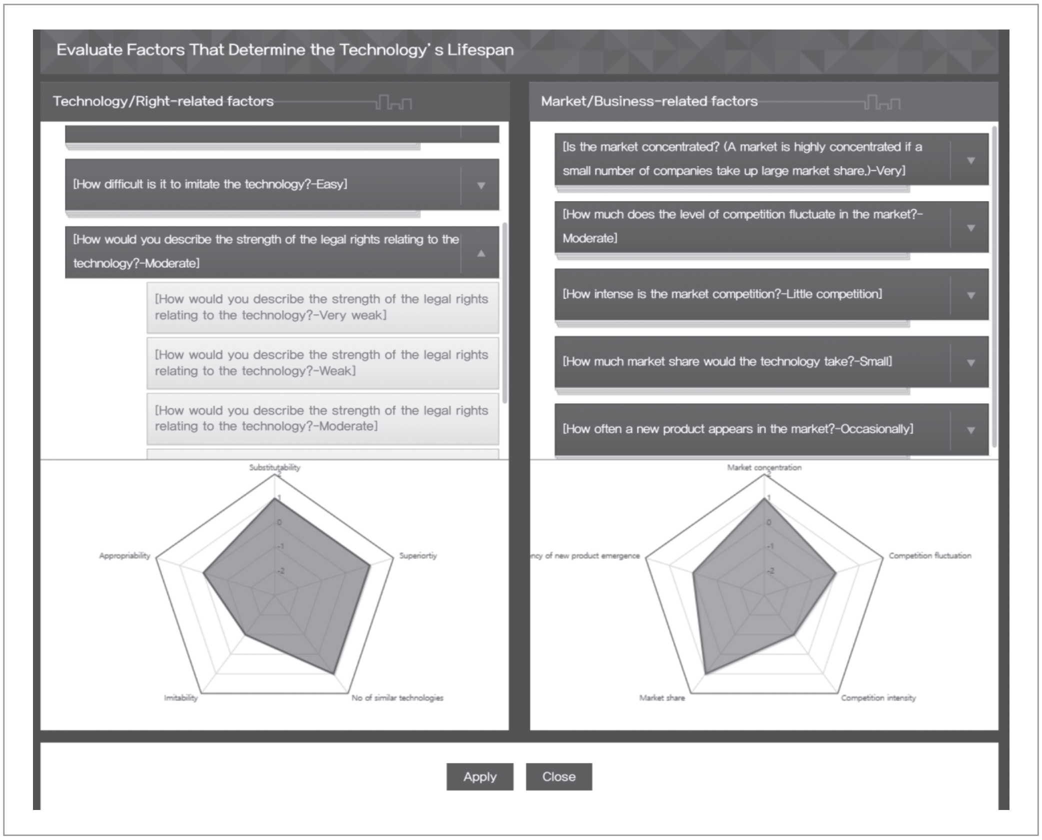
IPC	Description	Total number	Average	Distribution	Standard deviation	Max	Min	Q1	Q3	Median	Mode
C08J	WORKING-UP; GENERAL PROCESSES ···	24307	11.24	85.14	9.23	123	0	5	15	9	5

< 이전 1 다음 >

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Click the required IPC code and a question will appear: ‘Do you want to customize the assessment with technology life cycle chart?’ Click ‘Apply’ and the Technology Life Cycle Assessment Chart will open.

[Figure 3-23] Estimated Profit Period 3 of STAR-Value DCF Model



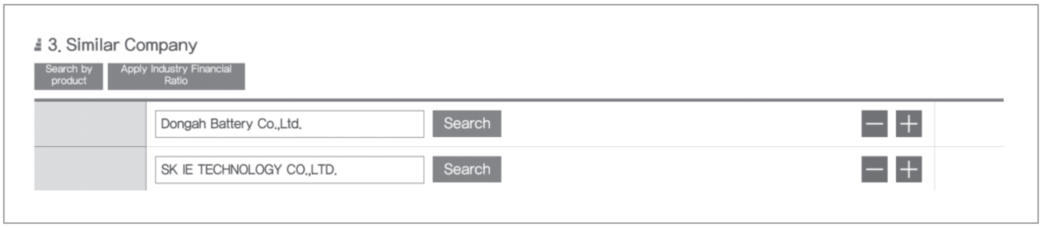
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Click 'Apply' and the IPC median adjusted with technology life cycle factors will be automatically reflected on the estimated profit period. The result was five years in this scenario.

2.2.3.1.3. Similar Companies

Select the industry to which the technology belongs, from the industry categories in the Basic Information section and a list of similar companies will appear as below.

[Figure 3-24] Similar Companies 1 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

① **Search by Product**

Click ‘Search by product’ and you will see a pop-up window as shown below. Search for similar companies by selecting options for company size and type and entering key words for the product. Following this, a list of similar companies with similar products will appear. Here, ‘bio-materials’ is entered as the keyword.

Check the box next to the company that produces the most similar products as the subject product and press ‘Select’ button. The list of automatically entered companies will be replaced with the ones selected based on your answer.

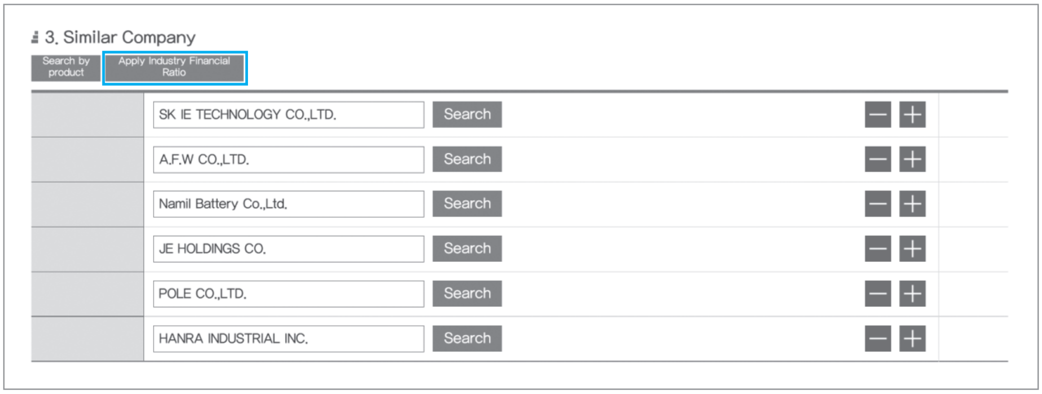
[Figure 3-25] Similar Companies 2 of STAR-Value DCF Model

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Apply Industry Financial Ratio

Click ‘Apply Industry Financial Ration’ and a list of companies will automatically appear as below.

[Figure 3-26] Similar Companies 3 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.1.4. Select Criteria to Search Financial Data

① Year Range

Set the year range to narrow down the scope of your search for financial information of similar companies or industries. Your choice of year range here will affect the market size trend, Compound Annual Growth Rate (CAGR) and operating margin in the 'Analyze Market and Cost Structures' tab.

Review the growth rates and operating margins for the past 3, 5 or 10 years and make modifications if needed. The available years are from 2000 to 2015.

② Company Size

Select the company size from large, medium and small and other options. You may select more than one.

③ Company Type

Select the category to choose the company's type from among incorporation, public offering, form of business establishment, company status and public institution. You will see different inquires in the next column depending on the option you select here.

[Figure 3-27] Select Criteria to Search Financial Data 1 of STAR-Value DCF Model

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

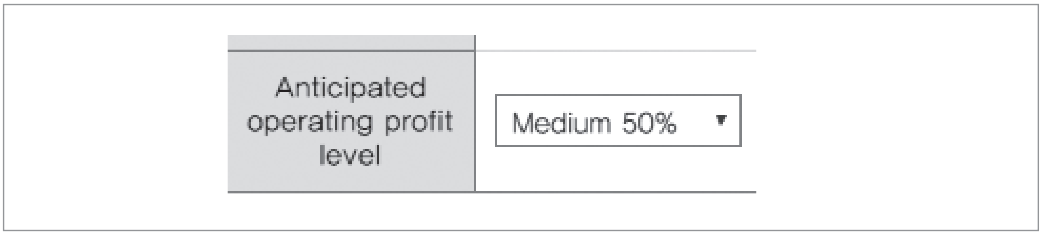
④ Risk-free Interest Rate

You can find the risk-free interest rate for the latest month from Korea Financial Investment Association (KOFIA)'s data.

⑤ Anticipated Operating Profit Level

Estimate the profitability of the subject product and choose the level of anticipated operating profit among 'All', 'Top 25%', 'Medium 50%' and 'Bottom 25%'.

[Figure 3-28] Select Criteria to Search Financial Data 2 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Here the year range is set as three years from 2012 to 2014. 'Large corporation' and 'SME' are selected for company size, with anticipated operating profit level at medium 50%.

2.2.3.1.5. Time and Cost to Market

① Time to Market

[Figure 3-29] Time and Cost to Market of STAR-Value DCF Model

5. Time and cost to market

Time to market (year)	2									
Cost to market	100	100								

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Choose the time the commercialization of technology would take, from 0 to 10 years.

The time to market will be considered in estimating the length of the technology's economic life. The longer it takes, the longer the cash flow period will be.

② Select Currency of Expenses

Select the currency you use to calculate the cost of commercialization. The default is set to million KRW.

③ Cost to Market

Insert the cost of commercialization for each year during the time period. The values here will be reflected to capital expenditure in estimation of cash flow and counted against the cash flow.

In the above example, time to market is set as two years, with cost to market of 1 million KRW per year.

2.2.3.1.6. Profit Strategies

Profit strategies here include market creation, market penetration and improvement of cost structure. Select the one that fits the subject technology the best.

[Figure 3-30] Profit Strategies of STAR-Value DCF Model

6.Profit strategies

○ Creating New Market	◉ Penetrating Existing Market	○ Improving cost Structur
The technology creates novel products or services.	The technology substitutes or supplements existing products or services.	The technology improves cost structure in producing existing products or services.

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

In the above example, the subject technology is penetrating an existing market.

After filling out technology summary, save the input and move to the next tab.

2.2.3.2. Analyze Market and Cost Structures

Enter the name of the main finished product implementing the subject technology and its usage. The usage is for reference in case you wish to print out the report.

[Figure 3-31] Analyze Market and Cost Structures of STAR-Value DCF Model

Main finished product	Positive electrode material, positive (Usage : electrode)

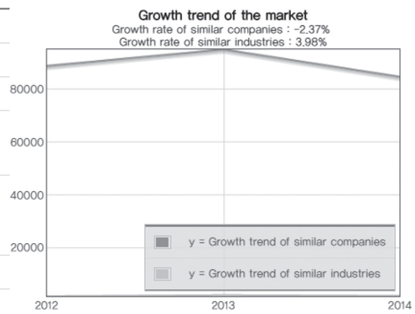
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.2.1. Growth Trend of the Market

[Figure 3-32] Growth Trend of the Market in STAR-Value DCF Model

1. Growth trend of the targeted market

Growth of the industry	CAGR	3.98 %
	KSIC	C27199
	Company size	Large,Medium,Small,Temporary SMEs
	Incorporated or Unincorporated	Corporation
	Anticipated level of operating profit	Medium 50%
Growth rate of similar companies	CAGR	-2.37 %
	Similar companies	OSSTEM IMPLANT CO., LTD., MEGAGEN IMPLANT CO.,LTD., Waiting...



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

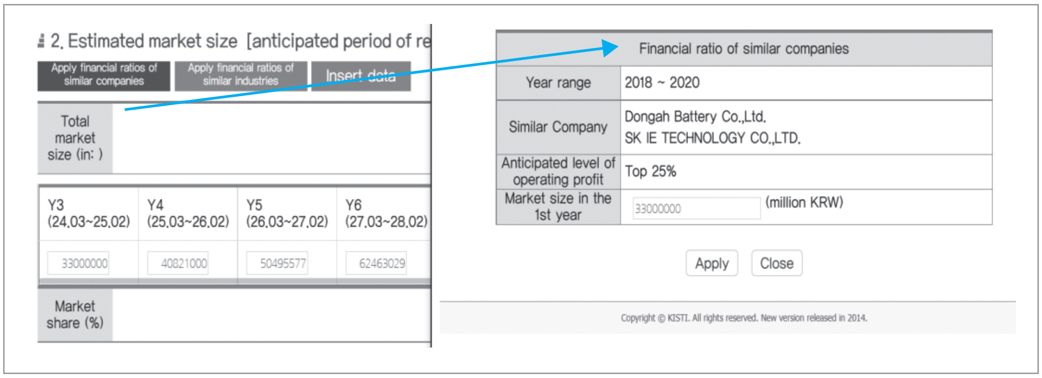
This section shows the growth trend and basic information of similar companies and industries selected in the Similar Companies section in Technology Summary. The list of companies you will see here are the ones you chose in 'search by product' or 'apply industry's financial ratio'. In the above example, similar companies are selected using 'search by product'.

2.2.3.2.2. Estimate Market Size

① Apply the Financial Ratios of Similar Companies

Click 'apply financial ratios of similar companies' and a pop-up will appear. In the example, the first two years are spent preparing for commercialization of the technology. Enter the size of the market for the third year.

[Figure 3-33] Estimate Market Size 1 of STAR-Value DCF Model



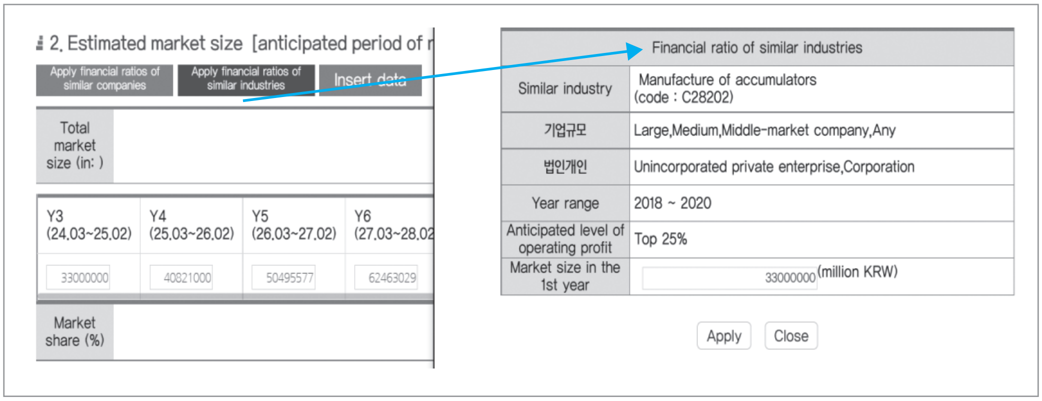
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Then click 'apply'. Another pop-up opens to show the yearly sales and CAGR of similar companies. Click 'apply' and the market size reflecting the CAGR at the bottom will appear in the original form.

② Apply Financial Ratios of Similar Industries

Click 'apply financial ratios of similar industries' and a pop-up window will appear as below. Enter the size of the market for the third year.

[Figure 3-34] Estimate Market Size 2 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Click ‘apply’. This will open another pop-up to show you the yearly sales and CAGR of similar companies. Select ‘apply’ and the market size reflecting the CAGR at the bottom will automatically entered into the system.

[Figure 3-35] Estimate Market Size 3 of STAR-Value DCF Model

Total market size (in:)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
33000000	40821000	50495577	62463029	77266767	95578991	118231212	146252009	180913735

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

In the above example, the total market size is estimated under ‘apply financial ratios of similar industries’.

Alternatively, you may insert the figure on your own based on your estimation or other reliable data on market size.

The above example used ‘apply financial ratios of similar industries’.

③ Market Share

Enter the market share (%) for each year.

Sales is derived by multiplying market size by estimated market share. The estimated sales can be found on the Produce Estimated Balance Sheet tab.

[Figure 3-36] Estimate Market Size 4 of STAR-Value DCF Model

Market share (%)

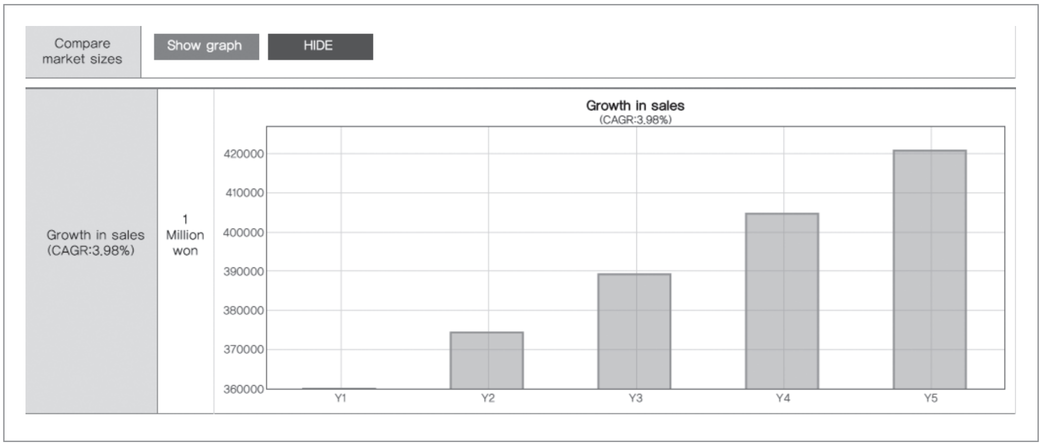
Y3 (18.07~19.06)	Y4 (19.07~20.06)	Y5 (20.07~21.06)	Y6 (21.07~22.06)	Y7 (22.07~23.06)
0.5	2.0	2.5	3.0	4.0

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

④ Compare Market Size

Click ‘show graph’ to find the growth trend of the selected industry. Enter and/or attach any supporting data if available.

[Figure 3-37] Estimate Market Size 5 of STAR-Value DCF Model



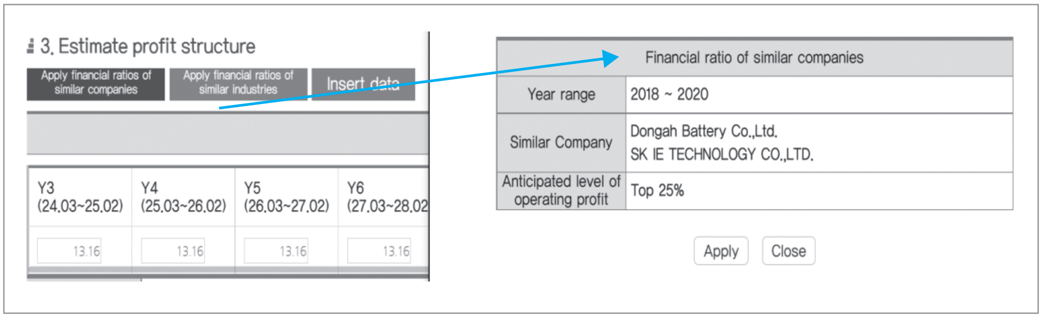
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.2.3. Estimate Profit Structure

① Apply Financial Ratios of Similar Companies

Click ‘apply financial ratios of similar industries’ and a pop-up window will appear as below. Click ‘apply’ to see the operating margins of similar companies.

[Figure 3-38] Estimate Profit Structure 1 of STAR-Value DCF Model

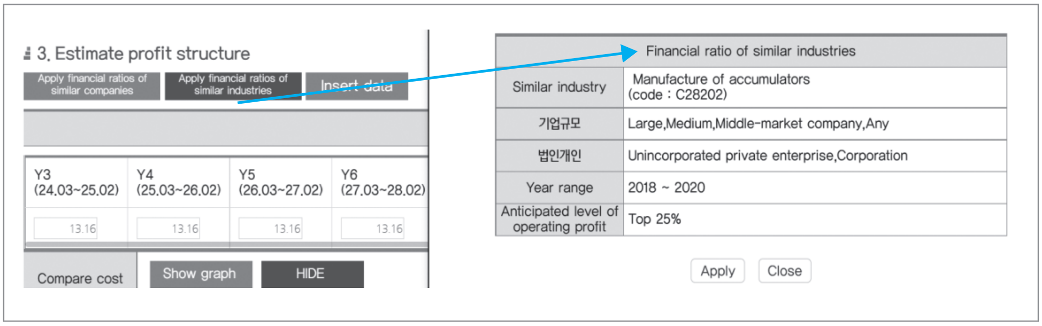


Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Apply Financial Ratios of Similar Industries

Click ‘apply financial ratios of similar industries’ and a pop-up window will appear as below. Click ‘apply’ to see the operating margins of similar companies.

[Figure 3-39] Estimate Profit Structure 2 of STAR-Value DCF Model



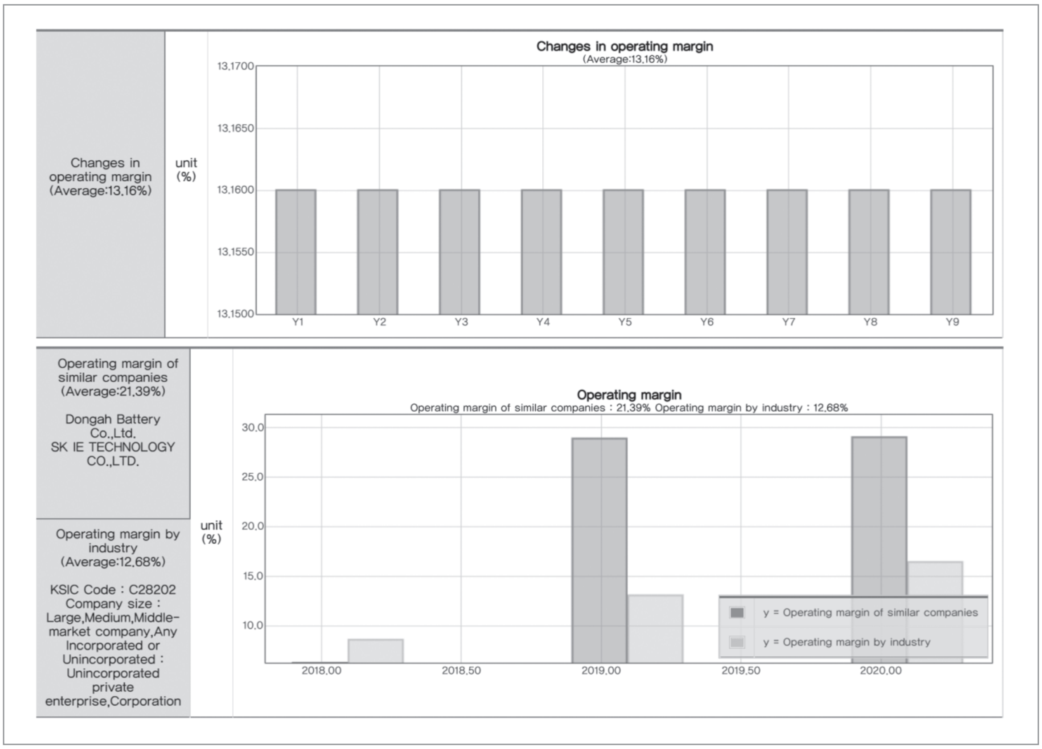
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Alternatively, you may insert the figure on your own based on your estimation or other reliable data on operating margin.

③ Compare Cost Structures

Click 'show graph' to see the trend of operating margin generated from 'apply financial ratios of similar companies' and a comparison chart for the operating margin of similar companies and of the industry. Enter and/or attach any supporting document if available.

[Figure 3-40] Estimate Profit Structure 3 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

In the above example, 'apply financial ratios of similar industries' is used for the estimation period.

2.2.3.3. Produce Estimated Income Statement 1.3

2.2.3.3.1. Pre-launch

Enter the sales amount if there is any before commercialization. Leave a blank otherwise. A space is given for each year of the period you entered as the time to market.

[Figure 3-41] Produce Estimated Income Statement 1 of STAR-Value DCF Model

<Pre-launch>

In million KRW

Year (YY.MM.)		Y1 (16.07~17.06)	Y2 (17.07~18.06)
Sales	100%	0	0
COGS		0	0
Gross margin		0	0
SG&A		0	0
EBIT		0	0

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.3.2. Post-launch

① Apply Financial Ratios of Similar Companies

The sales amount, equal to the multiplication of market size by market share as determined in the Analyze Market and Cost Structures, is displayed on the screen as shown below.

Click 'apply financial ratios of similar companies' to open a pop-up window. Click 'apply', and COGS, SG&A and EBIT reflecting the data for similar companies will be entered.

Click 'income tax and others' to choose your reference source of income tax among similar companies, similar industries and legal rate, or insert the data yourself. Income tax and NOPAT will be determined based upon your selection and entered into the system.

② Apply Financial Ratios of Similar Industries

Click 'apply financial ratios of similar industries' to open a pop-up window. Click 'apply', and COGS, SG&A and EBIT reflecting the data for similar industries will be entered.

Click ‘income tax and others’ to choose your reference source of income tax among similar companies, similar industries and legal rate or insert the data yourself. Income tax and NOPAT will be determined based upon your selection and entered into the system.

[Figure 3-42] Post-launch 1 of STAR-Value DCF Model

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

<Post-launch>

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27						
Sales	100%	3,300	20,410.5	126,238.9						
COGS	76.88 %	2,537.04	15,691.59	97,052.5						
Gross margin	23.12 %	762.96	4,718.91	29,186.4						
SG&A	9.95 %	328.35	2,030.84	12,560.7						
EBIT	13.16 %	434.28	2,686.02	16,613.04	32,880.5	81,346.45	100,625.5	124,473.8	134,727.3	119,041.2
Income tax and others (Apply the legal rate)	%	73.48	568.92	3,632.86	7,495.2	19,223.73	23,889.4	29,660.7	32,141.93	28,345.9
NOPAT	%	360.52	2,117.08	12,980.14	25,385.8	62,122.27	76,736.5	94,813.29	102,585.0	90,695.0

Financial ratio of similar companies	
Year range	2018 ~ 2020
Similar Company	Dongah Battery Co.,Ltd. SK IE TECHNOLOGY CO.,LTD.
Anticipated level of operating profit	Top 25%

Apply | Close

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

③ Insert Data

Alternatively, click ‘insert data’ to enter COGS and SG&A ratios yourself and following this, COGS, SG&A and operating profit will be auto-generated. Click ‘income tax and others’ to choose your reference source of income tax among similar companies, similar industries and legal rate or insert data yourself. Income tax and NOPAT will be determined based upon your selection and entered into the system.

[Figure 3-43] Produce Estimated Income Statement 2 of STAR-Value DCF Model

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

<Post-launch>

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Sales	100%	3,300	20,410.5	126,238.94	249,852.12	618,134.14	764,631.93	945,849.7	1,023,764.06	904,568.68
COGS	76.88 %	2537.04	15691.59	97052.5	192086.3	475221.5	587849.0	727169.2	787069.8	695432.4
Gross margin	23.12 %	762.96	4718.91	29186.44	57765.81	142912.61	176782.9	218680.4	236694.2	209136.2
SG&A	9.95 %	328.35	2030.85	12560.77	24860.29	61504.34	76080.87	94112.04	101864.5	90004.58
EBIT	13.17 %	434.61	2688.06	16625.67	32905.52	81408.27	100702.0	124568.4	134829.7	119131.7
Income tax and others (Apply the legal rate)	%	73.61	569.38	3635.65	7501.14	19238.8	23907.89	29683.55	32166.79	28367.87
NOPAT	%	361	2118.69	12990.02	25404.38	62169.46	76794.13	94884.85	102662.9	90763.83

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

The above example used ‘apply financial ratios of similar companies’, which set the share of cost at 48.47%, SG&A at 33.72% and operating profit at 17.81%. Legal rates are applied for income tax.

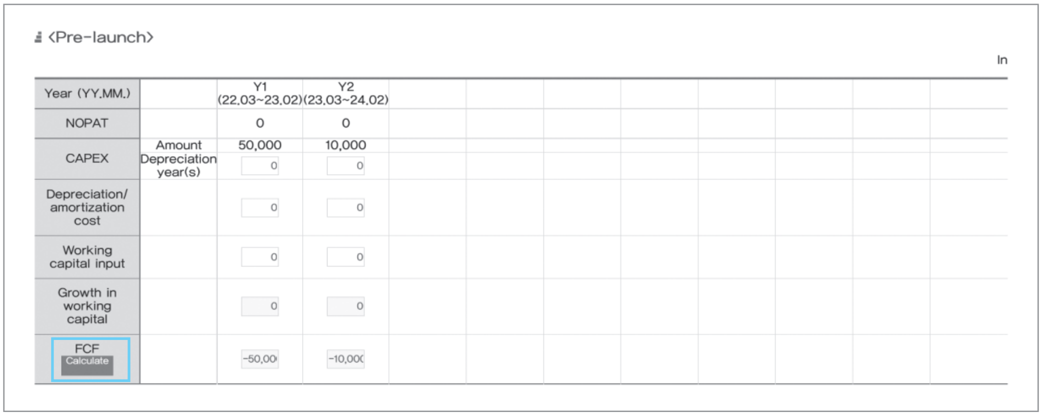
2.2.3.4. Estimate Cash Flow

2.2.3.4.1. Pre-launch

The amount you entered in Technology Summary will appear at the CapEx column here. Enter the time period for depreciation/amortization.

Click ‘calculate’ below FCF and Free Cash Flow for the pre-launch phase will be generated.

[Figure 3-44] Estimate Cash Flow 1 of STAR-Value DCF Model



<Pre-launch>

In

Year (YY.MM.)		Y1 (22.03~23.02)	Y2 (23.03~24.02)
NOPAT		0	0
CAPEX	Amount	50,000	10,000
	Depreciation year(s)	0	0
Depreciation/ amortization cost		0	0
Working capital input		0	0
Growth in working capital		0	0
FCF Calculate		-50,00	-10,00

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

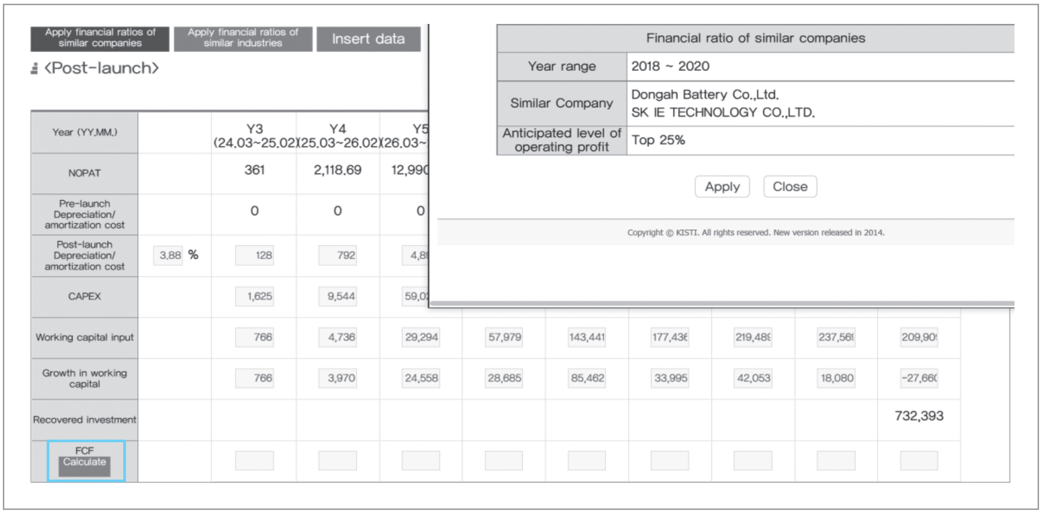
2.2.3.4.2. Post-launch

① Apply Financial Ratios of Similar Companies

Click ‘apply financial ratios of similar companies’ and a pop-up window will appear. Click ‘apply’ to have the depreciation ratio entered, along with CapEx, depreciation cost, working capital, changes in working capital and recovered investment, applying financial ratios of similar companies in the post-launch phase.

Click ‘calculate’ below FCF to auto-generate yearly FCF, including the amount of investment recovered for the last year in the estimation period.

[Figure 3-45] Estimate Cash Flow 2 of STAR-Value DCF Model



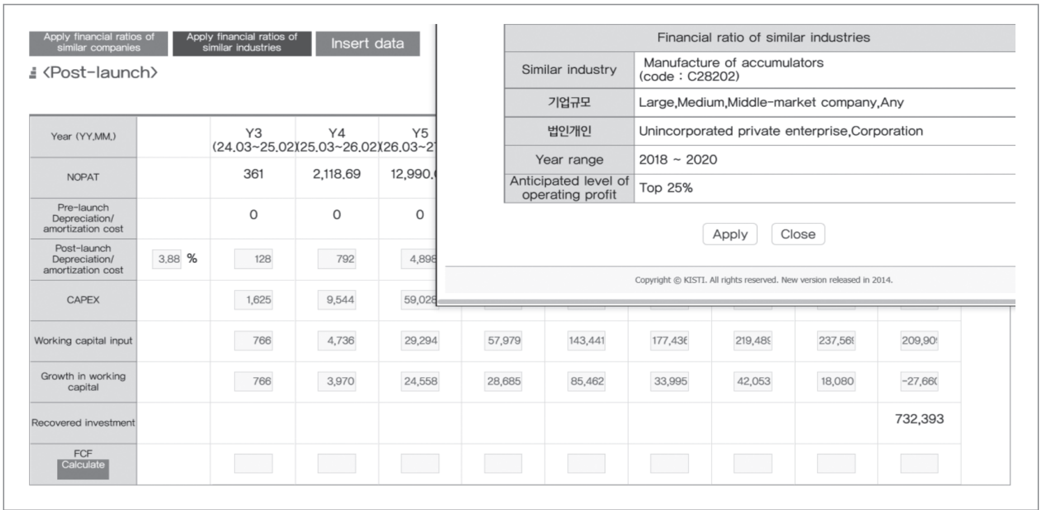
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Apply Financial Ratios of Similar Industries

Click 'apply financial ratios of similar industries' and a pop-up window will appear. Click 'apply' to have the depreciation ratio entered, along with CapEx, depreciation cost, working capital, changes in working capital and recovered investment, applying financial ratios of similar industries in the post-launch phase.

Click 'calculate' below FCF to auto-generate yearly FCF, including the amount of investment recovered for the last year in the estimation period.

[Figure 3-46] Estimate Cash Flow 3 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

To enter the data yourself for CapEx, depreciation cost, depreciation period for CapEx and working capital, click ‘Insert data’.

Click ‘Calculate’ below FCF to auto-generate the yearly FCF, including the amount of investment recovered for the last year in the estimation period.

[Figure 3-47] Estimate Cash Flow 4 of STAR-Value DCF Model

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

<Post-launch>

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
NOPAT		361	2,118.69	12,990.02	25,404.38	62,169.46	76,794.13	94,884.85	102,662.94	90,763.83
Pre-launch Depreciation/ amortization cost		0	0	0	0	0	0	0	0	0
Post-launch Depreciation/ amortization cost		128	792	4,898	9,694	23,984	29,668	36,699	39,722	35,097
CAPEX	Expenditure amount	1,625	9,544	59,028	72,920	212,35	104,60	129,39	79,574	-25,87
	Amortization period	0	0	0	0	0	0	0	0	0
Working capital input		766	4,736	29,294	57,979	143,441	177,43	219,48	237,56	209,90
Growth in working capital		766	3,970	24,558	28,685	85,462	33,995	42,053	18,080	-27,66
Recovered investment										
FCF Calculate										

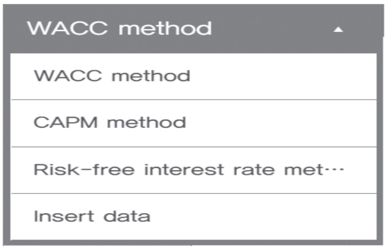
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.5. Estimate Discount Rate[6]

You can choose one out of four methods to estimate the discount rate.

Click on the dropdown menu, which is set at ‘WACC method’ by default, to see the four methods and select the one you prefer.

[Figure 3-48] Estimate Discount Rate 1 of STAR-Value DCF Model



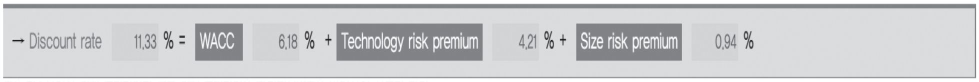
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

6 See (2) estimation of discount rate on page 297.

2.2.3.5.1. Weighted Average Cost of Capital (WACC) method

Under the WACC method, the Discount Rate is equal to the sum of WACC, Technology Risk Premium and Size Risk Premium.

[Figure 3-49] Estimate Discount Rate 2 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

① Weighted Average Cost of Capital

You may refer to KSIC to determine WACC. Click 'Search by industry group' next to WACC to find the cost of equity, cost of debt and debt-to-equity ratio for each section of industry. Click the WACC for an appropriate industry to enter the figure into your system. As shown in the below chart, C11's WACC is 6.30% and C27's WACC is 10.84%.

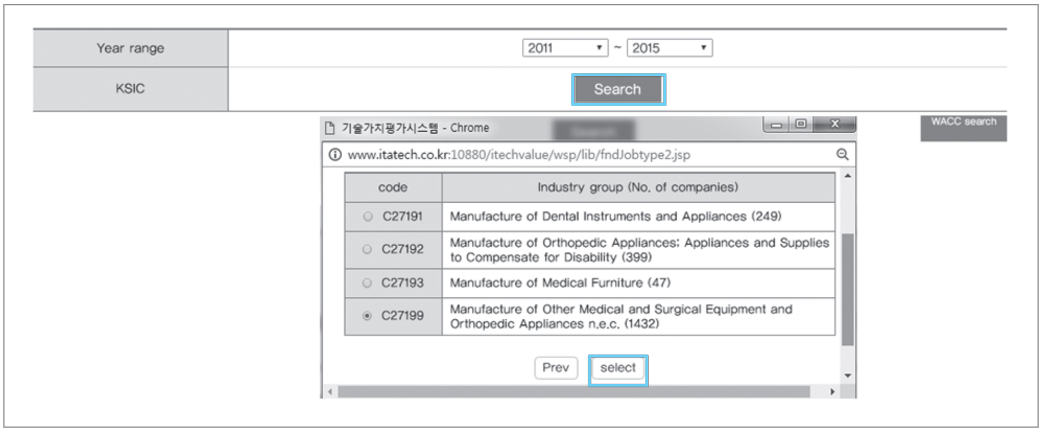
[Figure 3-50] Estimate Discount Rate 3 of STAR-Value DCF Model

Industry group	KSIC Code	Cost of equity	Cost of debt	Debt-to-capital ratio	WACC
C10	Manufacture of Food Products	7.55	12.52	0.65	**8.99**
C11	Manufacture of Beverages	6.31	8.08	0.63	**6.30**
C13	Manufacture of Textiles, Except Apparel	6.98	28.85	0.64	**16.91**
C14	Manufacture of wearing apparel, Clothing Accessories and Fur Articles	6.69	10.88	0.65	**7.86**
C15	Tanning and Dressing of Leather , Manufacture of Luggage and Footwear	4.01	12.24	0.65	**7.61**
C16	Manufacture of Wood Products of Wood and Cork ; Except Furniture	8.41	7.43	0.64	**6.74**
C17	Manufacture of Pulp, Paper and Paper Products	6.50	11.68	0.66	**8.22**
C18	Printing and Reproduction of Recorded Media	7.74	7.52	0.66	**6.50**
C19	Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	9.47	8.88	0.61	**7.92**
C20	Manufacture of chemicals and chemical products except pharmaceuticals, medicinal chemicals	9.47	8.69	0.62	**7.80**
C21	Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	8.99	13.82	0.55	**9.97**
C22	Manufacture of Rubber and Plastic Products	9.37	7.08	0.65	**6.87**
C23	Manufacture of Other Non-metallic Mineral Products	7.94	8.09	0.61	**6.94**
C24	Manufacture of Basic Metal Products	9.28	6.72	0.67	**6.57**
C25	Manufacture of Fabricated Metal Products, Except Machinery and Furniture	10.14	34.25	0.65	**20.91**
C26	Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	11.38	8.32	0.63	**8.30**

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Or click ‘Search by sub-industry group’ and a window will appear as below. Press ‘Select’ to choose the industry on your own.

[Figure 3-51] Estimate Discount Rate 4 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Go through the classification to the sub-class level and select one. Then click ‘WACC search’ to find a chart as shown below. The figure that appears under the WACC is the weighted average cost of capital for the sub-class industry you selected. Click the amount to enter it into the system. The WACC for Sub-Class C27199 is 7.86%.

[Figure 3-52] Estimate Discount Rate 5 of STAR-Value DCF Model

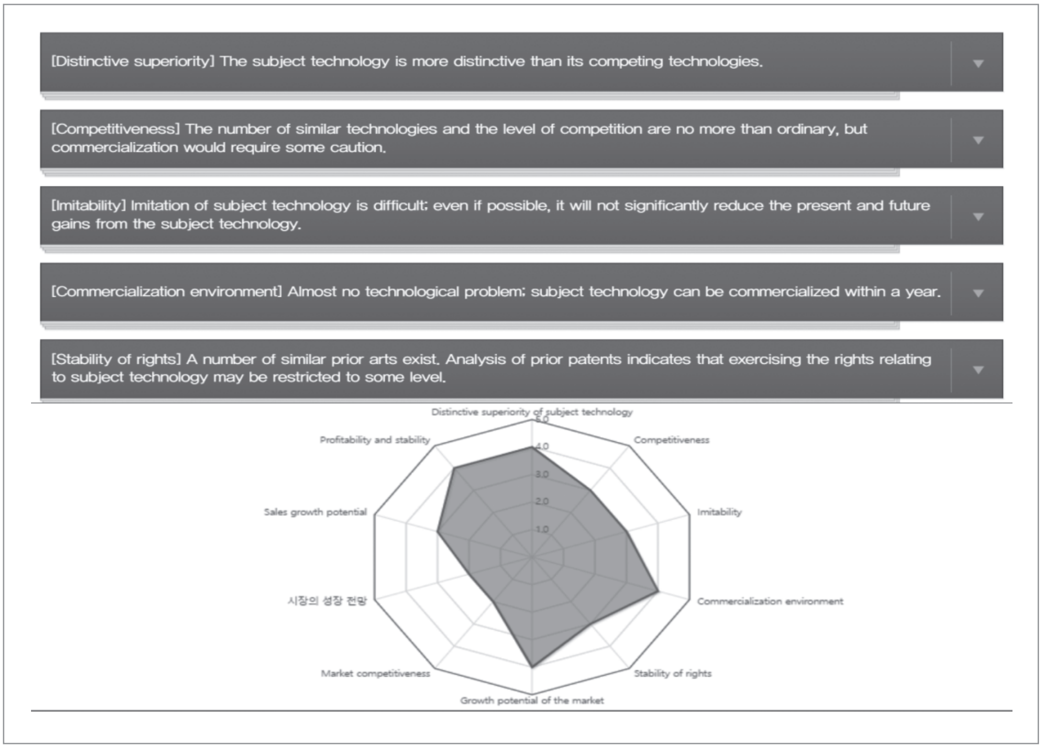
CODE	Description	Cost of equity	Cost of debt	Debt-to-capital ratio	WACC
C27199	Manufacture of Other Medical and Surgical Equipment and Orthopedic Appliances n.e.c.	13.52	5.43	0.61	7.86

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Technology Risk Premium

Click ‘technology risk premium’ and you will see an evaluation chart that will assist you to evaluate the technology risk premium.

[Figure 3-53] Estimate Discount Rate 6 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Click each item to see varying descriptions related to the category. Choose the one that best describes the subject technology for each category.

Click 'Continue' to see evaluation score and risk premium of technology commercialization. Click 'Apply' to apply the risk premium.

[Figure 3-54] Estimate Discount Rate 7 of STAR-Value DCF Model

Technological Commercialization Risk Score & Risk Premium	
Score	Risk premium
32	7.52

Apply Close

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

③ Size Risk Premium

Click ‘Size risk premium’ to see the discount rates for large, medium, small and venture companies by industry. Click the one that fits the subject company the best to apply the rate.

[Figure 3-55] Estimate Discount Rate 8 of STAR-Value DCF Model

Code	Industry	Large	Medium	Small	Startup
A01	Agriculture	1,15	2,37	3,81	5,80
A02	Forestry	1,15	2,37	3,81	5,80
A03	Fishing	1,15	2,37	3,81	5,80
B05	Mining of Coal, Crude Petroleum and Natural Gas	1,15	2,37	3,81	5,80
B06	Mining of Metal Ores	1,15	2,37	3,81	5,80
B07	Mining of Non-metallic Minerals, Except Fuel	1,15	2,37	3,81	5,80
B08	Mining support service activities	1,15	2,37	3,81	5,80
C10	Manufacture of Food Products	0,80	1,66	2,66	4,05
C11	Manufacture of Beverages	1,15	2,37	3,81	5,80
C13	Manufacture of Textiles, Except Apparel	1,02	2,12	3,40	5,18
C14	Manufacture of wearing apparel, Clothing Accessories and Fur Articles	1,19	2,46	3,94	6,00
C15	Tanning and Dressing of Leather , Manufacture of Luggage and Footwear	1,15	2,37	3,81	5,80
C16	Manufacture of Wood Products of Wood and Cork ; Except Furniture	1,15	2,37	3,81	5,80
C17	Manufacture of Pulp, Paper and Paper Products	0,78	1,62	2,60	3,96
C18	Printing and Reproduction of Recorded Media	1,15	2,37	3,81	5,80
C19	Manufacture of Coke, hard-coal and lignite fuel briquettes and Refined Petroleum Products	1,15	2,37	3,81	5,80
C20	Manufacture of chemicals and chemical products except pharmaceuticals, medicinal chemicals	1,12	2,32	3,73	5,68
C21	Manufacture of Pharmaceuticals, Medicinal Chemicals and Botanical Products	0,99	2,03	3,30	5,02
C22	Manufacture of Rubber and Plastic Products	1,03	2,14	3,43	5,22
C23	Manufacture of Other Non-metallic Mineral Products	1,21	2,51	1,03	6,14
C24	Manufacture of Basic Metal Products	0,90	1,87	3,00	4,57
C25	Manufacture of Fabricated Metal Products, Except Machinery and Furniture	1,22	2,52	4,04	6,16
C26	Manufacture of Electronic Components, Computer, Radio, Television and Communication Equipment and Apparatuses	1,17	2,43	3,89	5,93
C27	Manufacture of Medical, Precision and Optical Instruments, Watches and Clocks	1,27	2,63	4,22	6,42

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Once you determine ‘Size risk premium’, the discount rate is generated as the sum of WACC, technology risk premium and size risk premium. You will also see present value factors in the pre- and post-launch phases.

[Figure 3-56] Estimate Discount Rate 9 of STAR-Value DCF Model

⟨Pre-launch⟩

Year (YY.MM.)	Y1 (22.03~23.02)	Y2 (23.03~24.02)
Present value factor	0.8982	0.8068

⟨Post-launch⟩

Year (YY.MM.)	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Present value factor	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.5.2. Capital Asset Pricing Model (CAPM) Method

[Figure 3-57] Estimate Discount Rate 10 of STAR-Value DCF Model

CAPM method

→ Discount rate % = CAPM 8.71 % + Rip %+ Rcs %

Discount rate = CAPM (cost of equity by industry) + Rip (risk premium relating to intellectual property) + Rcs (risk premium in the commercialization process)

Rip: Insert (0~10%)
Risk premium in the commercialization process: make professional assessment to determine the value

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

The CAPM method calculates discount rate by referring to cost of equity by industry, risk premium related to intellectual property rights (Rip) and risk premium in the commercialization process (Rcs).

Click on the blank and you will be able to see costs of equity by industry. Click the industry that suits the subject company and the figure will be reflected into the system.

[Figure 3-58] Estimate Discount Rate 11 of STAR-Value DCF Model

CODE	Description	CAPM
A	Agriculture, forestry and fishing	5.84
B	Mining and quarrying	7.2
C10	Manufacture of food products	6.73
C11	Manufacture of beverages	5.49
C13	Manufacture of textiles, except apparel	5.49
C14	Manufacture of wearing apparel, clothing accessories and fur articles	6.86
C15	Manufacture of leather, luggage and footwear	9.19
C16	Manufacture of wood and of products of wood and cork; except furniture	7.82
C17	Manufacture of pulp, paper and paper products	6.45
C18	Printing and reproduction of recorded media	6.59
C19	Manufacture of coke, briquettes and refined petroleum products	6.52
C20	Manufacture of chemicals and chemical products; except pharmaceuticals and medicinal chemicals	8.91
C21	Manufacture of pharmaceuticals, medicinal chemical and botanical products	9.05
C22	Manufacture of rubber and plastics products	7.07
C23	Manufacture of other non-metallic mineral products	7.68
C24	Manufacture of basic metals	7.82
C25	Manufacture of fabricated metal products, except machinery and furniture	7
C26	Manufacture of electronic components, computer; visual, sounding and communication equipment	8.37
C27	Manufacture of medical, precision and optical instruments, watches and clocks	8.09
C28	Manufacture of electrical equipment	8.71

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Use your judgment to enter Rip from 0 to 10%.

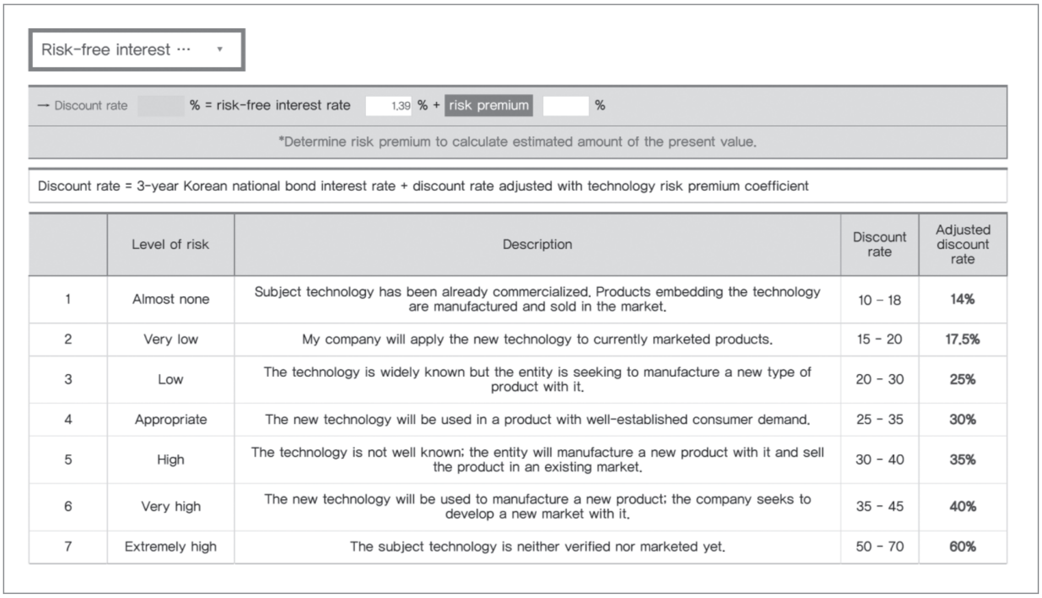
For Rcs, select the current stage of commercialization and the progress of the stage to generate present value factors for the pre- and post-launch phases.

2.2.3.5.3. Risk-free Interest Rate Method

This method estimates discount rate by adding risk premium to three-year Korean sovereign bond interest rate. Risk-free interest rate is determined in the financial information section of the Technology Summary tab and is reflected here.

Click on the blank next to 'Risk Premium' to see seven levels of risk. Select one to calculate the discount rate. This will also generate present value factors for the pre- and post-launch phases.

[Figure 3-59] Estimate Discount Rate 12 of STAR-Value DCF Model



Risk-free interest ···

→ Discount rate % = risk-free interest rate 1.39 % + risk premium %

*Determine risk premium to calculate estimated amount of the present value.

Discount rate = 3-year Korean national bond interest rate + discount rate adjusted with technology risk premium coefficient

	Level of risk	Description	Discount rate	Adjusted discount rate
1	Almost none	Subject technology has been already commercialized. Products embedding the technology are manufactured and sold in the market.	10 – 18	14%
2	Very low	My company will apply the new technology to currently marketed products.	15 – 20	17.5%
3	Low	The technology is widely known but the entity is seeking to manufacture a new type of product with it.	20 – 30	25%
4	Appropriate	The new technology will be used in a product with well-established consumer demand.	25 – 35	30%
5	High	The technology is not well known; the entity will manufacture a new product with it and sell the product in an existing market.	30 – 40	35%
6	Very high	The new technology will be used to manufacture a new product; the company seeks to develop a new market with it.	35 – 45	40%
7	Extremely high	The subject technology is neither verified nor marketed yet.	50 – 70	60%

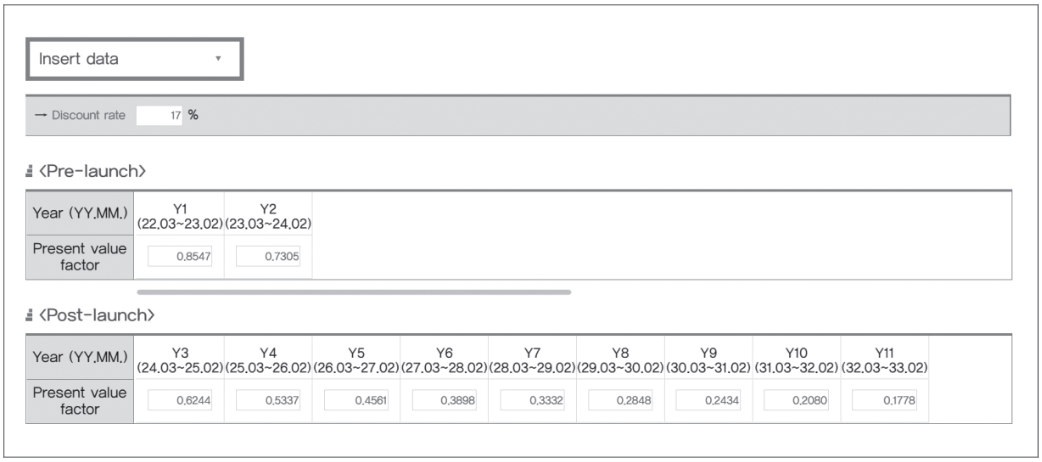
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.5.4. Insert Data

Alternatively, you may insert the discount rate yourself and the present value factor will be produced.

Once the discount rate is generated using one method of the four, data entered under the other three methods will be deleted.

[Figure 3-60] Estimate Discount Rate 13 of STAR-Value DCF Model



Insert data

→ Discount rate 17 %

<Pre-launch>

Year (YY.MM.)	Y1 (22.03~23.02)	Y2 (23.03~24.02)
Present value factor	0.8547	0.7305

<Post-launch>

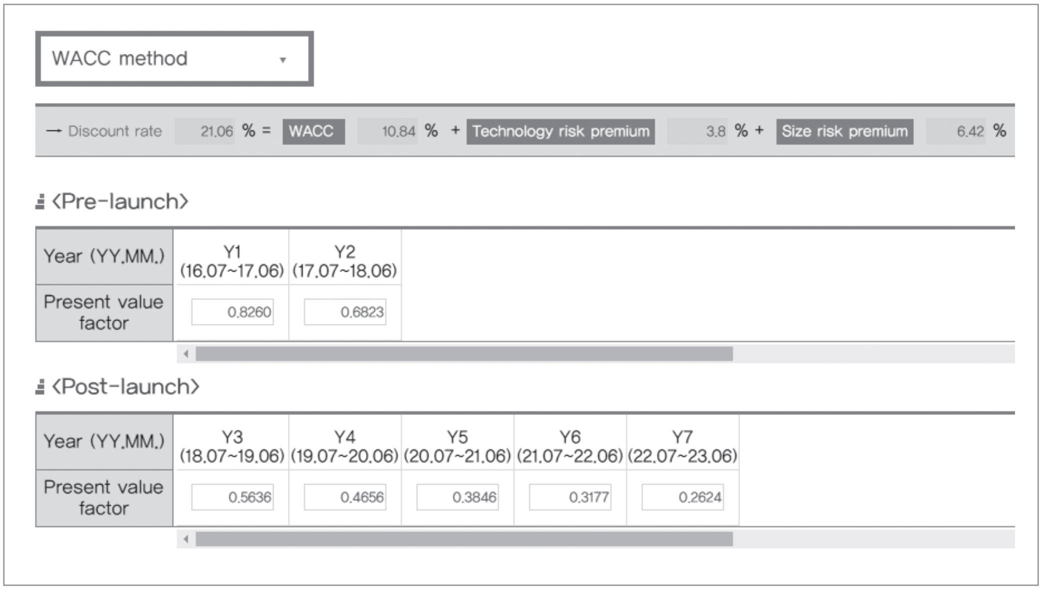
Year (YY.MM.)	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Present value factor	0.6244	0.5337	0.4561	0.3898	0.3332	0.2848	0.2434	0.2080	0.1778

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

The example above used the 'WACC method' to determine discount rate. Present value factors for the pre- and post-launch phases are produced accordingly.

For KSIC Sub-Class C27199 (Manufacture of Other Medical and Surgical Equipment and Orthopedic Appliances), the WACC is 10.84%, with technology risk premium at 3.8% and size risk premium at 6.42%, and the discount rate is determined to be 21.06%.

[Figure 3-61] Estimate Discount Rate 14 of STAR-Value DCF Model


WACC method

→ Discount rate 21.06 % = WACC 10.84 % + Technology risk premium 3.8 % + Size risk premium 6.42 %

<Pre-launch>

Year (YY.MM.)	Y1 (16.07~17.06)	Y2 (17.07~18.06)
Present value factor	0.8260	0.6823

<Post-launch>

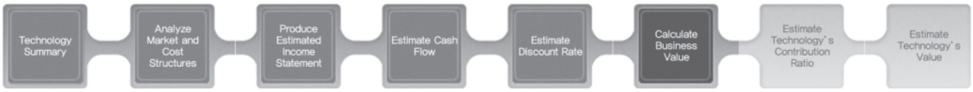
Year (YY.MM.)	Y3 (18.07~19.06)	Y4 (19.07~20.06)	Y5 (20.07~21.06)	Y6 (21.07~22.06)	Y7 (22.07~23.06)
Present value factor	0.5636	0.4656	0.3846	0.3177	0.2624

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.6. Calculate Business Value

Below is a sample for Discounted Cash Flow, generated by estimating cash flow during the set period and adjusting the flow with the present value factor calculated using discount rate.

[Figure 3-62] Calculate Business Value of STAR-Value DCF Model



<Pre-launch>

Year (YY.MM.)	Y1 (22.03~23.02)	Y2 (23.03~24.02)
FCF	-50,000	-10,000
Present value factor	0.8982	0.8068
PV(FCF)	-44,910	-8,068

<Post-launch>

Year (YY.MM.)	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
FCF	-1,902	-10,603.31	-65,697.98	-66,506.62	-211,663.54	-32,132.87	-39,859.15	44,730.94	911,783.83
Present value factor	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071
PV(FCF)	-1,378.38	-6,902.75	-38,413.61	-34,929.28	-99,862.86	-13,614.7	-15,170.39	15,293.51	280,008.81

PV(Total FCF)	32,052

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Here the business value, or the present value of cash flow, is estimated as 64million KRW.

2.2.3.7. Estimate Technology Contribution Ratio

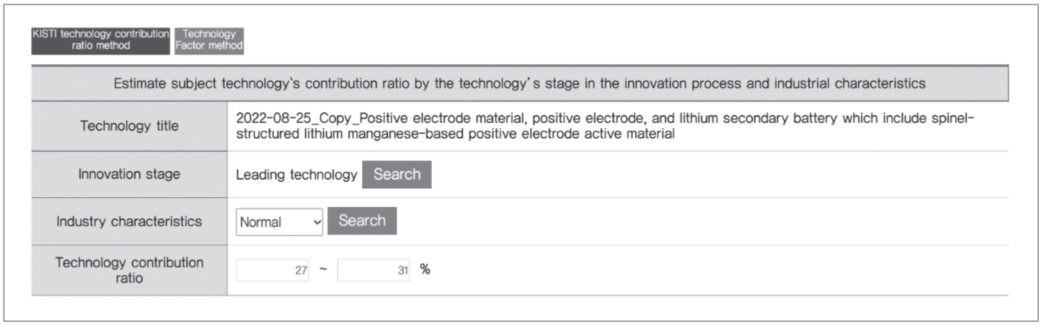
2.2.3.7.1. KISTI Technology Contribution Ratio Method

The KISTI method estimates the technology`s contribution ratio by accounting for its stage in the innovation process as well as the characteristics of the industry.

① Innovation Stage

Click 'search' to open a pop-up window, which shows categories such as Technology competitiveness, Implementation, Dissemination of technology, Spillover effect on other industries and Company competitiveness. Select the most appropriate description for the subject technology and the technology will be sorted as either: emerging technology, leading technology, foundational technology, core technology or core and influential technology.

[Figure 3-63] Estimate Technology Contribution Ratio 1 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

See below for innovation stages and sample descriptions in each stage.

<Table 3-1> Innovation Stages of KISTI Technology Contribution Ratio Model

Category	Content	Innovation Stage
Technology competitive-ness	The technology is still emerging and has not yet proven its competitiveness in the market.	Emerging
	Its potential competitiveness has been established in the market.	
Implementa-tion	The technology has not yet been implemented through manufacturing of product.	Leading
	The technology has already been implemented through product manufacturing.	
Dissemination of technology	The technology is widely disseminated and shared in the industry and thus has little impact on the company's competitiveness.	Foundational
	The technology is shared by only a handful of companies and is critical in enhancing the company's competitiveness.	
Spillover effect on other industries	It is uncertain if subject technology is extendable to other industries.	Core
	It is highly likely that subject technology will be extended to other industries and cause a spillover effect.	
Company competitive-ness	The technology does not affect the company's competitiveness substantially in terms of applicability in other industries.	Core and Influential
	The technology is determinant of the company's competitiveness in terms of its applicability in other industries.	

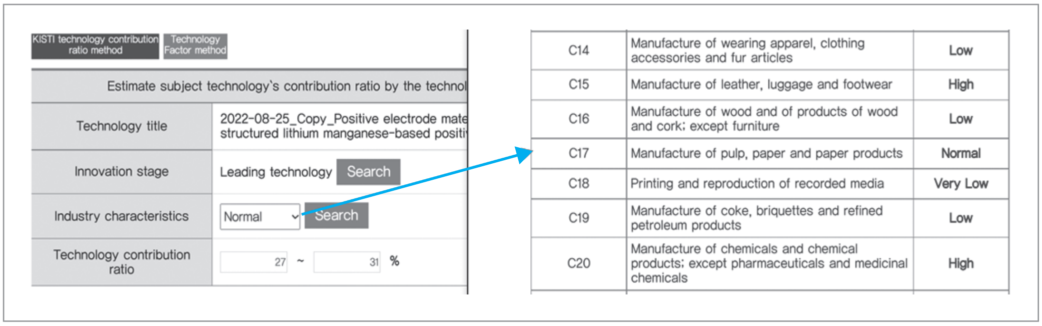
Source: Korea Institute of Science and Technology Information (2018).

② Industrial Characteristics

Click 'search' to see industrial characteristics rated in five levels (Very high, High, Normal, Low, Very low) for each industry. Choose the industry to which the subject technology belongs and the level will be selected accordingly.

Technology contribution ratio will be determined based on the input and entered into the system.

[Figure 3-64] Estimate Technology Contribution Ratio 2 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

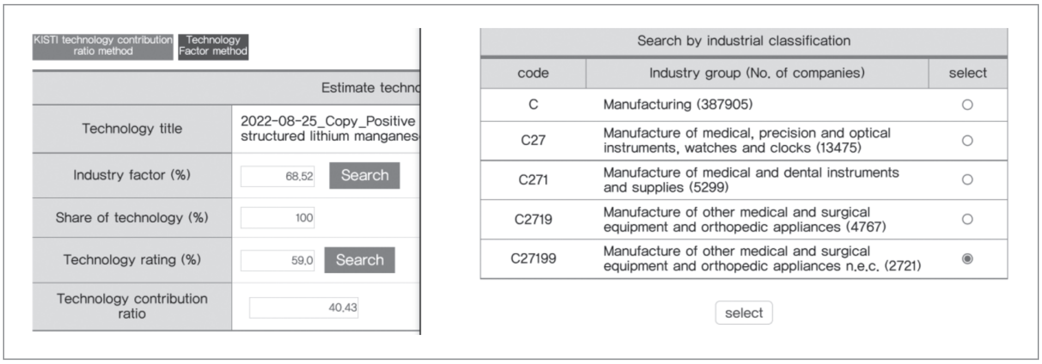
2.2.3.7.2. Technology Factor Method

This method estimates technology contribution ratio by referring to industry factor and technology rating.

① Industry Factor

Click 'search.' You may choose the most appropriate category from sections down to sub-class level in KSIC. The industry factor (%) will be calculated and reflected in the system accordingly.

[Figure 3-65] Estimate Technology Contribution Ratio 3 of STAR-Value DCF Model



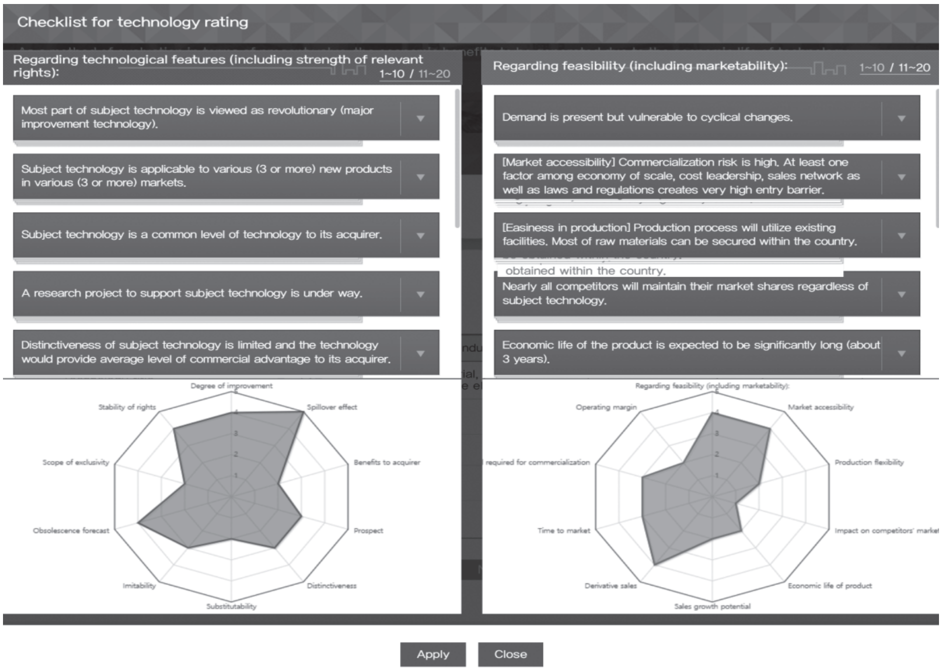
Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

② Technology Rating

Click 'search' to open a pop-up window that shows 20 items to evaluate the technology rating, ten for technological features and ten for marketability features. For each item, check the statement that best describes the subject technology to determine technology rating. The evaluation result will appear in diagram below.

Technology contribution ratio is equal to the multiplication of industry factor by technology rating.

[Figure 3-66] Estimate Technology Contribution Ratio 4 of STAR-Value DCF Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.8. Estimate Technology Value

This final tab reflects the process so far and estimates the subject technology's value.

[Figure 3-67] Estimate Technology Value of STAR-Value DCF Model

<Pre-launch>

In

Year (YY.MM.)		Y1 (22.03~23.02)	Y2 (23.03~24.02)
Sales	100%	0	0
COGS		0	0
Gross margin		0	0
SG&A		0	0
EBIT		0	0
NOPAT		0	0
Depreciation/ amortization cost		0	0
CAPEX	Amount	50,000	10,000
	Depreciation year(s)	0	0
Working capital input		0	0
Growth in working capital		0	0
FCF		-50,000	-10,000
Present value factor	11.33 %	0.8982	0.8068
PV(FCF)		-44,910	-8,068

<Post-launch>

In

Year (YY.MM.)		Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Sales	100%	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
COGS	76.88 %	2,537	15,691	97,053	192,086	475,221	587,849	727,169	787,070	695,433
Gross margin	23.12 %	763	4,719	29,186	57,766	142,913	176,783	218,681	236,694	209,136
SG&A	9.95 %	328	2,031	12,561	24,860	61,504	76,081	94,112	101,865	90,005
EBIT	13.17 %	435	2,688	16,626	32,906	81,408	100,702	124,568	134,830	119,132
Income tax and others (Apply the legal rate)		74	569	3,636	7,501	19,239	23,908	29,684	32,167	28,368
NOPAT		361	2,119	12,990	25,404	62,169	76,794	94,885	102,663	90,764
Pre-launch Depreciation/ amortization cost		0	0	0	0	0	0	0	0	0
Post-launch Depreciation/ amortization cost		128	792	4,898	9,694	23,984	29,668	36,699	39,722	35,097
CAPEX		1,625	9,544	59,028	72,920	212,355	104,600	129,390	79,574	-25,870
Growth in working capital		766	3,970	24,558	28,685	85,462	33,995	42,053	18,080	-27,660
Recovered investment										732,393
FCF		-1,902	-10,603	-65,698	-66,507	-211,664	-32,133	-39,859	44,731	911,784
Present value factor	11.33 %	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071
PV(FCF)		-1,378	-6,903	-38,414	-34,929	-99,863	-13,615	-15,170	15,294	280,009

Business Value	32,052
Technology contribution ratio	40.43 %
Technology value	12,959

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.3.9. Valuation Report

After the valuation result is produced, click ‘Search’ to generate a PDF version of the report. Containing the summary of each stage in the valuation process, the report may be printed as a draft for the final report. An example of valuation report is shown in Appendix.

2.2.4. Caution Regarding the Usage of DCF in STAR-Value System

(1) When selecting industry category under KSIC, narrow down the category to the lowest level possible.

(2) As for the estimated period of profit, use reference data and consult an expert to maximize accuracy of the data.

(3) In case you refer to the financial ratios of similar companies in the process, review the financial structure of each company to verify whether they indeed qualify as similar companies. Select the list of similar companies accordingly to enhance credibility of the report.

(4) Enhance accuracy of time and cost to market by verifying the information with involved parties.

(5) Consider the following in regards with financial information.

A. Insert data: It is recommended that you seek expert opinion so that you can apply more accurate figures.

B. Similar companies: Use the information of similar companies when you have a specific list of companies regarded as similar.

C. Similar industries: Use similar industries' data if you lack information on similar companies.

2.2.5. Theoretical Backgrounds of the RR Model in STAR-Value System

The Relief from Royalty (RR) model calculates a subject technology's value by estimating appropriate royalty rate for the technology based on transaction (licensing) records pertaining to similar technologies. The model, a combination of the market approach and the income approach, revolves around the amount of royalty a licensee would have to pay when acquiring the rights involved, rather than developing the technology on its own. The licensor and the licensee would refer to past transactions to determine their royalty rate and apply the rate to the expected profit from commercialization of the subject product implementing the technology.

The first step of the model is to determine the royalty rate. Useful data here includes corporate internal data on past licensing, data on royalty rates by industry or technology field, as well as data from companies holding royalty rate databases. Once a rate is determined, other variables such as expected profit and relevant risks (in the form of discount rate) would also be considered.

Below is the basic formula for the RR model.

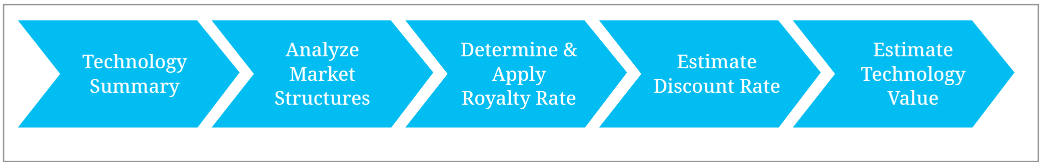
$$V = \sum_{t=1}^{n} \frac{S_t \times R - C_t}{(1+r)^t}$$

V : Technology value
n : Economic life of the technology
S_t : Sales during t
r : Discount rate
R : Royalty rate
C_t : Corporate tax during t

2.2.6. RR Model in STAR-Value System

The STAR-Value RR Model has five steps as below.

[Figure 3-68] 5 steps of STAR-Value RR Model

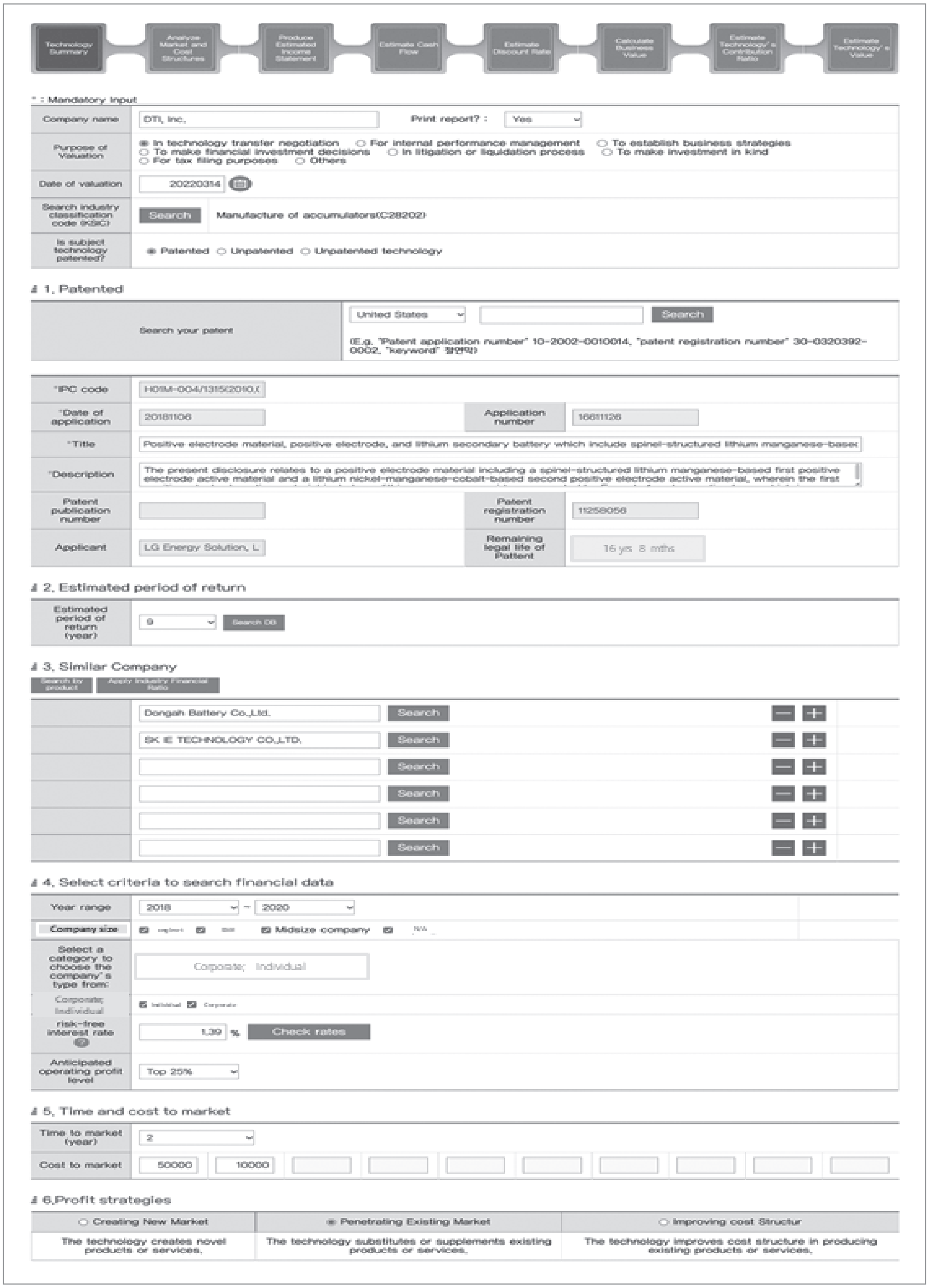


Source: Korea Institute of Science and Technology Information (2018).

Enter data as required for each step. The data will be analyzed to yield technology value in the final step. The chart below is an overview of each step in the Relief from Royalty model.

2.2.6.1. First Step: Technology Summary

[Figure 3-69] 1st Step of STAR-Value RR Model



Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

The “Technology Summary” tab is where you enter basic information that will be used to estimate cash flow. The RR model uses four items out of 6 items shown above.

(1) Basic Information

Enter data yourself or choose one of the given options for information on the company that holds title of the subject technology, purpose of valuation, date of valuation, industry to which the subject technology belongs, NSCST (National Standard Classification of Science and Technology) code, and whether the technology is patented. Your answer to the last inquiry will determine what you see in the section below.

(2) Profit Period (Period during which profit is expected)

In order to estimate cash flow, determine how long you expect the economic lifespan of the subject technology would be.

(3) Time and Cost to Market

To determine the period during which cash flow is expected from sales and other factors, the time it takes to get the product to the market must be considered in addition to the profit period in section (2). In other words, the estimated period of cash flow is obtained by adding the time to market to the profit period, i.e. economic lifespan of the technology. Here you can select the currency you use; the default is set to million Korean Won (KRW). It is also necessary to enter yearly costs during the time before launch.

(4) Profit Strategies

Select how the product or service employing the subject technology will generate profit, whether by creating a new market, penetrating into an existing one or otherwise.

2.2.6.2. Second Step: Analyze Market Structures

Estimate sales using market share on “Analyze Market Structure” to estimate sales. There are mainly four items that require your decision.

(1) On the “Main finished product” section, you will see the name you entered in the Technology Summary tab. Enter the usage of the product below the product name.

(2) Growth trend of the market

Check the past few years’ growth trend for the similar companies or industries you selected in Technology Summary.

(3) Estimate Market Size

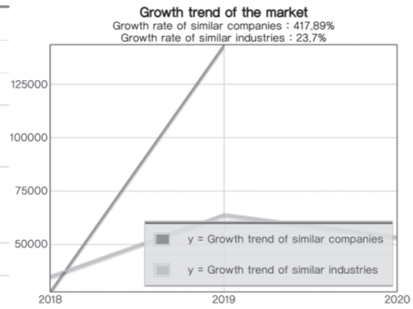
Using the growth rate of similar companies or industries, the system will show estimated market size and market share during the cash flow period.

[Figure 3-70] 2nd Step of STAR-Value RR Model

Main finished product	Positive electrode material, positive (Usage : electrode)

1. Growth trend of the targeted market

Growth of the industry	CAGR	23.7 %
	KSIC	C28202
	Company size	Large,Medium,Middle-market company,Any
	Incorporated or Unincorporated	Unincorporated private enterprise,Corporation
	Anticipated level of operating profit	Top 25%
Growth rate of similar companies	CAGR	417.89 %
	Similar companies	Dongah Battery Co.,Ltd., SK IE TECHNOLOGY CO.,LTD.



* Financial information above are provided from KED(Korea Enterprise Data)

2. Estimated market size [anticipated period of return: 9years]

Apply financial ratios of similar companies | Apply financial ratios of similar industries | Insert data

Total market size (in:)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
33000000	40821000	50495577	62463029	77266767	95578991	118231212	146252009	180913735

Market share (%)

Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
0.01	0.05	0.25	0.40	0.80	0.80	0.80	0.70	0.50

Compare market sizes	Show graph HIDE
Supporting data	
Attachment	Search * Attach files in the last step before you click Next.

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.6.3. Third Step: Determine & Apply Royalty Rate

On this tab, enter royalty rate yourself or use the Reference DB. The final rate will be determined by applying adjustment factor to the royalty rate.

[Figure 3-71] 3rd Step of STAR-Value RR Model

Royalty rate

Insert rate | Reference

Royalty rate	2.5 %

Determine adjustment factor

Weight to apply	Technology provider

Royalty rate factors	Weight for technology provision	Score(1~5)	Weighted Average for technology provision
1. Level of protection	4.2	3	12.6
2. Usefulness compared to existing methods	4.2	3	12.6
3. Scope of exclusivity	4.1	2	8.2
4. Expected profit of technology acquirer	3.4	4	13.6
5. Likelihood of commercial success	3.4	3	10.2
6. Geographical limits	3.5	3	10.5
7. Comparable royalty rates	3.7	2	7.4
8. Length of protection	3.1	2	6.2
9. Expected profit of technology licensor	3.1	4	12.4
10. Commercial correlation	3.6	4	14.4
11. Likelihood that subject technology will be sold at the same price as existing similar assets	2.1	2	4.2
Comparable technologies		Total	112.3
		All 3	115.2
		Ratio(multiple)	0.97

Adjusted royalty rate	2.4 %

Determine Operating Profit

In:

Year	Y2 (24.03~25.02)	Y3 (25.03~26.02)	Y4 (26.03~27.02)	Y5 (27.03~28.02)	Y6 (28.03~29.02)	Y7 (29.03~30.02)	Y8 (30.03~31.02)	Y9 (31.03~32.02)	Y10 (32.03~33.02)
Sales	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
Royalties	80	494	3,055	6,046	14,959	18,504	22,890	24,775	21,891
Income tax	8.8	86.68	650.1	1308.12	3268.98	4048.88	5077.38	5533.55	4835.62
Royalties after tax	71.2	407.32	2404.9	4737.88	11690.02	14455.12	17812.62	19241.45	17055.38

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.6.4. Fourth Step: Estimate Discount Rate

Here you can estimate discount rate using WACC, CAPM or risk-free rate method, or insert a rate as you see fit.

[Figure 3-72] 4th Step of STAR-Value RR Model

WACC method ▾

→ Discount rate 11.33 % = WACC 6.18 % + Technology risk premium 4.21 % + Size risk premium 0.94 %

주1) 기술사업화 위험 프리미엄과 규모 위험 프리미엄은 자기자본비중을 반영하여 산출된 값임

〈Pre-launch〉

Category	Y1 (22.03~23.02)	Y2 (23.03~24.02)
Present value factor	0.8982	0.8068

〈Post-launch〉

Category	Y3 (24.03~25.02)	Y4 (25.03~26.02)	Y5 (26.03~27.02)	Y6 (27.03~28.02)	Y7 (28.03~29.02)	Y8 (29.03~30.02)	Y9 (30.03~31.02)	Y10 (31.03~32.02)	Y11 (32.03~33.02)
Present value factor	0.7247	0.6510	0.5847	0.5252	0.4718	0.4237	0.3806	0.3419	0.3071

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.6.5. Fifth Step: Estimate Technology Value

Finally in "Estimate Technology Value", you will see the valuation result of the Relief from Royalty model based on your input.

[Figure 3-73] 5th Step of STAR-Value RR Model

Year	Y2 (24.03~25.02)	Y3 (25.03~26.02)	Y4 (26.03~27.02)	Y5 (27.03~28.02)	Y6 (28.03~29.02)	Y7 (29.03~30.02)	Y8 (30.03~31.02)	Y9 (31.03~32.02)	Y10 (32.03~33.02)
Sales	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
Royalties	79	490	3,030	5,996	14,835	18,351	22,700	24,570	21,710
Income tax	9	86	645	1,297	3,242	4,015	5,032	5,484	4,792
Royalties after tax	70	404	2,385	4,699	11,593	14,336	17,669	19,086	16,918
Present value	51	263	1,395	2,468	5,470	6,074	6,725	6,526	5,195
Sum of present values									34,167

Adjusted royalty rate	2.4 %
Technology value	34,167

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.7. A Walk-through of RR Model in STAR-Value System

2.2.7.1. Technology Summary

See 'Technology Summary' in DCF Model.

2.2.7.2. Analyze Market Structures

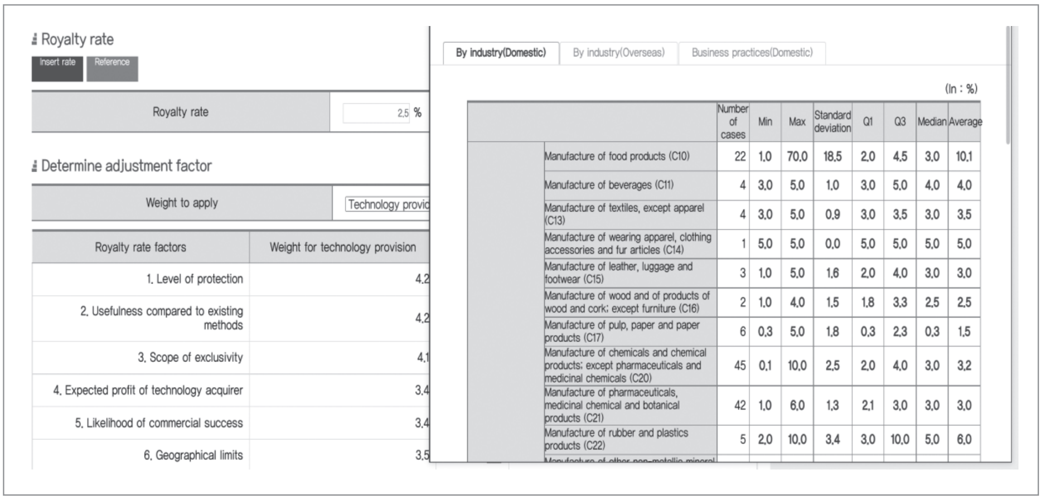
See 'Analyze Market Structures' in DCF Model.

2.2.7.3. Determine & Apply Royalty Rate

Click "Reference" to see the royalty rates for seven sectors generated through "By industry". Click on the average or median value of the sector to which the subject technology belongs and the rate will be entered into the system.

Click "By industry(domestic or overseas)" and you will see a pop-up on reference data for the royalty rates in each industry such as manufacturing.

[Figure 3-74] Determine & Apply Royalty Rate 1 of STAR-Value RR Model

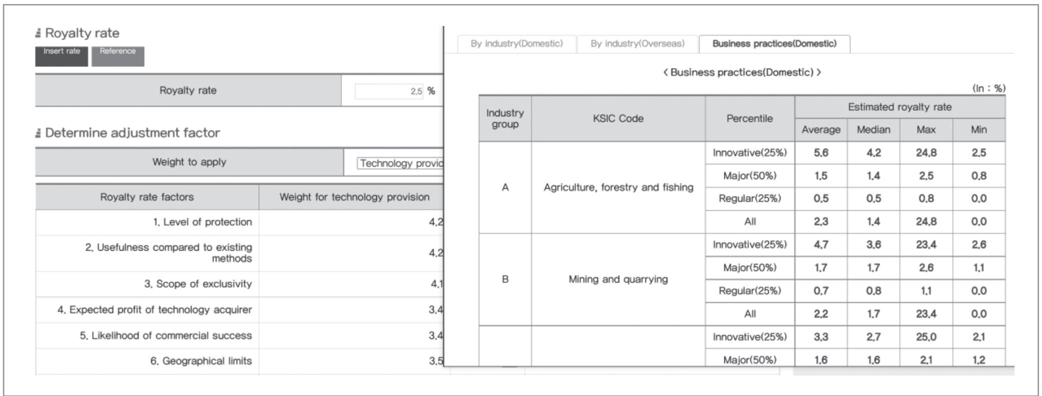


	Number of cases	Min	Max	Standard deviation	Q1	Q3	Median	Average
Manufacture of food products (C10)	22	1.0	70.0	18.5	2.0	4.5	3.0	10.1
Manufacture of beverages (C11)	4	3.0	5.0	1.0	3.0	5.0	4.0	4.0
Manufacture of textiles, except apparel (C13)	4	3.0	5.0	0.9	3.0	3.5	3.0	3.5
Manufacture of wearing apparel, clothing accessories and fur articles (C14)	1	5.0	5.0	0.0	5.0	5.0	5.0	5.0
Manufacture of leather, luggage and footwear (C15)	3	1.0	5.0	1.6	2.0	4.0	3.0	3.0
Manufacture of wood and of products of wood and cork; except furniture (C16)	2	1.0	4.0	1.5	1.8	3.3	2.5	2.5
Manufacture of pulp, paper and paper products (C17)	6	0.3	5.0	1.8	0.3	2.3	0.3	1.5
Manufacture of chemicals and chemical products; except pharmaceuticals and medicinal chemicals (C20)	45	0.1	10.0	2.5	2.0	4.0	3.0	3.2
Manufacture of pharmaceuticals, medicinal chemical and botanical products (C21)	42	1.0	6.0	1.3	2.1	3.0	3.0	3.0
Manufacture of rubber and plastics products (C22)	5	2.0	10.0	3.4	3.0	10.0	5.0	6.0

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Click " Business practices" and you will see royalty rates based on customary market practice in various industries as shown below.

[Figure 3-75] Determine & Apply Royalty Rate 2 of STAR-Value RR Model



Industry group	KSIC Code	Percentile	Estimated royalty rate			
			Average	Median	Max	Min
A	Agriculture, forestry and fishing	Innovative(25%)	5.6	4.2	24.8	2.5
		Major(50%)	1.5	1.4	2.5	0.8
		Regular(25%)	0.5	0.5	0.8	0.0
		All	2.3	1.4	24.8	0.0
B	Mining and quarrying	Innovative(25%)	4.7	3.6	23.4	2.6
		Major(50%)	1.7	1.7	2.6	1.1
		Regular(25%)	0.7	0.8	1.1	0.0
		All	2.2	1.7	23.4	0.0
		Innovative(25%)	3.3	2.7	25.0	2.1
		Major(50%)	1.6	1.6	2.1	1.2

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Reference provides the royalty rates by sector, industry and customary market practices. Select the most appropriate one to enter into the form. The rate here is the base royalty before adjustment.

Once the base rate is determined, identify the differences of the subject technology from standard technologies and reflect them through assessing the adjustment factors. The weight for each item changes depending on whether it is for the licensee or the licensor. Select a proper option between the two on the 'Weight to Apply' column.

Assign a score from 1 to 5 on each adjustment factor, which will be weighted to calculate the sum of the weighted average. This shows the comparative ratio of the subject technology and standard technologies. If the figure in the Ratio (multiple) line is higher than 1, it indicates the subject technology is more highly valued than standard technologies. If lower than 1, it is less valued; if it is 1, the technology is similarly valued as standard technologies.

[Figure 3-76] Determine & Apply Royalty Rate 3 of STAR-Value RR Model

Determine adjustment factor

Weight to apply	Technology provider

Royalty rate factors	Weight for technology provision	Score(1~5)	Weighted Average for technology provision
1. Level of protection	4.2	3	12.6
2. Usefulness compared to existing methods	4.2	3	12.6
3. Scope of exclusivity	4.1	2	8.2
4. Expected profit of technology acquirer	3.4	4	13.6
5. Likelihood of commercial success	3.4	3	10.2
6. Geographical limits	3.5	3	10.5
7. Comparable royalty rates	3.7	2	7.4
8. Length of protection	3.1	2	6.2
9. Expected profit of technology licensor	3.1	4	12.4
10. Commercial correlation	3.6	4	14.4
11. Likelihood that subject technology will be sold at the same price as existing similar assets	2.1	2	4.2
		Total	112.3
Comparable technologies		All 3	115.2
		Ratio(multiple)	0.97

Adjusted royalty rate	2.4 %

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

Once the adjustment factor is applied to the base royalty rate you will see the adjusted royalty rate at the bottom.

Royalties after tax is equal to the multiplication of sales as estimated in “Analyze market and cost structures” by the royalty rate (royalty income) less income tax.

[Figure 3-77] Determine & Apply Royalty Rate 4 of STAR-Value RR Model

Adjusted royalty rate	2.4 %

Determine Operating Profit

In:

Year	Y2 (24.03~25.02)	Y3 (25.03~26.02)	Y4 (26.03~27.02)	Y5 (27.03~28.02)	Y6 (28.03~29.02)	Y7 (29.03~30.02)	Y8 (30.03~31.02)	Y9 (31.03~32.02)	Y10 (32.03~33.02)
Sales	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
Royalties	80	494	3,055	6,046	14,959	18,504	22,890	24,775	21,891
Income tax	8.8	86.68	650.1	1308.12	3268.98	4048.88	5077.38	5533.55	4835.62
Royalties after tax	71.2	407.32	2404.9	4737.88	11690.02	14455.12	17812.62	19241.45	17055.38

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.7.4. Estimate Discount Rate

See ‘Estimate Discount Rate’ in DCF Model.

2.2.7.5. Estimate Technology Value

Apply the present value factor, calculated by applying the discount rate, to the royalties after tax over the estimation period. You will see the present value of royalty payments for each year during the period.

[Figure 3-78] Estimate Technology Value of STAR-Value RR Model

Year	Y2 (24.03~25.02)	Y3 (25.03~26.02)	Y4 (26.03~27.02)	Y5 (27.03~28.02)	Y6 (28.03~29.02)	Y7 (29.03~30.02)	Y8 (30.03~31.02)	Y9 (31.03~32.02)	Y10 (32.03~33.02)
Sales	3,300	20,410	126,239	249,852	618,134	764,632	945,850	1,023,764	904,569
Royalties	79	490	3,030	5,996	14,835	18,351	22,700	24,570	21,710
Income tax	9	86	645	1,297	3,242	4,015	5,032	5,484	4,792
Royalties after tax	70	404	2,385	4,699	11,593	14,336	17,669	19,086	16,918
Present value	51	263	1,395	2,468	5,470	6,074	6,725	6,526	5,195
Sum of present values									34,167

Adjusted royalty rate	2.4 %
Technology value	34,167

Source: https://www.starvalue.or.kr, accessed on September 1st, 2022.

2.2.8. Sample Reports of DCF and RR Models in STAR-Value System

See Appendix of this Report for a valuation sample report using DCF and RR model of the STAR-Value system.

2.3. Case Study of an In-depth IP Valuation Report

2.3.1. Theoretical Backgrounds and Analysis Steps of DCF and RR Model in In-depth Valuation Report

See the corresponding contents of STAR-Value online system (2.2.1., 2.2.2., 2.2.5., 2.2.6.).

2.3.2. Analysis Results by Table of Contents of DCF and RR Models in the In-depth Valuation Report

In the following text, the analysis results of the valuation for personal portable descending devices are specifically described, and the contents shown in the in-depth technology valuation are analyzed.

2.3.2.1. Valuation Overview and Assumptions

The object of valuation, the methodology used, the valuation base date, purpose and premise, valuation principles, and assumptions are introduced.

2.3.2.1.1. Overview of Valuation (Extracted from an in-depth report)

(1) Subject of Valuation

The technology to be valuated relates to a personal portable descent device using alpha technology (registered Korean patent No. 10-******).

(2) Valuation Method and Valuation Base Date

In this valuation, the Income Approach and the Royalty Method were applied to convert the value of the technology to be valuated in monetary terms. This valuation is performed for internal reference, and the above two methods are used from this perspective because it is determined that it can be utilized for decisions regarding external investment through determining the value of profits through this project and transaction price in the market.

The income approach focuses on the ability of the technology asset to generate future revenue, and calculates the value of the technology by multiplying the total present value of the future cash flows from the technology to be valuated. The Royalty Deduction method applies a 'Royalty Payment Saved' method that calculates the technology value by determining the appropriate royalty rate for the technology to be valuated through similar technology asset transactions (licensing). The valuation base date of this valuation shall be November 1, 2021, and the validity period of this report shall be one year from the date of submission.

(3) Purpose of Valuation

The purpose of this technology valuation is to calculate the technology value for the patented technology of "personal portable descent device using alpha technology" for internal reference.

The valuation of technology value not only estimates the amount of profits that a commercial entity will generate from commercializing the technology, but also provides information necessary for rational decision-making based on the business value and technology value of the technology as a result of the valuation.

(4) Standards of Value Determination

The criterion of value applied to this assessment is market value. Market value "refers to an estimate of the price that must be traded in a fair transaction by an unspecified majority, and refers to the estimated exchange price between the seller and the buyer, who has no interest in the entity to be transacted as of the valuation date, given an appropriate marketing period. "The terms 'buyer' and 'seller' refer to a person who is knowledgeable and considers the goods and acts freely without compulsion."

2.3.2.1.2. Valuation Assumptions (Extracted from an in-depth report)

(1) Principles and Assumptions of Valuation

In principle, the value calculated as a result of the technology valuation shall be the market value. It is determined by applying the highest and best use principle by setting conditions that are highly likely to be adopted in setting the valuation conditions and applying the use principle. In relation to the identification of the subject for valuation, the valuation is conducted by confirming the attributes, composition, use, and applicable products of the target technology, and the relationship of rights such as ownership. With regard to the specifications of purpose and use, the purpose and use of the assessment shall be specified if the assessment results vary in terms of the assessment perspective or the assessment factors that are considered. In relation to the scope, assumptions and limitations of the assessment, the assumptions used in the assessment process and limited conditions shall be presented, and it shall also be specified that the assessment results may vary with changes in circumstances.

(2) Utilization Information

For technology classification, the Korea Standard Industry Classification System is used to classify the industry, and the cited analysis information based on the International Patent Classification (IPC) is used to estimate technology lifespan, standard financial information, discount rate, and technology contribution. In addition, key variables are used for comparative review with the opinions of related experts and information of the relevant (similar) company, or as a proxy if it is not possible to acquire information about the company.

2.3.2.2. Technical Analysis

Technical analysis refers to analyzing and valuating technology overview (technology definition and overview), technology development trends and competition (new/alternative), status and level of technology (innovation, superiority, differentiation, etc.), utilization and ripple effects of technology.[7]

The technical analysis begins with a clear definition of the target technology and the product to which the target technology is applied, which is used as basic input information that defines the target market and industry for the technology in the marketability analysis. Accurate identification of these technologies, products, markets, and industries can have a significant impact on the reliability of value calculations.

Technical analysis is performed to analyze whether the target technology and the product (service) implemented with the target technology are technically feasible.

Even if there are new ideas, it is difficult to commercialize them if they are technically infeasible. Even if technically feasible, it is important to find the optimal method among the various alternatives and generate the maximum profit.

---

7 In cases of new drug development, which is expensive for a long period of time and requires licensing, there are uncertain(risky) factors such as development cost, development period, and probability of clinical success. For technologies with these characteristics, it may be necessary to adopt a methodology that reflects the specificity of new drug development that can be commercialized only when the processes of clinical practices are passed, with using these uncertain factors as input variables. The r-NPV (risk-adjusted Net Present Value) methods are used for these valuation cases.

Technical analysis is divided into analysis of the technology environment and analysis of the technology's usefulness and competitiveness. Technology environment is analyzed to understand the trends and prospects related to domestic and foreign target technologies, and to assess similar and competitive technology environments encompassing competitive technologies (existing and similar technologies), new and alternative technologies, and the support infrastructure (parts, materials, etc.). The usefulness and competitiveness of the technology are analyzed by comparing and analyzing the advantages and disadvantages of the target technology based on the characteristics of the competitive technologies identified based on the technology environment analysis.

It analyzes and reviews the characteristics of the technology itself (differentiated competitive factors), application fields and products, and additional necessary technologies (completeness of the technology), and compares and analyzes the characteristics and differentiation factors of the technology. The results can be used to analyze the usefulness of technology, such as innovation of technology, utilization by technology users, ripple effect on other fields, prospects, and the technology commercialization environment. In addition, it can be used by dividing it into items necessary for analyzing the competitiveness of the technology, such as superiority of the technology, differentiation, possibility of future replacement, difficulty of imitation (technical difficulty), and possibility of obsolescence.

It is necessary to include both the objective analysis content and the subjective opinion of the valuator so that the entity requesting the valuation and the user can easily recognize the result.

2.3.2.2.1. Valuation Assumptions (Extracted from an in-depth report)

(1) Overview of the Technology to be Valuated

Due to the rapid change in the form of housing due to industrialization and urbanization, most people live in complex dwellings such as apartments and residential complexes, and fire accidents in complex dwellings are frequently causing damage to lives and property.

An emergency escape device (emergency escape device) is an evacuation device that the occupant can use to escape to the ground when the occupant is unable to go outside using a passage such as a staircase or corridor in the event of a fire. The device is divided into a general descent life line device that can be used in a continuous shift and a relaxation device that cannot be used continuously. In general, the descent is a structure in the form of a descent rope that develops out of the building and descends by the evacuee's initiative, and should be installed on the exterior wall of the building, but it is usually placed inside the building for reasons such as aesthetics and the risk of falling due to external environmental factors like wind.

However, in the event of a fire, it is common to have safety accidents such as the occupants jumping out of the building because they did not know how to use the descending life line, or crashing due to inappropriate use of the descending life line. The existing descending life line is bulky, heavy, and the structure is separated, which makes it difficult to use easily for the following reasons: it is somewhat complicated to use; the location of the fire in the building cannot be predicted; and the application conditions of the escape device may vary depending on the building.

The technology subject to the present valuation, viz. ‘Personal Portable Descent Device Using Alpha Technology’ compensates for the shortcomings of the existing escape device, and provides ease of use in that it can be easily handled by beginners, children and the elderly while increasing safety by constantly adjusting the descent speed to a low speed, while still being easy to use, lightweight, and without restriction of location.

The characteristics of commercialization products that apply the technology to be valuated are summarized as follows.

- Integral structure
- Portability
- Preventing the loosening of the line
- Safe descent at low speed
- Available after selecting the appropriate location
- Easy to use with simplified operation

The technology to be valuated can alleviate the impact force of the descent to prevent the second safety accident that may occur immediately after the descent, and it is possible to take a stable descent position on one’s own, thereby enhancing the sense of psychological safety. In addition, it is noted that the technology to be valuated is portable and can be used to escape through the windows and railings of various buildings that have been moved in an emergency, so that the utilization is high.

2.3.2.2.2. Technology Trends (Extracted from an in-depth report)

(1) Overseas Trends

Looking at overseas technology trends, the United States saw a large number of victims in the 9/11 attacks in 2001 caused by the World Trade Center fire, and since then, many devices have been used to prevent work-related crashes or to solve the problem of descent that must be controlled during an emergency descent from a building. Related technologies began to develop.

The devices that were developed initially utilized mostly hydraulic or other fluid frictional braking systems, but these devices were relatively short-lived depending on the nature of the fluid and presented the risk of failure if the fluid level was low or insufficient. To remedy this problem, manual braking systems, such as the rope windlass system, have been developed that allow for long-term storage without degradation and maintenance. However, since the rotation of the rope when descending is slow, and the wear of the rope due to friction depends on the user's ability, it is difficult to use, so that a technique has been developed for manufacturing or coating the rope with wear-resistant material to prevent damage or wear of the rope. Later, technology was developed in the United States, Canada, Europe, etc. to break the fall by connecting the fall arrest actuator, a self-blocking actuator capable of braking itself, to the brake, and in addition a shaft was installed to allow the shaft to brake. Devices have been developed to decelerate and control the rate of descent with the current generated by magnetic interaction with the magnet when rotating.

In Japan, attention has been paid to technologies for safe use rather than deceleration control technology of emergency escape devices. By painting the rope with the same color as the speeder, the user can easily determine the wearing tool to be fitted and descend safely through the speeder, and the drop impact load is lower compared to the torso belt type. Devices have been developed with seat belt types consisting of shoulder hangers and thigh hangers that can be dispersed to reduce damage to the body and descend into a stable position. China has developed a technology that reduces the rotational speed of the rope roller by rotating the friction disc. For this the emission and discharge rate of the sand discharged into the transmission of the emergency escape device are regulated, and the friction of the centrifugal block is managed by installing centrifugal blocks at both ends of the centrifuge shaft and rotating the ring gear, transmission gear and solar gear in tandem and rotation. Techniques and devices have been developed for controlling the fall rate in which the rotation of the wire rope is slowed down.

(2) Domestic Trends

In the case of Korea, rapid industrialization and economic development have led to dense population in the cities, resulting in the development of large-scale, high-rise building complexes. In line with this trend, the damage caused by fires has increased due to the lack of awareness regarding safety management and the development of safety technology.

Previously developed devices were divided into wall-mounted installation support and speed controllers, belts, and reels contained in a decent life line box, but the installation method was somewhat complex, making it difficult for users with no experience of use or training to use it quickly and correctly in a crisis.

Initially, however, research on emergency escape devices was not actively carried out, which only exacerbated this problem, but as awareness of safety management improved, devices with the function of adjusting the speed of descent were developed for safe descent.

In Korea, in addition to the brake drum and brake pad, similar to overseas technology, friction-based speed control by magnetic force through the installation of magnetic members and speed control technology using the floating current (eddy current) generated by electromagnetic induction when the magnetic field jammed on the conductor changes in time have been developed.

In addition, in recent years, integrated structures that have been combined into one from separate structures that require additional installation, which has been a major problem with existing technology, have begun to be designed. Accordingly, there are developments of new emergency escape or personal descent devices that simplify the procedure of use and can be used quickly with or without user's training.

The Emergency Escape Aircraft SLS is an integrated emergency escape device with a winding roller and a deceleration device housed in a single unit. The device is highly portable and uses thin air wire with strong tensile force, and is equipped with a speed-regulating brake pad that allows the user to adjust the speed. The one-touch descent is a product that the user can operate by fastening the belt after a single operation, and when the handle protruding out of the box is pushed to the right, the lid to which the accelerator is attached spreads out of the window by the interaction of each link, so that the user can be evacuated quickly without going through several steps.

2.3.2.2.3. Skill Level Analysis (Extracted from an in-depth report)

(1) Characteristics of the Technology

A. Excellence of the Technology

The types of technologies to be valuated were divided into derivative technologies, applied technologies, and original technologies, and technical superiority was determined through comparison with prior work related to the valuated technologies.

The highest category, source technology, refers to the technology that drives the technical standards in the group of technologies.

The table below compares the existing prior technology with the technology to be valuated.

<Table 3-2> Comparison of Existing Prior Technology and Valuated Technology

Existing Leading Technology	Technologies to be Valuated
• Planetary gear reducer, lowering speed adjustment using friction member • Difficulty in controlling the descent speed • Installation required when used in a separate structure • Difficulties in handling and use due to heavy weight • High manufacturing unit price • Requires ongoing maintenance • Wear on the brake drum and brake pads requires frequent inspection and replacement of the friction member	• Control the descent speed with strong friction generated by magnetic force installed in the brake drum • Easy to use with simplified design and lightweight operation • Portable product • Mitigates the impact force of the descent and thereby prevents the second safety accident immediately after the descent • Slow descent increases safety and psychological sense of safety

As a result of comparing the valuation target technology with the existing prior technology, the valuation target technology is identified to be a derivative and application technology that has improved the problems such as the ease of adjusting the low descent rate of the existing emergency escape device (descent), the high manufacturing unit cost, the high weight, and the need for continuous maintenance.

In order to solve the problem of not being able to slow down the rapid descent or descent speed safely in the initial stubble period, the existing descent speed control technology uses friction members such as brake drums, brake pads, brake plates, etc., and applies techniques for slowing down the fall speed by the resistance of the air in the event of a fall by mounting a falling member such as an umbrella. However, there was a problem that when wear occurred in the friction member, the rate of descent was not controlled, which added to the risk. In order to solve the problem of the existing prior technology, the valuated technology can prevent the wear and tear of the friction member by additionally installing a magnetic part in the friction member.

The technology to be valuated uses a technique that can control the rotational speed of the bobbin by the frictional force generated by the magnetic weight being attached to the bobbin when descending, by installing a magnetic weight in the receiving groove of the brake drum, and it has been investigated that there is a competitive technology (similar technology) having a low-speed descent function activated by magnetism.

Therefore, the technology to be valuated is a derivative and applied technology that improves the problems of the existing technology, and the technical superiority is judged at the normal level because the function and performance are similar compared to the competitive technology (similar technology).

B. Competitiveness of Technology

As of the date of the valuation, similar frictional emergency escape device technology exists in relation to the products applied to the valuation technology, and there are companies that produce similar products. A comparison of the valuation target technology 'personal portable descent device using alpha technology' and the competitive technology (similar technology) are shown in the table below.

<Table 3-3> Competitiveness of Technology

Company Name	Corporation (Technology to be Valuated)	Ahnsang Tech Co., Ltd.	K.P.M.
Portability	Good	X	X
Descent speed control method	Magnetic churn Friction force caused by magnetism	By permanent magnet Induction of magnetic field resistance	The magnet is in contact with the fixed rail to prevent a sharp descent
Instantaneous descent impact force	Low	Low	Low
Evacuation Locations	Select the proper location	Specify a specific location	Specify a specific location
Key Configurations	Integrated	Wire, Speeder, Bracket	Integrated

The emergency escape descent developed by Ahnsang Tech Co., Ltd. uses a method of controlling the descent speed by a magnet similar to the technique to be valuated, and the permanent magnets are fixed on the support plates located on one side of the rotating plate made of non-ferrous metal material, so that when the rotating plate is rotated with the bobbin, it is possible to induce magnetic field resistance even in a non-contact state to slow down the descent speed. The descent steel device developed by K.P.M. Co., Ltd. operates as follows. When the speed control lever is activated, the brake pad and magnet are separated only partially from the lower area of the fixed relay part to prevent a sharp descent, and the descent speed can be adjusted to descend safely to the ground.

In addition to this, there is an emergency escape device technology that can generate additional braking force when a rotational force above the set threshold is acted on using a neodium magnetic member developed by the Donga University Industry-Academia Cooperation Group. Furthermore, there is a technique in which the downward speed is controlled by binding and separating functions operated by the magnetic force of the magnetic pad provided between the brake pad and the wheel hub. This technique was developed by the Gacheon University Industry-Academia Cooperation Group. Therefore, given the number of similar technologies that can be adjusted by magnets, the competition is intense and this competition is expected to interfere with the commercialization of the valuation target technology in the future. In this regard, the competitiveness (technical competition strength) is usually valuated at a level below the average level.

C. Substitute for Technology

Substitution refers to the possibility of the emergence of another innovative technology that can replace the technology to be valuated in the future, and the trends of patent applications, research and development, and frequency of emergence of new products are comprehensively valuated to assess the possibility of substitutes emerging.

A technology that can be replaced the technology to be valuated is the “skyscraper escape device using a drone” with Korean Patent No. 10-2162840. A skyscraper escape device using a drone is a technology that secures an escape device to a building and uses the drone to remotely control and guide the safe boarding and safe descent of the escape device.

Portable escape devices, such as existing escape devices or the assessment technology provided in buildings, present difficulties in operation for people who have not received safety training or who are shocked by accidents, and there are deficiencies in safety when used. However, the alternative technology can be remotely controlled without the need for the occupant to operate it, so that safety accidents caused by lack of expertise in operation can be prevented, and the escape device is fully fixed and therefore reduces the swaying by the wind when descending, thereby increasing the psychological sense of safety. In addition, it is possible to move and change direction from side to side, and up and down, so that the device can be moved to the place where the occupant is located, and in normal times when it is not used, the drone can be pulled to the side of the escape device to store it in a fixed position.

The valuation target technology uses the method of braking in the descent period to increase the friction force of the existing friction member with the additional installation of magnetic weight. As a result of looking at the alternative technologies as such, the number of related patent applications and the frequency of the emergence of new products are low, and there is a possibility that another innovative technology will emerge, such that the possibility of substitution is judged to be below the normal level.

(2) Differentiation of Technology

A. Differentiation of Technology

Differentiation assesses the discriminatory properties of the technology to be valuated against the competitive technology in terms of business superiority (improvement of production yield or function, cost reduction or time savings, improvement of process or process methods, ease of use, etc.).

The wire wound in the bobbin is released by the weight of the user, which causes the bobbin to rotate. When the rotation of the bobbin is suppressed, the descent speed of the falling device can be controlled, at which time a brake pad made of rubber material with a high coefficient of friction can be installed to make contact with it, so that the drop speed can be adjusted by generating friction force. Furthermore, the centrifugal force generated when the brake plate installed in the brake shaft rod rotates can be received and adjusted inside the brake drum to control the rotation of the bobbin. However, this existing friction-type emergency escape device technology presents problems such as failure in controlling the user's descent speed when the brake drum and brake pad are worn, resulting in safety risks and costs associated with frequent inspections and replacements.

In the technique to be valuated, a magnetic tube inserted into the receiving groove of the brake drum is attached to the inner surface of the bobbin by a strong magnetic force, effectively inhibiting the rotation of the bobbin. In other words, the loosening speed of the wire released from the bobbin is controlled, so that the user of the descent device can descend safely from the building at a low speed, which offers high safety, but only the descent device is moved to the lower part of the building while the end of the wire wound in the descending device is fixed to the building, etc., It is an improved technology that can be easily used by beginners and young children.

In addition, the personal descent device, which is the product of the technology to be valuated, is portable as a product with integrated main configurations such as wires, so that in the event of a fire, it is possible to escape quickly through the window or railing without restriction of place. In addition, the wear of the friction member is low, so that the management cost incurred in replacement or inspection can be reduced, such that it offers competitiveness in terms of cost burden.

That is, the technology to be valuated is a technology that compensates for problems such as ease of use and management of cost for friction-type emergency escape device products that are currently being commercialized. Further, it can be considered to be a technology that has a differentiation factor in that it adds friction force to the inner surface of the bobbin by installing a magnetic weight on the brake drum. However, there are companies that make products with the function of controlling the descent speed by installing a magnetic member, and the functions and performance are similar to those of competing technologies; hence, the products that can be carried in an integrated manner have strong discriminatory properties in that they are technologies that can be fully developed by competitors. Therefore, the differentiation of the technology to be valuated is judged at a moderate level.

B. Innovativeness of Technology

Innovativeness is valuated according to the degree of application and diffusion of technological innovation, divided into innovative technologies, technologies with major improvements, technologies with usual level of improvement, somewhat improved technologies, and technologies that are similar to existing ones.

In the field of descent devices, the technical problems are 1) the difficulty of controlling the descent speed, and 2) the psychological anxiety caused by the unstable descent position. In addition to the frictional force generated by the magnetic force of the magnetic weight, the valuation technology combines the bobbin gear inside the bobbin and connects it with the brake shaft while installing a number of planetary gears that are matched to the bobbin gear, so that the descending speed can be controlled easily.

In addition, as the valuation target technology forms a curved portion on the guide rod, the wire is supplied accurately to the guide groove (middle part) of the wire roller during the operation of the descent device, preventing the tilting of the descent device and thereby enhancing the user's psychological sense of safety. Therefore, since the technology to be valuated is judged to be somewhat modified in that it improves some problems compared to the existing technology and adds technical superiority to the product or service, the innovation of the technology is valuated at a level below the usual level.

(3) Maturity of the Technology

A. Feasibility of Implementing the Technology

The technology to be valuated has secured safety and convenience, and the business entity has applied for a patent and registered the technology to be valuated, and in order to reflect on the development of the next product, the company is conducting product reviews for residents living in high-rise buildings or for experiential applicants, buyers, and respondents through online media.

At present, the business entity is promoting product improvement based on the valuation opinion, performance certification and safety certification through implementation of testing, and the registration of excellent products by the PPS, so it is expected that it will take 6 to 12 months to commercialize the technology. In addition, since the business entity plans to establish semi-automated facilities in 2023 and 1 set of automation facility annually from 2024 to 2026, it is judged that additional technology development costs and time will be required accordingly. Therefore, considering that the technology to be valuated has currently only completed patent registration, requiring additional steps for mass production such as product improvement and safety certification, it is believed that more time is required to implement the technology.

(4) Difficulty in Imitation

The assessment of difficulty of imitation is concerned with the degree of difficulty of imitation based on the degree of the skill level's complexity. The difficulty of imitation utilizing external public data and the difficulty of imitation through reverse engineering of the released product are considered comprehensively. The configuration and characteristics of emergency escape devices proposed by the business entity, such as installation of magnetic churn, formation of curved part, integration of main configuration, portability, etc., are different from features offered by competitors, and furthermore the business entity holds a patent for its own technology.

However, various companies are developing technologies similar to the magnetic braking method in the descent period, which is the main constituent of the technology to be valuated. The valuation technology patent No. 10-***** is a technology that was filed on **March**, 2021 and registered on **March****, 2021, and is likely to be imitated by peer research developers as a known technology. In addition, although the technology to be valuated has an advantage in terms of safety and ease of use over competing technologies, the complexity of the technology is not high, so imitation is relatively easy, and as a result, the current and future profits of the business entity are likely to be affected. Considering these, the difficulty of imitation is judged to be below the average level.

(5) Utilization and Ramifications of Technology

A. Utilization of Technology

Utilization determines whether the technology to be valuated is in line with the current business strategy as the core technology of the business entity and whether it is possible to generate economic benefits through the utilization of the technology.

The Emergency Escape Device (Wangang Machine), an evacuation device installed on objects of fire, shall be installed on the 3rd to 10th floors of fire objects such as hotels, hospitals, and communal houses from March 10, 2005, according to the Fire Department's notice, and on the 2nd to 4th floors of multi-use establishments with a business location of 4 floors or less, such as a singing practice hall or a notice center.

According to the current data held by the Ministry of Land, Land and Transportation, on buildings by the number of floors, the number of double-story buildings (2 floors or more) is increasing at an average annual rate of 1%, the number of buildings over 5 floors is increasing at an average rate of 3% per year, and the proportion is also increasing every year. In line with the increasing trend of double-story buildings, the installation of descent steel machines will also be expanded, so the demand for emergency escape devices is expected to increase further in the future.

The business entity is a company that produces fire escape products, and plans to commercialize the personal descent device, which is a product related to the technology to be valuated, and sell it as the main product of the business entity. Furthermore, it is planning to register overseas patents, promote overseas certification, and enter the overseas online market. In other words, since the technology to be valuated is the core technology of the business entity and the demand is expected to increase in the future, it is judged to be an important technology that can provide economic benefits to the business strategy of the business entity. However, since there are a large number of similar technologies in the emergency escape device market, the utilization of the technology is valuated at a moderate level.

B. Ripple Effect of the Technology

The ramifications valuate the potential for future applications and applications in the development of convergence technologies in addition to the markets and products to which the technology to be valuated can be applied currently. That is, the potential for future expansion and applicability of the valuated technology to other technology products and markets is judged.

It is expected that the technology to be valuated can be used in as a life-saving escape tool used in emergencies such as building fires, and can be applied to automatic lift and descent devices for exchanging and cleaning bulbs of filters or lighting products such as ceiling air conditioners and air purifiers in fusion with automatic lift and descent systems.

Considering the technical capabilities of the business entity in terms of the utilization and ramifications of the technology, it seems that there will be no major difficulties in the commercialization of the technology to be valuated, but since the technology to be valuated is likely to be specialized and used only in the field of lift and descent devices for the transport of people and goods, the ripple potential is judged to be below the normal level.

2.3.2.2.4. Comprehensive Opinion (Extracted from an in-depth report)

The valuation target technology is a “personal portable descent device using alpha technology”. It is a technology that improves safety and convenience, and the value of the technology was comprehensively judged by taking into account (1) the necessity and urgency (2) the differentiation and innovation, and (3) the utilization and ramifications of the technology to be valuated.

(1) In the fire that occurred in a high-rise building, the crash caused by the difficulty in installation and use of the existing descending life line and the secondary safety accident caused by the rapid descent showed that the demand for improving the safety and ease of use of the emergency escape device is increasing. At a time when there is pressing demand for the development of technology that can ensure safety and economics, in view of the need for technology development and the urgent aspects, the security of the technology to be valuated is established given its capacity to improve the separate structure of the general descending life line and the method of controlling the descent speed. It is deemed necessary.

(2) The technology to be valuated complements the convenience of use and management of friction-type emergency escape devices that are currently being commercialized. The technology to be valuated is based on the installation of magnetic weights in the receiving-grooves of the brake drum to control the rotation of the bobbin with strong friction, which can reduce the costs of management such as replacement of

worn parts, regular inspection, etc., and is an all-in-one portable product with no constraints of space. Considering these features, it is judged to be a technology that has a distinction from competing technologies in that quick escape is possible through railings. In addition, as the valuation target technology forms a curved portion on the guide rod, the wire is supplied accurately to the guide groove (middle part) of the wire roller during the operation of the descent device, preventing the tilting of the descent device and thereby enhancing the user's psychological sense of safety. However, there is a competitive technology with the function of controlling the descent speed by installing a magnetic member, and the all-in-one portability of the product is a feature that can be fully developed by competitors, so it is difficult to judge that the discriminatory properties are strong. Therefore, the differentiation of the technology to be valuated is judged to be normal, and the innovation is usually assessed at a lower level in that it is an improved technology that has resolved some problems of the existing technology.

(3) Considering the technical capabilities of the business entity in terms of the utilization and ramifications of the technology, it is judged that there will be no major difficulties in the commercialization of the technology to be valuated. In addition, the technology to be valuated can be used as a life-saving escape tool in emergencies such as building fires, and can be applied to automatic lifts and descent devices for exchanging and cleaning the filter of ceiling household appliances or light bulbs of lighting products by fusion with the automatic lift and descent system. Therefore, it shows high potential for utilization. However, since the technology to be valuated is likely to be specialized and used only in the field of lifting and falling devices, the possibility of its use and ramifications in other fields is judged to be below the normal level.

Therefore, the technology to be valuated has low innovation and ripple effect, but offers excellent ease of use and management compared to competitive technology. Furthermore, the utilization of the valuated technology is high because there are a variety of products to which the technology to be valuated can be applied, such as lifesaving devices, elevators and descent devices that are fused with automatic lift and descent systems. In addition, as the installation of descending life lines will be expanded in accordance with the increasing trend of double-story buildings, it is expected that the demand for emergency escape devices for double-story buildings will increase further in the future. Considering these points comprehensively, the technology to be valuated is judged to be worthy of technological development.

2.3.2.3. Rights Analysis

Rights analysis refers to the analysis of rights stability, strength of protection, application to products, and association with business based on investigation of bibliographic information for the target patent, technical information, scope of rights, and prior information. It is meaningful to understand whether it is possible to secure an exclusive position in the market to commercialize the target technology and how much protection the business has from competition.

In the analysis of rights, basic bibliographic information (right holder, legal status, duration, family application, and information on related intellectual property portfolio of the right holder) should be identified first, and the description should be determined based on the information provided in the patent claim and specifications.

A thorough prior investigation shall be conducted on domestic patents, overseas patents, domestic and foreign papers, and other documents disclosed before the date of patent application. A presentation of the valuator's opinion on the rights can cause serious problems that hinder the reliability of the valuation if the opinion does not involve a faithful prior investigation. Based on the results of such prior technology investigation, it is necessary to determine the possibility of invalidation (possibility of prior registration) of patent rights and the strength of rights protection.

It is necessary to list the components in the claims on the scope of the patent accurately, and to investigate whether these components are applied to the product to determine whether the target technology product is protected by the patent. In some instances, it is necessary to determine and present the application for the product by schematizing the components of the claim and the actual product (claim chart).

As a result of the analysis of rights, if the patent rights are stable, the scope of rights is wide, the portfolio is diverse, the specifications are appropriate, and the product applicability is clear, it has a positive effect on the determination of technology life, technology contribution, discount rate, royalty adjustment coefficient, etc.

In the case of registered patents, the possibility of invalidation of rights is analyzed, and in the case of applied patents, the possibility of registration is analyzed. When valuating the intellectual property rights as independent property rights, for purposes such as securing intellectual property rights to financial institutions, selling or licensing intellectual property rights for intellectual property business, or calculating damages in intellectual property infringement lawsuits, rights analysis is a key valuation factor and can directly affect the value calculation process.

The analysis should present sufficient information such as the scope of technology protected by patent rights, results of prior technical investigations, claims and product comparison tables so that valuation requestors and users can understand the valuation report. In addition, an objective interpretation of the results of the analysis on the rights of the target technology should be included.

2.3.2.3.1. Overview of Patents to be Valuated (Extracted from an in-depth report)

(1) General Matters of Patented Technology

The patent to be valuated relates to a personal portable descent device using alpha technology, and in more detail, the magnetic weight is installed in a number of receptive grooves formed on the outer surface of the brake drum. It is configured to control the bobbin's rotational speed with the frictional force generated when the magnetic addition is attached to the bobbin.

The patent to be valuated prevents the string from unwinding itself, operates when subjected to a constant force or load, and causes the brake drum to rotate at a low speed by the initial, magnetically generated stop force. This prevents the user from descending sharply during the first descent, and enables safe descent from the building at low speed.

(2) Key Points and Features of Patented Technology

The patent to be valuated is for a technology that supports safe descent from buildings when using the descending device in the event of an emergency. In the device using this technology, the magnetic addition is strongly attached to the inner surface of the bobbin by magnetic force, resulting in a strong friction force that causes the brake drum to rotate at a low speed, so that the user of the descent device can descend from the building safely at a low speed. It has the effect of increasing safety in urban building structures.

In addition, the patent to be valuated is to combine the bobbin gear inside the bobbin and connect it with the brake shaft while installing a number of planetary gears that are matched to the bobbin gear, so that the speed of descent can be easily controlled, and the end of the wire wound in the bobbin can be easily controlled. By connecting the band to the hook coupled to the descent device while tied to the beams of the building, etc., the descent device is easy to use, and because of this, it is characterized as easy to use even for beginners and children.

(3) Scope of Rights of the Patent to be Valuated

The key components that make up the independent claims of Korean Patent No. 10-***** and the main scope of rights of the independent claims are as shown in the table below.

<Table 3-4> Scope of Rights of the Patent to be Valuated

Category	Claim Details	Core Components
Clause 1	A bobbin gear is installed at the inner end of the bobbin in which the wire is wound. A number of planetary gears are installed to be located on the inner side of the bobbin to interface with the bobbin gear, and a brake drum rotating at the rotational force of the planetary gear is installed inside the bobbin such that it is in contact with the inner surface of the bobbin. A number of receiving grooves are formed on the outer surface of the brake drum, and a magnetic weight is installed in the receiving groove to configure the rotational speed of the bobbin to be controlled by the frictional force generated when the magnetic weight is attached to the bobbin. The bobbin can be rotated by bearings between the gear fixed side plate and the fixed side plate, which are installed facing each other. A bobbin gear is installed on one side of the bobbin and a brake receptor is attached on the other side such that it can accommodate the brake drum. The personal portable descent device using alpha technology has the following characteristics: on one side of the brake drum that is inserted into the brake receiving port is attached a brake shaft of a predetermined length protrudes, and at the end of the brake shaft a gear portion is engaged with a number of planetary gears that are installed such that they are in contact with the bobbin gear.	Bobbin in which the wire is wound; Bobbin gear installed on the inner part of the bobbin; A number of planetary gears installed on the inner side of the bobbin to interface with the bobbin gear; Brake drum rotating with the rotational force of the planetary gear; A number of receiving grooves formed on the outer surface of the brake drum; Magnetic churn installed in the receiving groove

2.3.2.3.2. Prior Technology Survey (Extracted from an in-depth report)

(1) Scope of Investigation of Prior Technologies

In order to find the major prior patents that are highly relevant in whole or in part to the patents to be valuated, a search was performed for prior patents in the patent literature, and the search DB used was KEYWERT (https://www.keywert.com/). As of the date of application of the patent to be valuated, viz. **March**, 2021, the documents published before that time were examined and selected as the main prior patents.

<Table 3-5> Prior Patent DB Criteria

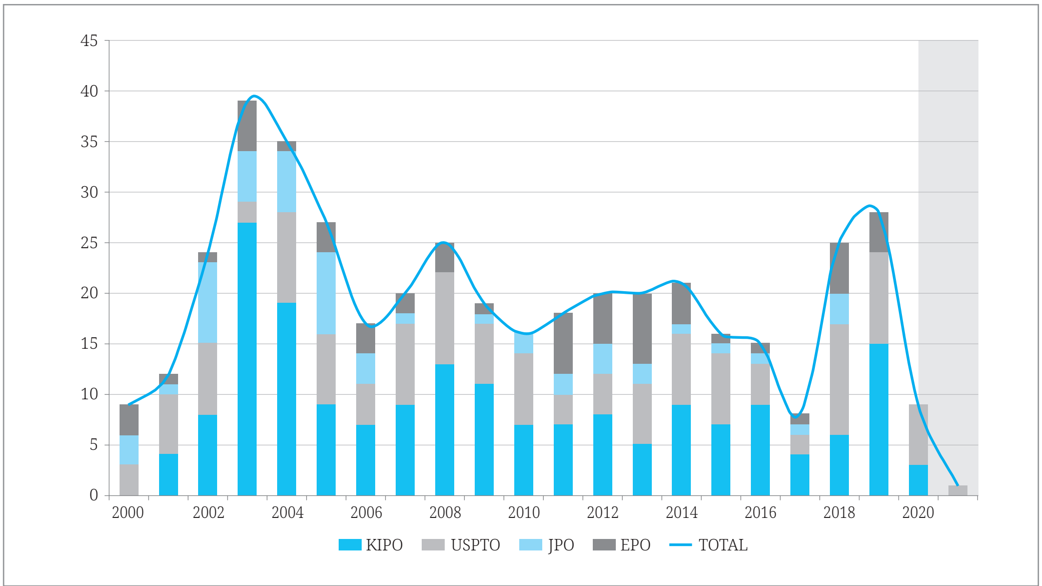
Country	Search for	DB Used	Scope of Search	Search Period	Number of Searches
South Korea (KR)	- Patent/Practical Disclosure - Patent/Utility Announcement	Keywert	- Bibliography + Summary + Representative Claims	2000.01.01.~ 2021.09.10	187
United States (US)	- Disclosure - Registration	Keywert	- Bibliography + Summary + Representative Claims		128
Japan (JP)	- Patent/Practical Disclosure - Patent/Utility Announcement	Keywert	- Bibliography + Summary + Representative Claims		52
Europe (EP)	- Released (EP-A) - Registration (EP-B)	Keywert	- Bibliography + Summary + Representative Claims		57

(2) Survey Contents and Results

Before analyzing the major patents, the macroscopic patent trends of the past 20 years in Korea, the United States, Japan, and Europe related to the patents to be valuated were examined.

A. Application Trend by Year of Application

[Figure 3-79] Application Trend by Year of Application

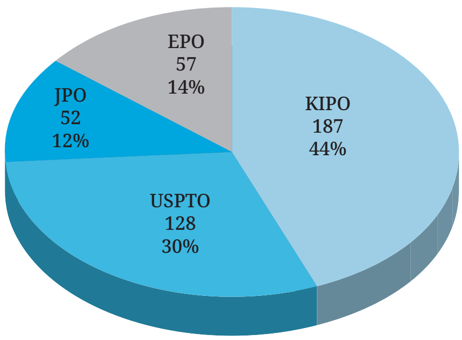


[Figure 3-79] shows the patent trends of Korea, the United States, Japan, and major countries in the Europe by application year. Patents in the field related to the technology to be valuated tend to have been actively filed in the early 2000s, and after a slight decline, they remain above a certain level and are steadily being filed, indicating a tendency to increase again in the last 3 years.

With the development of modern industrial society, cities have become densely populated with a large number of high-rise buildings, but the development of technology has not been achieved in line with the awareness of safety management. In this situation, the damage caused by fires has increased, and lightweight emergency escape devices with improved and simplified structure and function have recently been developed. On the other hand, in the case of patents, since the information related to the application is published 1 year and 6 months after the patent application, the trend of decline after 2020 is likely to reverse somewhat when the unpublished patents are published.

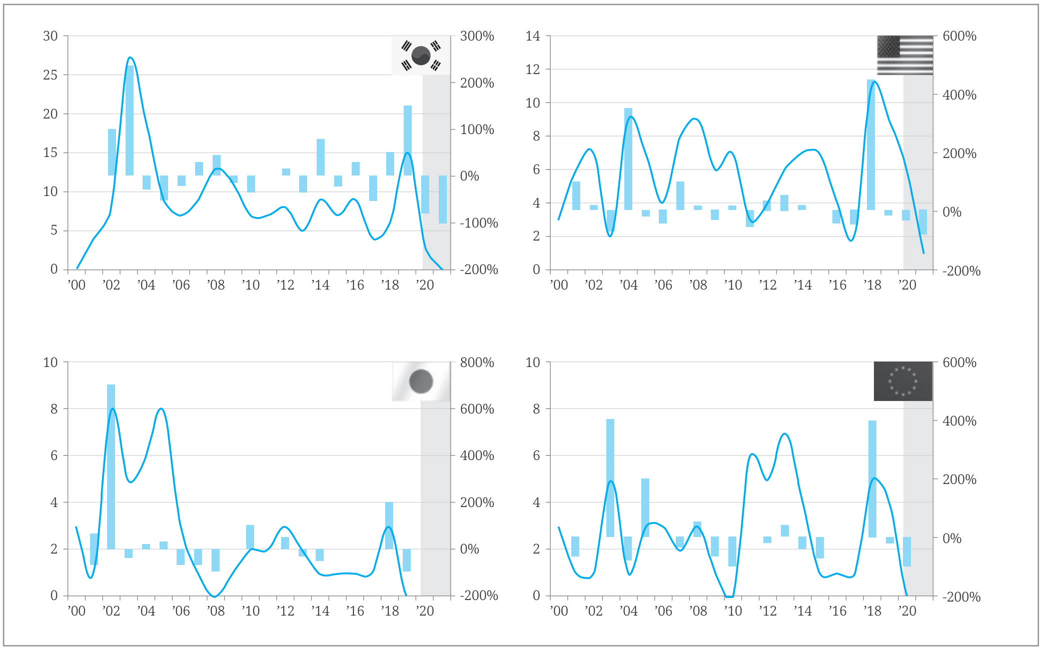
B. Application Trend by Country (Korea, USA, Japan, Europe)

[Figure 3-80] Application Trend by Application Year



The figures above and below show the total number of searchable applications for Korea, the United States, Japan, and European patents by country, and the patents are actively filed in the order of Korea, the United States, Europe, and Japan. In particular, it can be seen that the proportion of applications in Korea and the United States is as high as 44% and 30% respectively, which is analyzed as the influence of research and development and interest in emergency escape devices in the Korean and US markets.

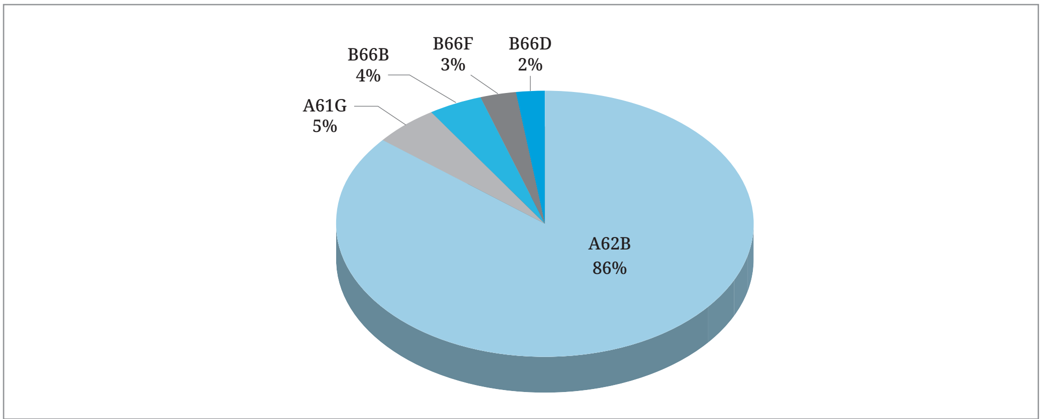
[Figure 3-81] Application Trend by Application Year and Countries



Looking at the Figure above, it is analyzed that Korea and Japan have a similar trend with regard to the overall number of patent applications, while the United States and Europe continue to apply for patents with recurring increases and decreases. Considering that all the major countries apply for around 10 patents every year, it is believed that the related technology field to be valuated has entered the maturity stage of the technology life cycle and that the growth rate is slowing.

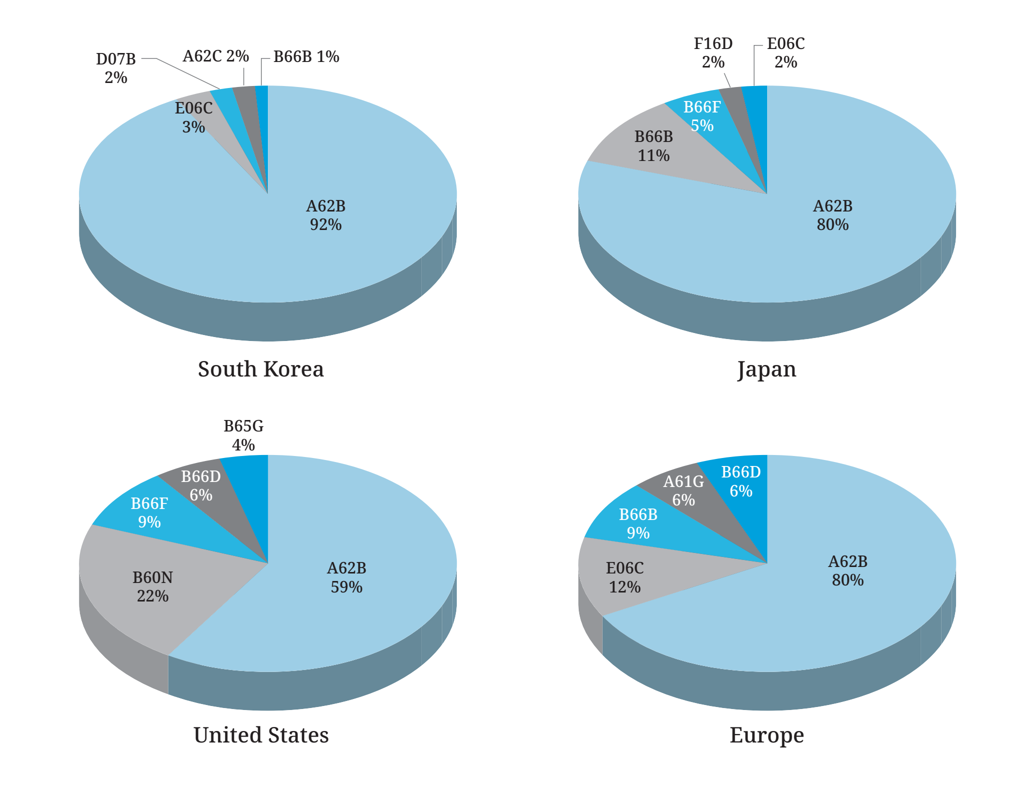
C. Application Trend by IPC Classification

[Figure 3-82] Application Trend by IPC Classification



Looking at the TOP5 IPCs by classifying the total number of searchable applications for Korean, U.S., Japanese, and European patents by the IPC Main classification, the following figures are seen. Looking at the IPC of the relevant technology, it is found that the proportion of A62B (lifesaving apparatus, device or method) was the highest at 86%, followed by A61G (transport and transport especially suitable for patients or persons with disabilities), or facilities. Operating tables or chairs; dental chairs; intestinal lens; light use lifts, etc. accounted for 5%.

[Figure 3-83] Application Trend by IPC Classification and Countries



IPC Main trends by country showed that South Korea, Japan, the United States, and all European countries have the highest proportion of A62B (lifesaving devices or methods). In Korea and Europe, the E06C (ladder) accounts for the next largest share; in the United States the B60N (passenger equipment not otherwise classified) has a share of 10%; in Japan, the B66B [elevator, escalators or mobile walkways (lifeguards used as a replacement for common exit means)] accounts for 11% of the weight, followed by B66F.

D. Analysis of Major Prior Patents

Among the prior documents examined above, the major prior patents that are highly relevant to the patents to be valuated are summarized in <Table 3-6>.

<Table 3-6> Major Prior Patents

No.	Release Date	Patent No.	Applicant	Description	Relevance
No.1	2016.09.05	10-1685463 (Registration Number)	Gacheon University Industry-Academia Cooperation Group	Descending life line	Y
No.2	2019.01.01	US 10166413 (Registration Number)	BAILOUT SYSTEMS, LLC	Controlled descent safety systems and methods	A

[Related Diagram Indicator]
X: Recognized by this document as having no novelty regarding the invention (design) described in the claim
Y: In combination with this document and two or more other documents, the invention described in the claim can be easily invented by a worker skilled in the field and is recognized as not being progressive.
A: Materials are not particularly relevant but contain general prior content related to the present technology

<Table 3-7> Major Prior Patent 1

No. 1 Name of the Invention	Descending life line		
Application Number (Date)	KR10-2015-0026534 (2015.02.25)	Registration Number (Registration Date)	KR10-1685463 (2016.12.06)
Patentee	Gacheon University Industry-Academia Cooperation Group	Inventor	Kim Han-sang
Priority Number	-	Priority Claim Date	-
Expiration Date	2035.02.25	Number of claims	3 (Independence Section 1)
Summarization	The present invention relates to a descending life line device that allows the evacuee to escape from a high-rise building or the like using a rope, whereby the brake pad and the wheel hub (deceleration wheel) for braking are bonded by magnetic force, allowing a fast descent speed at the beginning of the evacuee's descent, and decelerating the descent of the evacuee to a certain descent speed. It has the effect of shortening the rescue time. The present invention slows down the descent speed of the evacuee to prevent shocks and accidents that may occur due to the dive at the time of escape.		
Representative Claims	A rope wheel is provided, and a rope drive gear portion is provided to enable rotation in the housing. It is a steel system comprising a centrifugal brake that has a smaller size than the rope wheel and a reduction wheel that can be rotated in the housing while forming a tooth bond in contact with the rope wheel. The centrifugal brake has: a brake pad bound by a magnetic force having a set threshold with the reduction wheel; and a brake drum that is fixed to the housing to brake the reduction wheel by friction with the brake pad. When the centrifugal force of the brake pad is greater than the size of the set critical magnetic force between the reduction wheel and the brake pad, friction is achieved with the brake drum.		

Korean Patent No. 10-1685463 (hereinafter, prior to document No.1) pertains to a technique aimed at providing a descending life line device that allows for a fast descent speed at the beginning of the evacuee's descent and slows down when the descent speed reaches a certain level, thereby shortening the rescue time.

In the technology described in the preceding document No.1, the device has a disc-shaped wheel hub consisting of an integral reduction wheel, and either of the brake pads and the wheel hub is made of a magnetic material. The magnetic pad activates a magnetic force between the two contact surfaces so that the brake pad and the wheel hub are combined by magnetic force.

Prior to the technology described in the preceding document No.1 is a technique whereby the brake pad is separated partially from the wheel hub when the centrifugal force is greater than the magnetic force, and friction with the brake drum is formed to slow down the descent; conversely, when the magnetic force is greater than the centrifugal force, the brake pad and the wheel hub rotate together such that the braking function is not generated by the magnetic force. This is a difference from the patent to be valuated, where the device generates strong friction between the brake drum and the bobbin and slows it down.

However, since the preceding document No.1 includes a drive gear portion, a brake drum, and a magnetic member as components, attention is required in correspondence with the components of the patent to be valuated. Therefore, the degree of relevance to the prior patent document No.1 is judged to be "Y".

<Table 3-8> Major Prior Patent 2

No. 2	Name of the Invention	Controlled descent safety systems and methods		
Application Number (Date)		US15/209469 (2016.07.13)	Registration Number (Registration Date)	US10166413 (2019.01.01)
Patentee		BAILOUT SYSTEMS, LLC	Inventor	Michael A. Ragsdale et al 2
Priority Number		-	Priority Claim Date	-
Expiration Date		2036.07.13	Number of claims	8 (Independence clause 1)
Summarization		Embodiments include a system for controlled release of a descent line, with a shaft secured to the first end of the descent line. Embodiments include a magnet cradle housing fixedly coupled with the shaft, a first magnet retained by the magnet cradle housing, and a coil assembly secured in magnetic proximity to the magnet assembly to generate an electric current by magnetic interaction when the shaft is rotated. Embodiments include a braking assembly powered by the magnet and coil assembly such that the user's descent is slowed to a safe speed.		

<Table 3-8> Continued

Representative Claims	A system for controlled release of a descent line, the system comprising: a housing; a shaft at least partially retained within the housing and having a central axis, the shaft being secured to the first end of a descent line, wherein the shaft rotates about the central axis when a force is applied to the second end of the descent line; a magnet cradle housing coupled to the first end of the shaft such that the magnet cradle housing rotates together with the shaft; at least one magnet retained by the magnet cradle housing, such that the at least one magnet is coupled with the shaft at all times; a coil assembly coupled with the housing in magnetic proximity to at least one magnet, the coil assembly and the at least one magnet working together to facilitate generation of electric current when the shaft is rotating; a ferrous body coupled to the second end of the shaft; an electromagnet coupled with the housing in magnetic proximity to the ferrous body; a first terminal electrically coupled with the coil assembly; a second terminal that is electrically coupled with the electromagnet and in electrical communication with the first terminal to facilitate transmission of the electric current generated by the coil assembly to the electromagnet such that the electromagnet works with the ferrous body to reduce the rotational speed of the shaft.

U.S. Patent No. 10166413 (hereinafter, prior to Document No.2) relates to a descending device for escaping from a high-rise building in an emergency such as a fire.

Prior to the preceding document No.2 is a technique in which resistance develops due to the eddy current generated by the magnetic interaction between the magnet and the rotating plate to which the coil unit is attached when the shaft is rotated, and the descent speed is slowed down. It is partially similar to the patent to be valuated in that it is a technique of controlling descent speed using a magnet.

However, prior document No.2 describes a different technique from the patent to be valuated in which descent speed is slowed down using a strong frictional force generated by magnetic force in that here the descent is slowed down by magnetic field resistance induced during rotation. In addition, prior document No.2 includes a coil member as a component and does not include components corresponding to the key components of the patent to be valuated: bobbin gear, planetary gear, brake drum.

Therefore, since the preceding document No.2 differs from the patent to be valuated in terms of the descent speed control method and the detailed configuration, the relevant degree is judged to be “A”.

2.3.2.3.3. Rights Analysis Opinions (Extracted from an in-depth report)

(1) Stability of Rights

The patent to be valuated is a registered patent, and whether it is likely to remain stable and not invalidated due to prior work is valuated by comparing it with the prior work.

After examining the prior work among the patents published before the application date of the patent to be valuated, the prior documents No.1 and No.2 were reviewed as the main prior patents, the technical composition of which was somewhat similar to the patent to be valuated.

Prior Document No.1 is a technique for generating friction with the brake drum through magnetic force and centrifugal force by installing a brake pad or wheel hub made of a magnetic material and a magnetic pad having a magnetic force, and there is a difference from the patent to be valuated based on the feature of installing a magnetic weight on the brake drum and rubbing it with the bobbin. However, prior document No.1 is similar in that it controls the descent speed by generating frictional force with a magnetic member, and includes a drive gear part, a brake drum, and a magnetic member as components, and corresponds to the components of the patent to be valuated, so care is required.

Prior Document No.2 is somewhat similar to the patent to be valuated in that it uses a technique of controlling descent speed using a magnet, but differs in that it slows down rotation with magnetic field resistance induction and does not contain components corresponding to bobbin gears, planetary gears, and brake drums.

Therefore, the patent to be valuated has some similarities in that there is a similar prior work that includes a magnetic member, but since there are technical differences from the prior documents in areas such as the use of the magnetic member, the method of controlling descent speed, and the descent method, the patent to be valuated can be validated for novelty mentioned in Article 29 of the Patent Act in comparison with the prior documents No.1 and No.2. In other words, it is judged that the probability of being invalidated by progressive defects is not high.

In addition, the patent to be valuated is a registered patent consisting of 1 independent clause and 2 subordinate clauses, and if a competitor subsequently claims an invalidity judgment based on a similar prior patent, the scope of the claim can be reduced by restricting the subordinate term to an independent term so that it can further refine the technology to be valuated. Since rights can be maintained, the stability of rights is judged to be at a normal level.

(2) Scope of Legal Rights

A. Content Aspects of the Rights

The scope of rights shall be determined by the matters described in the claims of the patent, and the review of the main components of the independent section shall be conducted to assess the clarity and degree of protection of the scope of the rights for which the patent is to be protected.

The patent to be valuated consists of 1 independent clause and 2 subordinate clauses that specifically limit it.

<Table 3-9> Claims of Valuated Patent

Claims	Contents of the Invention
Clause 1	A bobbin gear is installed at the inner end of the bobbin in which the wire is wound; a number of planetary gears are installed to be located on the inner side of the bobbin to interface with the bobbin gear, and a brake drum rotating at the rotational force of the planetary gear is installed inside the bobbin to be in contact with the inner surface of the bobbin. A number of receiving grooves are formed on the outer surface of the brake drum, and a magnetic weight is installed in the receiving groove to configure the rotational speed of the bobbin, which is to be controlled by the frictional force generated when the magnetic weight is attached to the bobbin. The bobbin can be rotated by bearings between the gear fixed side plate and the fixed side plate, which are installed facing each other. A bobbin gear is installed on one side of the bobbin, and a brake receptor is formed on the other side such that it can accommodate the brake drum. The patent application is for a personal portable descent device using alpha technology, where on one side of the brake drum that is inserted into the brake receiving port is formed a protruding brake shaft of a predetermined length, and at the end of the brake shaft a gear portion is engaged with a number of planetary gears that are installed so as to be in contact with the bobbin gear.

Source: Korean Patent Registration Number **-******

The patent to be valuated relates to a “personal portable descent device using alpha technology”, and in the scope of the right, the representative claim consists of the invention of an object.

The patent to be valuated includes the bobbin, bobbin gear, planetary gear, brake drum, receptive groove, and magnetic weight required to control the speed of the descending device as the main components. Furthermore, the patent to be valuated provides a limited description of the bobbin that can be rotated by the bearing between the gear and fixed side plates. In addition, the device includes a brake receptor unit capable of receiving the brake drum, a brake shaft formed with a predetermined length protruding on one side of the brake drum, and a gear part that engages with a number of planetary gears that are installed so as to fit into the bobbin gear at the end of the brake shaft.

As such, the patent to be valuated specifically lists the key components for the personal descent device in the independent section and sets the scope of rights so that it is appropriate to protect the core content. However, the patent to be valuated provides a limited description of the bobbin's driving method and adds the brake receptor, brake shaft and gear section, which can be considered to have been configured to the extent that it can protect only the main functions of the technology and the products of the core production line. Therefore, the strength of the protection of rights is judged to be at a normal level.

B. Regional Aspects

Since the patent to be valuated is currently registered in Korea, and the applications for international patents and overseas patents through entry into individual countries have not yet been investigated, the scope of regional protection of the patent to be valuated is limited to domestic protection.

However, the patent to be valuated was filed on *March*, 2021 and is 5 months past the current application date, and if an international patent application is filed within 1 year from the date of the domestic patent application, the priority of the patent may be recognized.

At the current valuation date, the patent to be valuated cannot exercise patent rights outside the country, so it is difficult to believe that the regional scope of protection of the patent to be valuated is wide.

The application date for the patent to be valuated is March 19, 2021, and if the annual fee is paid faithfully by March 19, 2041, which is 20 years from the filing date in accordance with the principle of first-day dispersion, the exclusive right to the patent to be valuated can be maintained.

In addition, considering that the period of existence of the patent to be valuated is more than 19 years, and that the median economic life (Q2) for A62B, the IPC field of the patent to be valuated, is 10 years, the duration of the patent to be valuated is considered to be relatively excellent.

(3) Possibility of Protection of Rights

A. Applicable Capacity to Protect the Product (Service)

Since the patent to be valuated protects the configuration of a personal portable descent device using alpha technology as a right, and adds a limited description of the bobbin's driving method and the brake receptacles, brake shafts, and gear parts, it can be seen that the scope of rights is configured to the extent that it can protect only the main functions and the products of core production line.

In other words, the claims of the patent to be valuated correspond to the personal descent devices that the business entity intends to commercialize, but it is judged that only the device invention can be protected from competitors, and the possibility of avoiding competitors' products and third-party patents through the principle of component completion is moderate.

B. Adequacy of Building a Portfolio of Intellectual Property at Home and Abroad

The valuation of adequacy of building a portfolio of intellectual property at home and abroad assesses whether the patents to be valuated or the patents that are set up as collateral can construct the portfolio to fully protect the technology held and the products or services produced.

The business entity is a company established in January 2021 of this year, and in March of the same year, it applied for a patent for the technology to be valuated and received a patent registration in Korea. It is believed that the patent to be valuated is currently in the process of applying for international patent and overseas patent, and the business entity cannot be sufficiently protected by the business area of the business entity abroad.

The company established a Research and Development department to conduct research and development of fire escape products such as personal descent devices to which patents subject to valuation are applied, and has a factory for production. The company is currently in the processes of securing intellectual property rights for commercialized products of the technology to be valuated and registering them as excellent products after performance certification and safety certification through test performance. Going forward, the company plans to promote them online and offline through participation in exhibitions at home and abroad.

Therefore, it is judged that XXX Co., Ltd. is a company specializing in technology development and business related to the patents subject to valuation, and is highly related to the business.

(4) Ease of Exercising Rights

A. Ease of Proving the Detection of Infringement

Ease of discovery of infringement is a valuation item that assesses how easy it is to identify the infringement of a patent, and the more difficult it is to detect infringement, the lower the validity of a patent right.

According to the requirement for determining patent infringement, i.e., the "All Element Rule", which is the criterion for determining the scope of a patent right (Articles 97, 126 to 132 of the Patent Act, Supreme Court 2000. 11. 14 Judgment 2351 after Sentence 98, etc.), all components of a patented invention must be exercised in order to state that an infringement of the patent has occurred. Therefore, the more claims by which the components described in the independent clause are listed, the more infringement claims can be made only for products that carry out all the components, such that the scope of rights is narrower and the strength of legal protection is weak (the principle of multi-substrate narrowing scope).

The patent to be valuated relates to a personal portable descent device using easy-to-use alpha technology that increases safety during descent, and includes the bobbin, bobbin gear, planetary gear, brake drum and magnetic weight required to control the speed of the descent device as the main components. It corresponds to the invention of things.

Therefore, based on the scope of the claim, the patent to be valuated can be checked for infringement through reverse engineering of the infringing product in accordance with the All Elements Rule.

On the other hand, when the claims presented by the valuated patent and the components of the claims presented by the allegedly infringing product are compared literally, infringement is established when the allegedly infringing product includes all the components of the patent claim to be valuated, and the absence of any one component makes the competing product non-infringing. However, if the components of a particular claim are not included in the infringing product but the infringing product contains corresponding elements or alternative elements that are recognized as uniform even if they are verbally non-infringing, they may be judged to be infringing.

Therefore, the ease of proving the identification of infringement is judged to be at a normal level in that the technology to be valuated can easily claim not only infringement in wording but also equal infringement through close investigation.

B. Possibility of Restriction of the Exercise of Rights

The valuation on the possibility of restricting the exercise of rights assesses whether there are any elements restricting the exercise of rights in terms of the legal and external environment.

According to the “FILE WRAPPER ESTOPPEL,” which applies to the scope of protection of a patent, if a correction is made to reduce the scope of the claim to reach the registration of the patent in the application process, the Supreme Court cannot enforce the effect of the patent (ECTIV, etc.) in the application. In the case of the patent to be valuated, the first 4 claims were filed and Claims 1 and 3 were rejected in the Notice of Opinion as a progressive defect based on Article 29(2) of the Patent Act, but the final patent registration was made through the Self-Progress Clause merging Claim 2 into Claim 1. Therefore, since it was later confirmed that there is no comment to prevent the extension of the scope of rights themselves to equality in accordance with the principle of rebuttal to the theory of equality, the possibility of restricting the exercise of rights is valuated at the usual level.

(5) Marketability of Intellectual Property Transaction

Valuation on the marketability of intellectual property transaction corresponds to the assessment whether the patent to be valuated is likely to be transferred in whole or in part to a business entity operating a related business, or whether the patent to be valuated will be transferred to a normal or dedicated enforcement right. In order to valuate the marketability of intellectual property transactions, disputes, utilization of license, and patent application activity are also assessed as items.

Dispute and utilization of license can be assessed with reference to three-year trial statistics, and the patents to be valuated fall under A62B in accordance with the International Patent Classification (IPC).

<Table 3-10> Dispute and License Utilization Statistics

Category	2017	2018	2019
A61~A63 (medical/leisure) judgment statistics	240 cases	229 cases	179 cases
Proportion of the total IPC sector	4.14%	4.69%	4.53%

Source: Patent Office, each year.

According to the statistics of the Patent Office on the number of patent cases with regard to A62-A63 technology, the number of cases is decreasing, but the proportion is increasing slightly compared to the overall IPC field. The total number of judgments in the A62-A63 technical field till date is 648 cases, which is estimated to be close to the Q3 value when compared with the maximum/minimum value and quartile value of the number of judgments. Therefore, the utilization of disputes and licenses is rated as being on the high side.

<Table 3-11> The Number of Applications in the A62 Technical Field

Category		2017	2018	2019	Sum
A62	Lifesaving; firefighting	610 cases	837 cases	1041 cases	2,488 cases

Source: Patent Office, each year.

In addition, the activity of patent applications can be valuated with reference to the statistics of applications over 3 years, and after looking at the patent application statistics in the A62 technology field, the number of patent applications has been analyzed as increasing continuously between 2017 and 2019. The total number of applications in the A62 technical field is 2,488, which is analyzed as approximately close to the Q2 value when compared with the maximum/minimum value and quartile value of the number of applications. Therefore, the activity of the patent application is judged to be at a moderate level.

2.3.2.3.3. Comprehensive Opinion (Extracted from an in-depth report)

The patent to be valuated is based on some similar prior documents including a magnetic member in the speed control unit. On the other hand, there are technical differences in the use of the magnetic member, the descent speed control method, and the like, such that it may possibly be invalidated based on the novelty or progressive defect of Article 29 of the Patent Act due to the preceding documents No.1 to No.5. It is judged not to be high. In addition, the patent to be valuated is a registered patent consisting of 1 independent clause and 2 subordinate clauses, and the scope of the claim pertains to a correction that limits the subordinate term to an independent term so that even if a competitor claims an invalidity judgment based on a similar prior patent, the subordinate term can be further refined. Since rights can be maintained through reduction, the stability of rights is judged to be at a normal level.

The patent to be valuated specifically lists bobbins, bobbin gears, planetary gears, brake drums, receptive grooves, and magnetic weights as key components for personal descent devices in the independent section to establish a scope of rights that is appropriate to protect the core contents. However, the patent to be valuated provides a limited description of the bobbin's driving method and adds the brake receptor, brake shaft and gear section, which are considered to have been configured to the extent that it can protect only the main functions of the technology and the products of the core production line. Therefore, the strength of the protection of rights is judged to be at a normal level.

The patent to be valuated relates to a personal portable descent device using easy-to-use alpha technology that increases safety during descent, and corresponds to the invention of an object. Therefore, based on the claims, it is possible to determine whether the rights have been infringed through reverse engineering of the allegedly infringing products in accordance with the All Elements Rule. In addition, the ease of proving the identification of infringement is judged to be at a normal level in that the patent to be valuated can easily claim not only wording infringement but also equal infringement through close investigation.

Finally, the business entity, XXX Co., Ltd. is a company that has fire escape products as its main product line, and is currently in the processes of securing intellectual property rights for the commercialization products based on the technology to be valuated, and promoting the registration of excellent products by the PPS through performance certification and safety certification, and so on. The company plans to promote its products offline, develop continuous application products, and expand overseas. Therefore, the company is judged to be specializing in the development of technology and business related to the patents to be valuated, and it is understood that it is highly relevant to the business.

2.3.2.4. Marketability Analysis

Marketability analysis should clearly define the product (or process) applied with the target technology and target market, summarize the characteristics (differentiation or competitiveness) of the applied product, and assess the size, growth and prospects of the target market.

Marketability analysis refers to valuating the market competitiveness of the applied products based on the results of analyzing the environment and competition of the market to which the target technology is applied. It examines the characteristics and environment of the industry to which the target technology belongs, and valuates market competitiveness based on the analysis of market structure and competition status, product status and competitiveness, and related policies. Marketability analysis consists of assessments of the market environment and competition in the market. Market environment analysis reviews the characteristics and environment of the industry and presents opinions on the impact on the commercialization of the target technology. The front and rear industries of the industry to which the product implementing the target technology belongs are classified and the characteristics of the industry are analyzed. The trend of the industry to which the target market belongs is analyzed in terms of politics, economy, society, environment, etc., and the trend of the target market at home and abroad is investigated, and opinions are presented on the effect these factors will have on the commercialization of the target technology.

Market competition analysis is to analyze the structure of the target market and the status of competition, such as the current status of domestic and foreign partners. It evaluates the possibility of securing a market position based on the competitiveness of the target technology products, and presents valuators' opinions. It presents opinions on opportunities to commercialize target technologies and associated threats through analysis of competitors, for factors such as products, size (large or small companies), and market dominance. In order to determine the possibility of market entry, economies of scale, product differentiation, required capital, and institutional factors are considered. In order to secure the objectivity of the analysis results, the valuator refers to market analysis data for products applied with the target technology or market analysis reports of external specialized institutions. In order to understand the possibility of securing a market position, it is necessary to analyze whether products with target technology can secure a certain market share in the target market. After selecting and analyzing competitors in the market, if the competitive edge of the product applied with the target technology is found to be relatively high, it is highly likely to secure a superior position in the market.

Based on analyses of the market environment and competition, the target market size and future market prospects are presented. The size of the target market at home and abroad is analyzed through objective data, and the target market size during the cash flow estimation period is estimated and presented. The market size forecast should predict the trend based on the results of various recent surveys such as market surveys and quantitative analyses and future forecast data. In order to secure reliability in prediction, a valuator's opinion on the prospects of the target technology product market is synthesized and presented based on recent market data and information. Sufficient information should be included so that the entity requesting the valuation and user of the valuation can understand the valuation report, including an objective interpretation of the market analysis of the target technology. In addition, the sources of data and information used in the marketability analysis should be indicated and the basis for the established assumptions should be presented.

2.3.2.4.1. Industry Trends (Extracted from an in-depth report)

(1) Definition of the Market

The technology to be valuated (hereinafter, the present technology) relates to a personal portable descent device using alpha technology, and the business entity plans to commercialize a fire escape personal descent device using the technology.

Apartments, multi-family homes and general commercial buildings are increasingly constructed as high-rises, but the lack of emergency escape means has led to a surge in human casualties in the event of a fire. When a building fire occurs, a large amount of toxic gas is generated during the combustion of various flammable materials used in interior decoration, and evacuation through elevators or emergency stairs is practically impossible. Upon the formation of toxic gases, the occupants in distress may suffer a disaster before the rescuers can access them so it is desirable for the occupants to take proactive measures to escape from the building.

An active response for sufferers is to try to escape outside the building. Although the descending life line machine is mainly used for escape, the existing descending life line devices almost always feature a complex structure using the reducer, and the manufacturing unit is expensive. Furthermore, the descent speed is not easy to control, presenting a risk to life, and the configuration is complicated and requires continuous maintenance. Due to the heavy weight, it is difficult to handle the device and thus, the existing devices are not practical. In order to solve this problem, a frictional descending life line machine using a brake drum has also been provided, but in the event of wear of the brake drum and brake pad, the descent speed cannot be controlled, which increases the risk.

The present technology to be valuated is a personal portable descent device using alpha technology developed to solve this problem, which allows the user to descend safely from the building at a low speed and control the speed of descent easily. In addition, the descent device is easy to use, so that it can be used by beginners without training. It is a technique that has the advantage that children can use it easily. In addition, there is an advantage that the existing descent device is used only on the floors below 10 floors, whereas the technology/device to be valuated can be safely used in high-rise buildings.

The business entity is promoting the commercialization of a personal descent device for fire escape using this technology, and in the first place, it aims to apply the device to nursing homes, schools, academies, hospitals, etc. Since this technology is a replacement for the descending life line machine among the fire evacuation apparatus, the target market is the descending life line machine market. The patent to be valuated has been filed in Korea, is still pre-registered, and as a domestic-oriented industry, the target area is limited to the country.

(2) Characteristics of the Industry

This technical product is a personal portable descent device using alpha technology, and the related industry can be defined as "Other Goods Handling Equipment Manufacturing (C29169)" by the Korean Standard Industry Classification (SIC). The rear industry is the material and parts industry that supplies gears, bobbins, brake drums, wire rollers, wires, bearings, magnetic weights, etc., and the front industry is used for emergency escape in the event of a fire in a multi-story building such as nursing homes, schools, academies, hospitals, skyscrapers, etc.

The characteristics of the fire-fighting equipment industry, which includes personal descent devices for fire escape, can be summarized as in the table below.

<Table 3-12> Features of Fire Equipment Industry

Features	Content
Government-regulated industries	• In accordance with Article 9 of the "Act on Fire Prevention, Installation, Maintenance and Safety Management of Fire Protection Facilities", the fire safety standards (NFSC 301) of the evacuation apparatus shall be complied with when installing, maintaining and managing evacuation equipment such as slip stands, evacuation bridges, evacuation traps, easy-to-relax steel machines, air safety mats, multi-person evacuation equipment, and elevator evacuation machines for certain buildings.
Industries that are somewhat sensitive to the construction economy, etc.	• The standards for fire-fighting equipment stipulate the products that must be provided for a particular building, so that the nature of the essential goods is strong, and the annual demand fluctuations are not great. • Industries that are somewhat sensitive to economic fluctuations, such as those that may be affected by a fundamentally stagnant construction economy.
Industries where safety and reliability are important	• Fire escape descent lifts are used for emergency escape in the event of a fire in high-rise buildings, so installation of descent devices is essential in industries where safety and reliability are very important.
Industries that require expertise	• The fire-fighting equipment industry requires expertise in construction-related knowledge such as knowhow regarding construction, electricity, machinery, etc., as well as knowledge and skills related to dangerous goods such as fire, combustion, explosion-proofing, and fire protection.
Small and medium-sized businesses	• Only companies that have passed government certification as a regulated industry are allowed to do business, and the domestic market size is limited and the domestic sector has a high share of sales, so small and medium sized businesses participate mainly in this industry field participate mainly in the market for SMEs.

A. Government Regulated Industries

The fire-fighting equipment industry is government-regulated, and only companies that have passed the government-certified business are allowed to do business, and these regulations can act as a factor in raising the barriers to entry within the industry.

The government has stated that, "In accordance with Article 9 of the Law on Maintenance and Safety Management, the fire safety standards (NFSC 301) of the evacuation apparatus are notified, install and maintain evacuation equipment such as elevator evacuation machines,· veteran facilities (1st to 10th floors), medical facilities, slip stand for multi-use establishments (2nd to 4th floors), evacuation bridge, evacuation traps, relaxation strength· air safety mat, and multiple evacuation equipment. It stipulates that the safety systems be managed in accordance with Article 2 of the "Enforcement Decree of the Special Law on the Safety Management of Multi-use Establishments."

B. Industries That are Somewhat Sensitive to the Construction Economy

Fire protection equipment, including personal descent devices for fire escape, is used for emergency escape in the event of a fire in a multi-story building, and the government stipulates the products that must be provided for a particular building, so that the nature of the essential goods is strong and the annual demand fluctuations are not great, but the construction is fundamentally stagnant. It is an industry that is somewhat sensitive to economic fluctuations, such as being affected by the economy.

C. Industries Where Safety and Reliability are Important

Since the personal descent device for fire escape is used for emergency escape in the event of a fire in a high-rise building, safety and reliability are very important. Therefore, product certification from a reliable organization is essential in order to enter the relevant market.

D. Industries That Require Expertise

Fire-fighting equipment shall be mandatorily installed in buildings of a certain size or larger and multi-use facilities as stipulated by the Fire Protection Regulations. In addition, reliability factors such as safety and accuracy are important, and the National Fire Safety Standards stipulate the matters necessary for the installation, maintenance and safety management of fire-fighting facilities. Accordingly, the fire-fighting equipment industry is an industry segment that requires expert-level knowledge and skills related to dangerous goods such as fire, combustion, explosion-proofing, and fire protection, as well as construction-related knowledge in areas such as construction, electricity, machinery, etc.

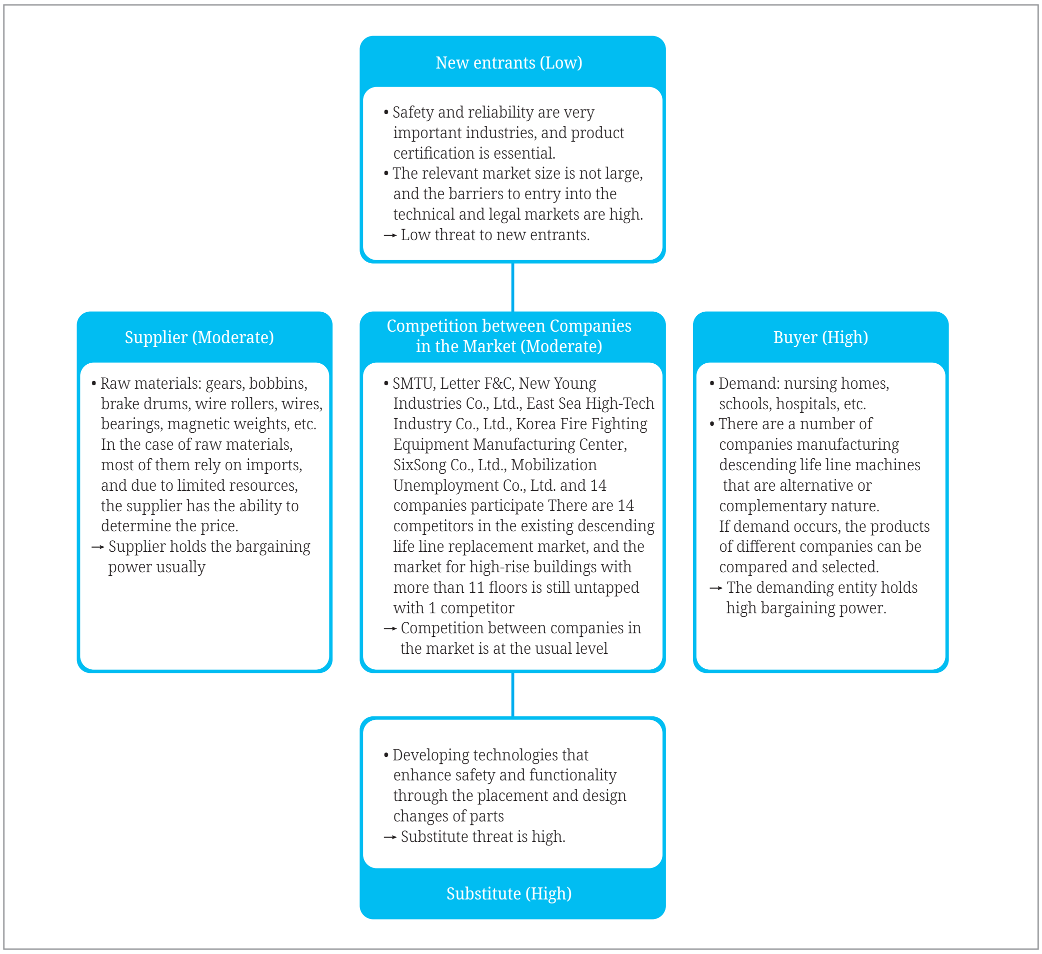
E Small and Medium-sized Business-oriented Industries

Only companies that have passed government certification as a regulated industry are doing business, and the domestic market size is limited and the domestic sector has a high share of sales, so small and medium-sized businesses participate mainly in the market for small and medium-sized enterprises.

(3) Competitive Situation

The following figure shows the competitive structure of the market through the Five Forces Analysis, including the demanders, suppliers, new participants, threats of substitutes, and the degree of competition in terms of the competitiveness of the industry.

[Figure 3-84] 5-force Analysis



2.3.2.4.2. Market Trends (Extracted from an in-depth report)

(1) Domestic and Foreign Market Trends

According to the Statistics on Buildings published by the Ministry of Land, Land and Transportation, domestic buildings increased by an average of 0.96% per annum from VND6,731,787 in 2011 to VND7,275,266 in 2020, while the increase in newly constructed 2nd to 4th floors, which are the main targets for the installation of evacuation equipment in firefighting objects, averaged 1.48% per annum. The annual average increase was 3.93% for the 5th floor, and 5.61% for the 6-10 floors. In addition, the 21-30 floors increased by an average of 8.46% per annum, and the 31st floor and above increased by an average of 17.30% per annum, indicating that construction of high-rises was progressing rapidly.

<Table 3-13> Status of Buildings by Number of Floors in Korea

(Unit: Number of Building)

Category	System	Floor 1	Floor 2-4	Floor 5	Floor 6-10	Floor 11-20	Floor 21-30	More than 31 floors	Other
2011	6,731,787	4,286,114	2,146,763	130,846	61,192	72,148	12,954	887	20,883
2012	6,796,239	4,305,333	2,180,533	137,463	64,560	73,936	13,599	1,020	19,795
2013	6,851,802	4,319,571	2,210,286	142,971	67,666	75,960	14,203	1,189	19,956
2014	6,911,288	4,335,822	2,241,023	148,087	71,714	78,041	15,127	1,319	20,155
2015	6,986,913	4,356,666	2,279,814	154,587	76,542	80,836	16,413	1,478	20,577
2016	7,054,733	4,371,257	2,316,594	161,147	81,998	83,614	17,630	1,661	20,832
2017	7,126,526	4,389,751	2,354,435	166,372	86,804	86,563	19,597	1,912	21,092
2018	7,191,912	4,410,699	2,384,798	170,783	90,753	89,518	21,780	2,325	21,256
2019	7,243,472	4,433,793	2,402,064	174,588	93,577	92,190	23,832	2,739	20,689
2020	7,275,266	4,446,868	2,412,563	177,727	95,574	94,476	25,505	3,165	19,388
CAGR	0.96%	0.46%	1.48%	3.93%	5.61%	3.38%	8.46%	17.30%	-4.78%

Source: Data extracted from Statistics on Buildings (http://stat.molit.go.kr).

According to the Ministry of Administrative Security's Disaster Annals (Social Disasters), from 2010 to 2019, the statistics on large-scale fire accidents in multi-density facilities in the last 10 years shows that a total of 32 incidents occurred, resulting in 769 casualties and property damage of 3,05 billion won. In particular, 10 cases occurred in 2019, accounting for 31% of the number of cases in the last 10 years, 17% of the cases of human injury to 128 people, and 30% of property damage worth 918 billion won. In line with this trend, the number of large-scale fire accidents in multi-density facilities has been gradually increasing in recent years.

The Wangang Machine, an evacuation device to be used in the event of a fire, has been installed in the fire protection objects since March 10, 2005, from the 3rd to the 10th floors of fire objects such as hotels, hospitals, and communal houses, and from the 2nd floor of the multi-use businesses where the location of the business premises such as a singing practice hall or the notice center is less than 4 floors or less. It should be installed on the 4th floor. All accommodations on the 3rd floor and above, except for recreational condominiums, are obliged to have a relaxation unit in each room.

Hasty use of a descending life line machine can pose danger. If two people descend at a time or don't wear their chest belt properly, a fatal safety accident can occur, such as falling out of the belt on the way down. Accordingly, countries around the world have stipulated standards for the safety of the descending life line machine.

In Europe, the standards for personal protective equipment for the prevention of fall (BS EN 341:1993) stipulate a maximum load of 1500 N for verifying the performance of the descending life line. Japan supplies descending life lines that have been subjected to load testing of more than 1200 N. Our country has been defining a maximum load of no more than 1,000 N (100 kg), and since November 1, 2012, the maximum load has been limited to 1500 N (150kg) in the aftermath of an accident in December 2011 in which two people were killed while using a descending life line. Since January 2015, regulations have been tightened to require the installation of at least two descending life lines per room on the third floor and upper floors of the accommodation.

Although most of the source technology for safety products is retained by developed countries, the market is expanding in developing countries with a relatively low supply of products that can improve the level of safety even if it is lower than that of developed countries. According to The Freedonia Group (2016), the global market for safety products is expected to grow at a CAGR of 6.26% from USD 1,255 billion in 2018 to reach USD 1.70 billion by 2023. In Korea, it is expected to grow from $2 billion in 2018 at an average annual rate of 6.19%, reaching $27 billion in 2023. As a result, the Korean safety products market is expected to account for 1.59% of the global market in 2018.

<Table 3-14> CAGR for the Global Safety Products Market

(Unit: Billion Dollars)

Category	Year 2013	Year 2018	Year 2023	CAGR (%)		
				2013-2023	2013-2018	2018-2023
World	902	1,255	1,700	6.54%	6.83%	6.26%
United States	144	196	258	6.00%	6.36%	5.65%
Western Europe	228	282	342	4.14%	4.34%	3.93%
People's Republic of China	176	291	448	9.79%	10.58%	9.01%
Japan	54	66	80	4.01%	4.10%	3.92%
South Korea	14	20	27	6.79%	7.39%	6.19%
Korea's Ratio	1.55%	1.59%	1.59%	-	-	-

Source: The Freedonia Group (2016).

According to the Ministry of Fire Protection, the sales volume for the fire- fighting sector of the Korean fire manufacturing industry increased from 28,486 billion won in 2015 at an average of 4.79% per annum, to reach 34,347 billion won in 2019. In addition, the sales of the firefighting sector in the machinery manufacturing industry that includes this technology increased from 9,405 billion won in 2015 at an average annual rate of 5.04%, to reach 11,448 billion won in 2019.

In recent years, natural disasters have been increasing due to environmental changes, and the increase in the extent of damage caused by large fires has increased with the increasing trend of skyscrapers, leading to growing public awareness regarding fire safety. Accordingly, existing laws and regulations related to fire protection have been strengthened by measures such as the expansion of the mandatory target for fire inspections, and the interest and demand for high-quality international standard-certified evacuation organizations is on the rise.

<Table 3-15> Trend in the Sales for the Fire-fighting Sector of Domestic Fire Manufacturing Industry

(Unit : Billion Won)

Category	2015	2016	2017	2018	2019	CAGR
Manufacturing of alarm systems	8,024	8,677	9,006	9,173	10,545	7.07%
Manufacturing of fire extinguishers	7,189	7,469	7,711	8,057	6,730	-1.64%
Manufacturing of machinery	9,405	10,788	11,400	11,728	11,448	5.04%
Manufacturing of other firefighting supplies	718	703	870	647	706	-0.42%
Manufacturing of fire vehicles	488	665	1,058	1,143	665	8.04%
Manufacturing of other firefighting equipment	454	423	331	346	733	12.72%
System	28,486	30,648	32,387	32,897	34,347	4.79%

Source: Fire Department, each year.

(2) Market Size

According to the report 'Global Market Insights, Inc. (2020)', the global market size of personal safety equipment (PPE) is expected to grow from USD 539 billion in 2020 at a CAGR of 7.44% to reach USD 828 billion by 2026. By region, North America accounted for 41.91% of the total market at $226 billion as of 2020, followed by the Asia-Pacific region and Europe accounting for $ 112 billion and 20.77% each. In terms of growth rate by 2026, the Asia-Pacific region is projected to have the highest growth rate at 8.18%, followed by Latin America at 7.87% and North America at 7.36%.

<Table 3-16> Market Size and Forecast for Personal Safety Equipment (PPE) by Global Region

(Unit: Million Dollars)

Category	2020	2021	2022	2023	2024	2025	2026	CAGR ('20~'26)
North America	22,570.6	23,682.2	25,227.2	27,099.7	29,300.9	31,768.6	34,571.2	7.36%
Europe	11,185.7	11,682.8	12,387.5	13,245.3	14,254.3	15,382.2	16,660.1	6.87%
Asia Pacific	11,212.6	11,855.2	12,725.1	13,773.4	15,004.5	16,390.2	17,969.1	8.18%
MEA	5,525.5	5,784.8	6,148.6	6,590.3	7,109.6	7,691.1	8,350.8	7.13%
LATAM	3,360.6	3,542.7	3,791.6	4,092.2	4,445.3	4,842.1	5,293.8	7.87%
Total	53,855.0	56,547.7	60,280.0	64,800.9	70,114.6	76,074.2	82,845.0	7.44%

Source: Global Market Insights (2020).

By product, protective clothing represents the largest market share with $121 billion accounting in 2020, followed by $118 billion (21.87 percent) for hand protection and $10.2 billion for protective shoes (19.02 percent). The anti-fall market to which the technology belongs is valued at $31 billion, growing at a CAGR of 8.18% over the future, to around $5 billion in 2026.

<Table 3-17> Global Personal Safety Equipment (PPE) Market Size and Forecast by Product

(Unit: Million Dollars)

Category	2020	2021	2022	2023	2024	2025	2026	CAGR ('20~'26)
Head protection	1,839.2	1,928.7	2,053.2	2,204.2	2,381.8	2,580.7	2,806.5	7.30%
Eyes, face protection	3,846.0	4,040.6	4,309.7	4,635.5	5,018.3	5,447.7	5,935.5	7.50%
Ear protector	1,438.2	1,487.8	1,562.3	1,654.0	1,762.2	1,882.1	2,017.2	5.80%
Protective clothing	12,069.1	12,695.6	13,558.1	14,601.2	15,826.8	17,202.7	18,766.9	7.63%
Respirator	7,503.5	7,914.5	8,474.9	9,151.4	9,946.0	10,839.2	11,856.0	7.92%
Protective shoes	10,243.8	10,809.3	11,579.5	12,508.7	13,599.9	14,826.7	16,223.3	7.96%
Fall prevention	3,100.9	3,278.3	3,518.5	3,808.2	4,148.6	4,531.9	4,968.8	8.18%
Hand protection	11,776.1	12,270.6	12,980.2	13,846.1	14,865.4	16,003.2	17,290.7	6.61%
miscellaneous	2,038.2	2,122.4	2,243.6	2,391.6	2,565.8	2,760.2	2,980.1	6.54%
Sum	53,855.0	56,547.8	60,279.9	64,800.9	70,114.6	76,074.3	82,845.0	7.44%

Source: Global Market Insights (2020)

The domestic market size for fall prevention devices among the personal safety equipment corresponding to this technology is estimated based on the size of the global market for fall prevention devices, and the size of the Korean market for safety products is estimated by applying the Korean share of safety products (1.59%), and as of 2020, it is estimated to be $49.30 million (58,182 million won).

<Table 3-18> Estimation of Domestic Market Size for Fall Prevention Devices (2020)

Global Market Size (Million Dollars) (A)	Korean Share (%)(B)	Korean Market Size (Million Dollars) (C) (=A×B)	Exchange Rate (USD)(D)	Korean Market Size (Million Won) (E) (=C×D)
3,100.90	1.59%	49.30	1,180.05	58,182

Source: Bank of Korea Trading Reference Rate.

It is believed that the personal descent device based on this technology will be located in the category of replacement and complementary products for the existing fire-fighting evacuation apparatus, the descending life line. The descending life line is categorized as machinery in the classification of fire-fighting products. If we look at the sales of the firefighting industry within the domestic machinery manufacturing industry, including the descending life line, it has increased from 9,405 billion won in 2015 at an average annual rate of 5.04%, to 1.448 trillion won in 2019.

<Table 3-19> Trend in the Sales of the Fire-fighting Sector of Domestic Machinery Manufacturing Industry

(Unit: Billion Won)

Category	2015	2016	2017	2018	2019	CAGR
Machinery Manufacturing	9,405	10,788	11,400	11,728	11,448	5.04%

Source: Fire Department, each year.

According to the procurement history of specific items in the Procurement Information Open Portal, the procurement volume for domestic descent steel has shown a growth rate of 110.16% per annum during the same period, from 41 million won in 2015 to 180 million won in 2020.

<Table 3-20> Domestic Descent Life Line Procurement Amount Trend

(Unit: Million Won)

Category	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019	Year 2020	CAGR
Descent devices	41	0	22	36	119	180	110.16%

Source: Data extracted from Procurement Information Open Portal, https://data.g2b.go.kr:1443/pt/pubdata/moveSpcifyPrdlstPrcurePop.do, accessed on September 1st, 2022.

The personal descent device based on this technology is intended to be applied to buildings over 5 floors. Therefore, since the market for this technology does not currently have any published market data, the potential market size was estimated according to the following criteria.

Based on the status of buildings over 5 floors in 2020, it is assumed that 4 devices will be applied per new building. Although there has been some prevalence in buildings below 10 floors, and in buildings over 11 floors it has not been disseminated to existing buildings, it is assumed that demand will grow in line with the increase in the number of new buildings in view of the market size of domestic fall prevention devices. The unit price of the product was estimated by applying 400,000 won for the 5th floor, 400,000 won for the 6th to 10th floors, 100,000 won for the 11-20th floors, 150 million won for the 21-30 floors, and 2 million won for the 31st floor and above.

As a result of the estimates, the potential market for the fire escape personal descent device based on the technology is estimated to be 308 billion won as of 2020.

<Table 3-21> Potential Market Estimate for Fire Escape Personal Descent Devices (as of 2020)

Category	Floor 5	Floors 6-10	Floors 11-20	Floors 21-30	More than 31 floors	Sum
Number of new buildings (East) (A)	3,139	1,997	2,286	1,673	426	9,521
Amount required (B) (=A×4)	12,556	7,988	9,144	6,692	1,704	38,084
Unit price (full capacity) (C)	40	40	100	150	200	-
Potential market size (million won) (D) (=B×C)	5,022	3,195	9,144	10,038	3,408	30,808

Note: Basis for calculation: (A) Based on the status of buildings by number of floors, new buildings with five floors or more (number of buildings in 2020-2019). (B) 4 devices per building, (C) Data provided by the business entity.

(3) SWOT Analysis

<Table 3-22> SWOT Analysis

Strengths	Weaknesses
• Has a good IT infrastructure • Promoting the government's policy of mandating the installation of evacuation equipment for certain types of buildings	• Industrial structure centered on domestic demand and SMEs • The source technology for safety products is owned mostly by developed countries • No obligation to install descending life lines in buildings over 11 floors
Opportunities	**Threats**
• The construction of skyscraper buildings is progressing rapidly • Increased need for safety equipment due to the increase in large-scale fire accidents in multi-density facilities • Prospects for continued growth of the safety equipment and products industry • Expanding awareness of the safety of fire fighting	• The barriers to entry are high for the technology, and quality certification and reliability verification are time-consuming. • Limitations of the domestic market with a domestic market-oriented market structure • Safety apathy reduces support and concern for safety

2.3.2.4.3. Enterprise and Products Trends (Extracted from an in-depth report)

(1) Domestic and Foreign Company Trends

Since this technology is aimed at the domestic market, and competition is expected to be mainly centered on domestic companies, this review of trends is focused on domestic companies.

SM2 Co., Ltd. has developed and released "SLS (Safety Life Spare), an evacuation facility similar to this technology that can be used in a 60-meter building. Other companies that manufacture replacement and supplementation of this technology are Seohan F&C, Shinyoung Industrial Co., Donghae High Fire Station, etc.

A. SM2 Co., Ltd.

Founded in November 2013, Safety Medical Two is a manufacturer of life-saving devices that are used to escape safely from fires and disaster sites in high-rise buildings, apartments and hotels over 10 floors in the event of a fire, disaster, etc.

The company's financial status is as follows: it holds total assets of 721 million won, equity capital of 72 million won (140 million won of paid up capital), and 13 million won of turnover as of the end of December 2020. The company is believed to have closed its business on August 31, 2021.

B. Seohan F&C

Seohan F&C is a company that manufactures rescue products, tonic machines, air safety mats, and special fire extinguishers, which are equipment to save lives in the event of various disasters, and is currently the leading company in the industry. The company is carrying out both domestic operations and exports, and is expanding its business area by constantly developing advanced disaster prevention systems. The company's product line includes air safety mats, lifesaving mats, air slides, tonic machines, rescue items, solid aerosol extinguishers, disinfection equipment, small hydraulic equipment, and mobile emergency fire extinguishers.

The company's financial status is 11,241 million won in total assets, 10,390 million won in equity capital (400 million won in paid capital), and 12,192 million won in sales as of the end of December 2020.

(2) Domestic and Foreign Product Trends

A. SM2 Co., Ltd.

SM2 Co., Ltd. developed the 'Safety Life Spare' (SLS) for emergency escape and obtained type approval for the descending life line from the Korea Institute of Fire Industry and Technology.

It is an evacuation facility that can also be used in a 60-metre building with a height of about 20 floors, and is a lightweight device of about 6 kg that applies a special wire 3 mm thick with a built-in rope, with high heat resistance and a load capacity of up to 150 kg. Unlike the traditional descent devices, it is equipped with a handle-shaped deceleration control (brake pad) that allows for speed adjustment, which provides the advantage of the capacity to support escape from the middle layer in case of an emergency. It is portable and has been developed as an all-in-one combination of a controller and an emergency escape unit, making it convenient to use it in places such as balcony railings. The product is registered for sale in the PPS Venture Country for KRW 484,000.

B. Seohan F&C

Seohan F&C's products include an evacuation device that lowers automatically by the user's own weight in the event of a fire or disaster and guides evacuees to the ground safely.

2.3.2.4.4. Market Forecast (Extracted from an in-depth report)

The market size for fall prevention devices among global personal safety equipment is expected to grow at a CAGR of 8.18% from USD 3,100.9 million in 2020 to reach USD 4,968.8 million in 2026.

<Table 3-23> Global Personal Safety Equipment Market Forecast

(Unit: Million Dollars)

Category	2020	2021	2022	2023	2024	2025	2026	CAGR ('20~'26)
Market size	3,100.9	3,278.3	3,518.5	3,808.2	4,148.6	4,531.9	4,968.8	8.18%

Source: "Personal Protective Equipment (PPE) Market Report", Global Market Insights, 2020

The calculation of future market size is based on the estimated market size of Fall Prevention Devices in the Asia-Pacific region for 2020 (KRW 581.82 billion), among the global regional personal safety equipment market. The growth rate of 8.18% was estimated by applying the base figures. As a result, the size of the domestic market for fall prevention devices is expected to reach 932.54 billion won in 2026.

We estimated the potential market for personal fire escape descent devices in 2020 by multiplying the number of new buildings over 5 floors, the amount of personal descent devices required per building, and the sales unit price of personal descent devices in 2020. It was estimated to be 308.08 billion won. The future market size was estimated by applying the growth rate of 8.18% to the personal safety equipment market in the Asia-Pacific region. As a result, it was found that the potential market for personal descent devices for domestic fire escape is expected to reach 493.79 billion won in 2026.

<Table 3-24> Market Forecast for Domestic Fall Prevention Devices and Potential Market Forecast for Personal Descent Devices

(Unit: Million Yuan)

Category	2020	2021	2022	2023	2024	2025	2026	CAGR ('20~'26)
Fall prevention	58,182	62,941	68,089	73,659	79,684	86,203	93,254	8.18%
Personal descent	30,808	33,328	36,054	39,004	42,194	45,646	49,379	8.18%

Note: Basis for output: Estimation of the personal safety equipment market growth rate in the Asia-Pacific region is based on the market size of fall prevention devices in 2020 and the potential market for personal descent devices for fire escape.

2.3.2.4.5. Comprehensive Opinion (Extracted from an in-depth report)

This technology is related to a personal portable descent device using alpha technology, and the applied product is a personal descent device for fire escape. The target market is an overlapping area among the markets for fire escape equipment.

The personal descent device market for fire escape is expected to grow in line with the trend of high-rise buildings, increased need for safety equipment due to the increase in large-scale fire accidents, continuous growth prospects of safety equipment and product industries, and increased safety awareness among the public.

There are 14 domestic companies that manufacture softeners that can replace and supplement the technology products to be evaluated, including Seohan F&C, Shinyoung Industrial Co., Donghae High Tech Co., Ltd., Korea Fire Equipment Manufacturing Co., Ltd., Yuksong Co., and Dongwon Co., Ltd., and the market concentration is considered moderate. The market for fire safety equipment suitable for high-rise buildings with 11 floors or higher, such as the technology subject to evaluation, was dominated by SMTO Co., Ltd., but the company is currently closed, and there are no manufacturers of softeners for high-rise buildings with 11 floors or higher.

Safety and reliability are very important factors because personal descent devices for fire escape are used in high-rise buildings. In order to enter the market, it is essential to obtain KFI recognition from reliable institutions. Furthermore, existing competitors' distribution networks are likely to enter the market, although new products are unlikely to appear.

According to Global Market Insights (2020), the market size for anti-fall devices among global personal protective equipment is expected to grow at 8.18% annually from $3100.9 million in 2020, reaching $4,968.8 million in 2026. The potential market for personal descent devices for fire escape in Korea is estimated to grow at 8.18% annually from KRW 30,808 million in 2020, reaching KRW 49,379 million in 2026.

The descent device based on this technology is designed as a personal descent device that enables the user to descend safely from a building at a low speed. The descent device is easy to use, and can be used to evacuate safely from a high-rise building with 20 or more floors.

The target market for fire escape devices can be classified into an alternative market for fire breakers in high-rise buildings with more than 11 floors. As 14 companies divide the market, there are many technologies that implement similar functions as the evaluation technology.

2.3.2.5. Analysis of Business Feasibility

Business feasibility analysis considers the overall business outlook, including management factors such as commercialization capabilities, production and sales capabilities of the subject (business entity) that promotes commercialization using the target technology, price and quality competitiveness, and sales outlook.

The business feasibility analysis is conducted to determine the possibility of generating profits through commercialization based on the results of technical analysis, rights analysis, and marketability analysis of the target technology. However, the results of business feasibility analysis and cash flow calculation may vary depending on the business entity or business model.

In the business feasibility analysis, opinions on the feasibility of commercialization and the feasibility of business promotion, such as sales generated during the cash flow estimation period, are presented based on the analysis of commercialization capability, price and quality competitiveness of the product, and size of commercialization investment. In the analysis of commercialization capabilities, human and material factors such as technology development capabilities, production capabilities, marketing capabilities, and management capabilities are analyzed systematically by the entity that wants to commercialize the target technology. Product competitiveness analysis reviews specific functions and characteristics of products based on the target technology, products and comprehensively identifies attributes that can secure comparative advantage in the target technology market in terms of price competitiveness, quality competitiveness, and other factors of competitiveness. Comprehensive opinions on the feasibility of the business plan and the feasibility of project promotion are presented through the analysis of commercialization capabilities and product competitiveness.

As a broad concept of business feasibility analysis, various inputs comprised of the most basic and core information of technology valuation should be presented for evaluating sales.

The business feasibility analysis reviews the commercialization capability of the business entity and the competitiveness of the target technology product based on analyzing the valuation factors.

2.3.2.5.1. Business Performance Assessment (Extracted from an in-depth report)

(1) Ability to Conduct Business

A. Overview of Business Entities

1) Status

<Table 3-25> Overview of Business Entities

<table>
<tr><th>Company Name</th><td colspan="2">Co., Ltd. corporation</td><th>Markers</th><td colspan="2">Kim**</td></tr>
<tr><th>Year and month of establishment (Practitioner's Year and Month Date)</th><td colspan="2">20xx.x.xx</td><th>Homepage</th><td colspan="2">https://www. xxxxxx.com</td></tr>
<tr><th>Business Registration Number</th><td colspan="2">381-*******</td><th>Corporate Registration Number</th><td colspan="2">210111-*******</td></tr>
<tr><th>Address</th><td colspan="3">Gyeonggi @ @%% && **</td><th>Telephone number (Fax number)</th><th>Ownership</th></tr>
<tr><th>Business</th><td colspan="3">Gyeonggi @ @%% && **</td><td>031-xxx-xxxx</td><td>Rental</td></tr>
<tr><th>Type of Business</th><td colspan="5">(C28422) General Purpose Electric Lighting System Manufacturing</td></tr>
<tr><th>Products</th><td colspan="5">Descent, CC. DDDD et al</td></tr>
<tr><th>Grade</th><td colspan="5">AA, BB</td></tr>
<tr><th rowspan="4">Business size (Million won)</th><th>Contents</th><th>Year 2018</th><th colspan="2">Year 2019</th><th>Year 2020</th></tr>
<tr><td>Sales</td><td>-</td><td colspan="2">-</td><td>-</td></tr>
<tr><td>Capital</td><td>-</td><td colspan="2">-</td><td>-</td></tr>
<tr><td>Operating profit</td><td>-</td><td colspan="2">-</td><td>-</td></tr>
</table>

Source: www.cretop.com

The commercialization entity (Co., Ltd.) was established in January 2021 in Gyeonggi-do, ** by CEO Kim ****, for the purpose of manufacturing general purpose electric lighting equipment, etc. [Paid up capital: 5 million won]. As a non-externalized monitoring company, the company manufactures fire escape descent devices, LED landscape lighting, and landscape sculptures as its main products (business), and is currently a small business owner with 4 permanent employees.

2) History

The company was established in January 2021 and applied for a patent for the "Personal Portable Descent Device Using Alpha Technology" in March 2021, and registered the factory in ********. In April 2021, a Research and Development department was established by securing two research and development personnel, and in May, an industrial design company was registered.

<Table 3-26> History of Business Entities

History Date	Content
2021.01.21	Establishment of a corporation (Corporation Corporation)
2021.03.22	Patent application (Application No. : 10-2021-00*****)
2021.03.29	Registration of factory (***********)
2021.04.07	Registration of the dedicated R&D department
2021.05.07	Registration as an Industrial Design Specialist Company

Source: Provided by the applicant company.

3) Organization

The company is an early stage company established in January 2021, and consists of an organization of dedicated research and production departments under the leadership of the CEO, with two people working in each department.

B. Competence of the Business Entity

The capabilities of the business entity can be understood through the management status of the business, the performance of research and development, and the sales status.

1) Management Status

The company's CEO Kim ** (born 19**, M) is a graduate of the Department of Convergence Technology under the University of **.He worked with **(1995-2008, Final Position: Representative), **(1996-1999, Final Position: Representative), (Yu)*****(2010). Based on his experience working in the years up to 2013, (Final Position: Team Leader) and working with XXX Co., Ltd. (2014-2017, Final Position: Team Leader), he took over as CEO in

January 2021 and is in charge of the overall management of the company. The management team is composed of directors, and the biographical history of the management team is as shown in the table below.

<Table 3-27> Executive Biography

Position	Statement	Final Academic Background (Major)	Career
Representative	Kim**	Bachelor's Degree (Convergence Technology Division)	Winner of Creative Economy Innovation Center Competition – Gyroka (2015) Development of crop growing device (Patent : 10-*******) Development of the concentrator (Patent : 10-*******) Development of excellent manure network (Patent : 10-*******) - Excellent invention, excellent procurement registration Development of life-saving drones Descent lift for fire escape (Patent : 10-2021-00*****) Product Design Development Support Project (Fire Escape Descent Lift, 21.04.29~21.07.28) BI Development Support Project (Descent Lift for Fire Escape, 21.05. 31.~21.12.10)
Director	Lee**	PhD (Department of Electrical Engineering)	Start-up Growth Technology Development Project (Descent Lift for Fire Escape of High-rise Building. 21.06.23.~22.06.22)

Source: Provided by the applicant company.

The CEO majors in fusion technology and has experience in commercialization of products such as developing crop growing equipment, concentrator equipment, drones, outdoor (bus stops, etc.) heat/cooling chairs, etc., and the director has a PhD in electrical engineering. In view of the fact that the company is promoting the commercialization of a down-lift based on this technology for escaping from high-rise buildings through the start-up growth technology development project, it is judged that the company has the experience and ability to promote this project.

2) Research & Development Performance

The company established a research and development department with two research and development personnel in April 2021, and has been operating the department till date. The company is promoting the development and commercialization of a falling lift for fire escape in high-rise buildings with an investment of KRW 120 million from June 2021.

The company was established in January 2021 and the only patent held is the 'Personal Portable Descent Device Using Alpha Technology' filed in March 2021. However, the CEO holds a number of patents such as crop growing devices, heat collectors, etc. through his previous business experience.

3) Sales Status

The company is an early start-up company that was established in January 2021 and has no data on its sales status.

The company plans to generate sales from 2022 through more than a year's preparations for commercialization such as safety certification. Although it currently lacks sales capacity, the company conducts its own survey, and 28.7% of the people surveyed have expressed their intention to purchase. Accordingly, if the company sells the device at a price of 150 million won for buildings over 30 floors, it is believed that it will be possible for this technology product to enter the market.

4) Conclusion

As a result of analyzing the company's capabilities in terms of management status, R&D performance, and sales status, it is necessary to make the commercialization of this technology smoother by recruiting personnel with professional experience in related fields, depending on the desired degree of commercialization.

(2) Feasibility of Business Promotion

A. Production Planning

The company was founded in January 2021, registered the plant in ** in March 2021, and currently has two production personnel.

Regarding the production of applied technology products, most of the manufacturing, except for the painting work in the current factory, will be carried out by the company on its own, and in response to the future increase in production, the company will invest 10 million won in 2024 to introduce semi-automated facilities. It plans to invest 100 million won annually from 2025 to 2026 to introduce automation facilities. Since the commercialization of this technology is expected to require a preparation period of 6 months to 1 year, for tasks such as completion of development, patent registration, performance certification, preparation of domestic sales promotional materials, full-scale mass production and sales will take place from the second half of 2022.

<Table 3-28> Investment and Production Plan of the Commercialization Entity

Contents		Year 2021	Year 2022	Year 2023	Year 2024	Year 2025	Year 2026
Facility investment (million won)		-	-	-	10	100	100
Development costs (million KRW)		8	50	-	10	100	100
Space (Production/ Inventory (㎡))		-	-	150	150	300	300
Number Volume	12m class	-	0	60	200	900	2,500
	15m class	-	10	140	300	500	850
	30m class	-	0	20	200	400	600
	60m class	-	0	20	170	300	1,000
	Grade 150	-	0	0	65	250	800
	Grade 300	-	0	0	0	100	145
Personnel		-	4 people	5 pax	7 pax	10 pax	13 pax
Main Contents		Development completed Patent registration Performance certifications Domestic sales Exposure of promotional material		Mass production system Good procurement Registration Domestic sales Overseas certifications Overseas sales	Overseas market expansion Launch of versioned products Construction of semi-automated facility	Expand your automation footprint Release of derivative products	Create custom products

Source: Provided by the applicant company.

B. Sales Plan

The target demand for the technology originates from multi-story buildings, safety-related agencies such as fire stations, and firefighters. If application is expanded to the maximum, it will be available on every floor of every multi-story building in Korea, but in the first place, it aims to be applied to nursing homes, schools, academies, hospitals, etc. In addition, the company plans to build sales by manufacturing products that can be applied to buildings that are 20 meters high (approximately 5-6 floors) with a high degree of completeness, and then expand sales to higher building products. Technically, it is possible to manufacture devices for 150 m (30-storey buildings) at the current level, but the company plans to expand its commercialization target to high-rises, starting with low-rise buildings. The estimated sales price is 400,000 won for 5-storey buildings, 400,000 won for 5-10 floors, 1 million won for 10-15 story buildings, and 150 million won for 15-30 floors. It is charging 2 million won for buildings over 30 floors.

At the beginning of commercialization, the company will focus on use in low-rise structures such as the 12m class (4th floor), 15m class (5th floor), and 30m class (10th floor). The company plans to expand the proportion of high-rise use from 2024, when the supply has been achieved to a certain extent. Sales are planned at 5 million won in 2022, 144 million won in 2023, 815 million won in 2024, 2,160 million won in 2025, and 5,415 million won in 2026.

<Table 3-29> Itemized Sales and Sales Plan

(Unit: Device, Million Won)

Contents		Unit	Year 2022	Year 2023	Year 2024	Year 2025	Year 2026
Number Volume	12m class	0.4	0	60	200	900	2,500
	15m class	0.4	10	140	300	500	850
	30m class	1	0	20	200	400	600
	60m class	1.5	0	20	170	300	1,000
	150m class	2	0	0	65	250	800
	300m class	2	0	0	0	100	145
Turnover (Million KRW)		-	5	144	815	2,160	5,415

Source: Provided by the applicant company.

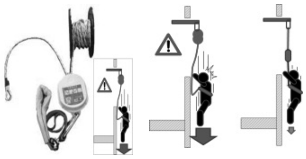
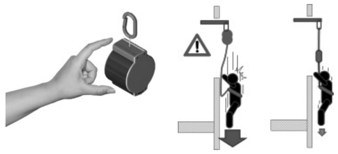
The fire escape personal descent device based on this technology offers the following advantages: it can be used to descend safely, the descent speed can be controlled, it is easy for beginners and children to use, and it can be used in high-rise buildings of 11 floors or more, based on the demand for replacement of existing descending life lines and more than 11 floors. It is believed that the generation of new demand for high-rise buildings will allow sales to be generated.

C. Price and Quality Competitiveness

Escape from a building fire can be implemented in a variety of ways, including stairs, descent gear, emergency exits, fire brigade bridges, airmats, and industrial supplies. However, the location of fire in a building cannot be predicted in advance, and the application of a building escape device depends on the conditions of the building, making it difficult to achieve a uniform escape method, and furthermore there are no products available to address this. Comparing the fluidity and ease of use between the present technology and the existing escape path, it is estimated that the product offers advantages in terms of both fluidity of the escape path and ease of use.

In addition, compared with the existing similar products of other companies' descending life lines, it is more portable, can be used for evacuation by selecting the appropriate location, does not present the risk of loosening of strings, has a low impact of momentary descent, and lowers the psychological anxiety associated with ropes and fasteners.

<Table 3-30> Comparison of the Competitiveness of this Technology

Category	Existing Third-party Products	Development Products
Example images		
Portability	×	Good
Evacuation locations	Specify a location	Appropriate location to evacuate
Loosening of the rope	Possible	Does not occur
Instantaneous descent impact force	High impact	Low impact
Psychological anxiety	High anxiety	Low anxiety
Key Configurations	Rope, Speeder	Integrated

Source: Provided by the applicant company.

In terms of price, the 5th floor and below have a similar price structure as the competitors, but the 11th floor and above are expected to show high profitability compared to the competitors due to the fact that there are few competitors. In the business entity's own survey, when the drop-off device was offered at a price of 150 million won for a building with more than 30 floors, 28.7% of the survey subjects indicated their intention to purchase, and the survey subjects who gave a negative opinion were more likely to be burdened with the price than likely to doubt the product. Therefore, it is judged that it will be necessary to reduce the consumer's price burden by reducing the cost through further development in the future.

(3) Adequacy and Feasibility of Business Promotion

The company registered the plant in March 2021 in ****** and currently has two production personnel, so most of the manufacturing, except for painting work, will be carried out on its own at the current plant, in response to future increases in production. It plans to invest 10 million won in 2024 to introduce semi-automated facilities, and to invest 100 million won annually from 2025 to 2026 to introduce automation facilities. Through this, it is believed that the smooth production of products based on this technology will be possible.

In addition, for the areas that need to be improved through the valuation of the product, the company plans to improve customer satisfaction by reflecting on the development of the next product, and will converge the reviews by residents living in high-rise buildings or experiential applicants, buyers, and respondents through online media to make improvements. In addition, the company plans to secure intellectual property rights for developed products and reinforce the registration of excellent products by promoting performance certification through performance tests. In order to promote the product, the company plans to combine online and offline platforms for promotion and information collection such as YouTube and Instagram; implement feedback from survey specialists and sites, and municipal and fire-related organizations; and participate in exhibitions and fairs.

In order to secure the sales market, the company will combine the B2C business through exchanges with domestic buyers, promote the product to local governments/public institutions, utilize online media, and provide continuous exposure through the company homepage and YouTube to promote the brand and enhance the image. The company will update the relevant knowledge of technology development products constantly, enhance awareness regarding the need for products through the collection and uploading of videos and data on the fire hazards of high-rise buildings, and collect use cases obtained during the commercialization process to promote product excellence, etc.

With a view to entering overseas markets, the company will promote overseas patent registration and overseas certification, pursue certification targeting countries with expected demand, create packaging boxes for overseas shipping, share videos (YouTube, Instagram) and homepages and promote the products online. In order to commercialize this technology, the company has received a grant of 120 million won as a start-up growth technology development project supported by the Ministry of Small and Medium-sized Venture Enterprises for one year from June 2021. The funds are to be used to promote the development and commercialization of the descent lift for escape from high-rise buildings, and considering that 28.7% of the people surveyed have expressed their intention to purchase the products for the building with more than 30 floors, based on the business entity's own investigation, the possibility of realizing biz profit is valuated as high.

In addition, the target market is clear, the factory and the necessary production personnel are secured, and the advantages such as safe descent, ease of controlling the descent speed, ease of use for beginners and children to use, and cost reduction compared to the existing descent steel machine make the quality and price competitive. In particular, it is believed that it will be possible to enter the market and expand sales in view of the fact that the device can be used in high-rise buildings of 11 floors or more where it is difficult to use the existing descending life line.

In order to do this, it is important to secure a level of price competitiveness that differentiates itself along with the superiority of quality aspects such as safety and ease of use over existing descent and emergency escape device products in terms of quality. Accordingly, it is necessary to systematically secure reliable valuation data for the technical products from trusted institutions to ensure the reliability of quality, and to enter the relevant market based on differentiated price competitiveness compared to the existing similar competitive products. In addition, based on the business entity's own survey, when the 150 million won descent device is offered for buildings over 30 floors, the negative feedback from some respondents was found to be due to the price burden rather than product quality, and the anticipation that costs will be reduced in future. It is believed that it will be necessary to reduce the price burden. Entering the market within the planned period of time requires the expansion of the relevant organizations, as well as appropriate role-sharing and management work. In addition, it is necessary to identify the characteristics of the target market and formulate a strategy for entering the market accordingly. In addition, in order to address barriers created by the market standing and reliability of existing competitors who are already dominating the market, it is necessary to consider various business models that take into account price and production flexibility.

2.3.2.5.2. Estimation of Technology Lifetime and Sales

(1) Estimation of Profit Period

The economic lifespan of a technology refers to the period during which profits are produced by the use of a technological asset. It also refers to the point at which no further profit is generated by the use of a technological asset, or when greater profit can be produced by the use of another technological asset. When considering the lifespan of a technology in the valuation of a technology, the life of the technology is estimated on the premises: of the existence of the market in which the relevant technology is used; the continued need for the technology to grow in the market; and the barriers to entry of the technology, the duration of the patent, the possibility of the emergence of alternative technologies, and the similarities of technologies offered by competitors. It is calculated by comprehensively considering the development trend of improvement technology, the life cycle of the product, and the characteristics of the market.

As an estimate of the economic lifespan of a technology, the Technology Cycle Time (TCT) can be applied. Patent citation life refers to the period of time during which a particular patent is cited by another patent after it is registered. In addition to the patent citation lifespan, it is also possible to utilize the roadmap developed in the field of the target technology, or to estimate and utilize the remaining lifespan of the technology through survival analysis. It is desirable to determine these values by the consensus of experts in order to utilize the experience and knowledge of experts in the field of the technology.

In the Technical Valuation Practice Guide, the calculation of the economic lifespan of a technology to obtain the cash flow estimation period uses the statistics of the Patent Quoted Life Index (TCT, etc.), along with (1) the economic life quantification model by technology life impact factor Model I or (2) the economic life quantification model by technology life impact factor Model II.

In this assessment, the economic life span calculation for the target technology is based on the use of the economic life expectancy quantification model I. by the patent citation life index and the technology impact factor. Here, the patent quotation life index is calculated by taking into account the technology life impact factor, and the calculation formula is indicated as follows.

Economic life of the target technology = median patent citation life x (1 + total rating/20)

On the other hand, in the case of patented technology, since the economic life span cannot exceed the remaining period of the patent rights, the final economic life period of application shall be determined so as not to exceed the remaining period of the patent right.

(i) The economic life of the individual technology > the period of residual rights of the patent:
Economic life span = Period of residual rights of a patent right

(ii) The economic life of the individual technology < the period of the remaining rights of the patent:
Economic lifespan application period = Economic lifespan of individual technology

The following shows the analysis results for the actual case.

The International Patent Classification (IPC) of the technology to be valuated applied A62B based on the representative patent (No. 10-2021-00*****). The detailed technical name is 'Lifesaving Apparatus, Device or Method', and the median lifespan by patent citation is 10 years.

<Table 3-31> IPC of the Valuated Patent and its TCT

IPC	Title	Average	Q1	Median (Q2)	Q3
A62B	Lifesaving apparatus, device or method	10.84	5	10	16

The duration of the patent right is stipulated to be 20 years from the date of the patent application. Therefore, the economic lifespan of the technology to be valuated is calculated by applying the period of legal protection of the patent right as of November 1, 2021, which is the valuation reference date.

<Table 3-32> Period of Legal Protection for the Patent

Application Number	Name of the technology	Filing Date	Duration	Remaining Period
10-2021-00*****	Personal descent device with contact magnetic rotating brakes	2021.03.19	2041.03.19	19 years 4 months

Source: Note: Valuation Date is 2021-11-01.

The technical factors and market factors that have a significant influence on the determination of technology life with TCT are divided into technicality and marketability based on the analysis of the expert survey, as shown in the Technical Life Impact Factor Assessment Table below. At this time, in terms of technology, the possibility of the emergence of alternative technologies, technological superiority, similarities, the existence of competitive technologies and the scope of rights are valuated. In the marketability analysis, the technology life impact factors from the market perspective were included by setting the market concentration, expected market share, etc.

According to Model I, the valuation based on the indicators for technological life impact factors is -1 point. The economic life span of the target technology is calculated as 9.5 years when calculated through the valuation of the economic life impact factors of the technology, and if the elapsed years after the registration of the target patent, 0 years, are subtracted from 9.5 years. If the shorter of the legal residual period of the technology and the economic life of the technology were applied, the economic life of the technology was calculated to be 9.5 years.

<Table 3-33> Technology Life Impact Factor Assessment

Category	Detailed Factors	weight	Very low	Low	Usual	High	Very high
			-2	-1	0	1	2
Technical factors	Superiority	1			●		
	Technology competition strength	1		●			
	Potential to be replaced	1		●			
	Imitation difficulty	1		●			
	Strength of rights protection	1			●		
Market factors	Market entry potential	1			●		
	Market competition strength	1			●		
	Changes in market competition	1				●	
	Possibility of new product emergence	1				●	
	Expected market share	1			●		
Total Influencer Ratings		-1 point					

Thus, the estimated cash flow period by Model I of the Quantification of Economic Life by Technology Life Impact Factors was calculated as 10.17 years plus the commercialization investment period of 0.67 years in the period of applying the economic life of the technology.

<Table 3-34> Estimate of Economic Lifetime

Phase		Estimation Results
Step 1	Technology life impact assessment	Impact Factor Score Result Acquisition Value = -1 point
Step 2	Calculate the economic lifespan of the technology	The economic lifespan of the target technology = Q2 × (1+ (Total Influencer Ratings/20)) = 10 years × (1+(-1/20)) ≒ 9.5 years
Step 3	The economic lifespan of the technology Determining the duration of application	Economic lifespan of the technology (9.5 years) – the number of years elapsed since the registration of the patent to be valuated (0 years) ≒ 9.5 years
Step 4	The economics of technology Determination of life expectancy	Applying the economic life period of the technology (9.5 years) as the effective life: Legal residual period (19.4 years) The application period of the economic life of the technology (9.5 years)
Step 5	Determine the estimated cash flow period	Estimated cash flow period = Commercialization investment period + Economic useful life of technology = 0.67 Years + 9.5 Years ≒ 10.17 Years

(2) Market Forecast (Extracted from an in-depth report)

The present technology relates to a personal portable descent device using alpha technology, and the target market is the descent steel machine market within the market for fire- fighting and evacuation equipment. The patent to be valuated is registered only in Korea, so it is intended for the domestic market.

In the marketability analysis, the application target for the present technology was defined as a building with more than 5 floors, and after estimating the potential domestic market for personal descent devices used in fire escape as of 2020, the market was forecast by applying the future growth rate.

As of 2020, the potential Korean market for personal descent devices used in fire escape was estimated by multiplying the number of new buildings over 5 floors, the number of personal descent devices required per building, and the sales unit price of personal descent devices, respectively. The number of personal descent equipment required per building is 4 units, and the unit price of the personal descent unit is based on the verbal presentation sales unit price (400,000 won for the 5th floor of a building, 400,000 won for the 6th to 10th floor, 1 million won for the 11th to 15th floors, 1 500,000 won for buildings of 16 to 30 floors, and 2 million won for buildings over 31 floors).

As a result, the potential domestic market for personal descent devices used in fire escape was estimated to be 308.08 billion won as of 2020. The future market size was estimated by applying the growth rate of 8.18% of the personal safety equipment market in the Asia-Pacific region. The potential market estimate for the domestic fire escape personal descent devices are as shown in the table below.

<Table 3-35> Potential Market Forecast for Domestic Fire Escape Personal Descent Devices

(Unit: Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	CAGR (21~31)
Market Size	33,328	36,054	39,004	42,194	45,646	49,379	53,419	57,788	62,515	67,629	73,161	8.18%

Note: estimating an 8.18% growth rate after 2027

(3) Estimation of Sales (Extracted from an in-depth report)

A. Estimation Method

Estimation of sales can be made in a variety of ways depending on the valuator, but generally applies: (1) sales volume-based estimation, (2) estimation by market share, or (3) estimation by demand forecast.

First, the sales volume-based estimation is a method of assessing the sales amount based on the price and quality competitiveness of the target technology product, the marketing plan and business capabilities of the target company, etc., if the sales capacity can be derived for the expected sales location.

Second, the estimation by market share can be calculated based on the analysis of the target technology through the review of the industry and the market. Further, the estimated market share of the business entity can be calculated based on the analysis of the macro economy at home and abroad and the analysis of the industry to which the product applying the target technology belongs. It is a method of estimating sales using the market size and the expected market share of the business entity in the target market.

Third, the estimation by demand forecast is a quantitative method of calculating the sales amount by applying quantitative data such as past sales data, marketing-related data, macroeconomic indicators, etc., to the forecast model and assessing the business entity's technology development capability, production capacity, marketing capability, etc. After comprehensively considering the feasibility, changes in the market environment, etc., it is divided into qualitative methods of estimating the turnover by the subjective judgment of the valuator.

This assessment will estimate the potential market size in a top-down manner based on the target market forecast to which the technology product is applied, the business capability of the business entity, and the expected market share taking into account the market structure. Based on the data for buildings with 5 floors or more, the potential market size is estimated by taking into account the buildings to which the technology to be valuated is applied. The target market share and the expected sales of the technology to be valuated was estimated based on the market structure and the opinions of experts in the relevant fields. When estimating the turnover, the regional scope was limited to the domestic area in view of the fact that the technology to be valuated was a domestically registered patent.

B. Estimation of Market Share

In this assessment, the market share reflects the technicality, entitlement, marketability, and business feasibility analyzed above, and after assessing technological competitiveness, the possibility of securing an exclusive market position for the patent to be valuated, the competitive structure of the market, and the commercialization capability of the business entity were analyzed. Based on the views of experts in the relevant fields, the realistically achievable target share was estimated.

Based on the technical analysis of this valuation, the technology to be valuated improves upon the safety problems of the existing descent devices, resolves the problems that make existing devices difficult for children or beginners to use, adjusts the descent speed using the contact magnetic rotating brake to improve safety and convenience, and furthermore the technology can be used in buildings with more than 11 floors. Based on these characteristics, it was analyzed that it will be possible to enter the market.

In the entitlement analysis, the patent to be valuated was assessed as a patent applied for and the probability that the patent right will be invalidated by the prior literature was low. Furthermore, the right can be maintained through the reduction of the claim, and the scope of the right is not wide although the product based on the technology to be valuated can be protected. Based on these findings, it was analyzed that there will be no problem regarding commercialization.

In the marketability analysis, in the existing market for descent devices, 14 companies are occupying the market. Accordingly, there are a large number of devices that implement the valuation technology and similar functions, and the competition is high. However, the market for high-rise buildings of 11 floors and above still remains largely untapped, with 1 competitor. Considering these, it has been analyzed that the expected market share at the time of market entry will be able to occupy about halfway through the target market.

In the business performance analysis, as a result of assessing the commercialization capabilities of the business entity, it is found that the business entity is an early start-up company established in January 2021, and experiences in commercialization of fire-fighting evacuation apparatus, related organization composition, and sales network are insufficient. The high-rise building fire escape project is currently carried out through the start-up growth technology development project of the Ministry of Small and Medium-sized Venture Enterprises. As a step in the development of the descent lift, the company is expected to generate full-fledged sales from July 2022 after completing the development and safety certification by June 2022. Production is planned to be carried out directly by introducing automation facilities, and the company plans to obtain performance certifications for marketing, register excellent procurement products, promote the technology to municipalities/public institutions, and use online media to promote the product.

For the purpose of estimating revenue, the life cycle of the technology to be valuated is defined as the commercialization preparation period (November 2021 to June 2022), the introduction period (July 2022 to 2023), the growth period (2024 to 2026), the maturity period (2027 to 2028), and the period of decline (2029-2031). This is in view of the high probability that alternative technologies may emerge, which was identified in the technical analysis of this assessment.

For the period from July 2022 to 2023, the market share was estimated to be 0.014% (=5/36,054) in 2022 and 0.369% (=144/39,004) in 2023, taking into account the business plan of the business entity. This takes into account the fact that the business entity is planning a turnover of 5 million won in 2022 and 144 million won in 2023, which is a feasible estimation. Considering that SMTU Co., Ltd. demonstrated a turnover of 9 million won in the first year of commercialization, 5 million won is considered to be feasible enough. In 2023, the company plans to uncover demand through the promotion of descending life line devices at experience sites, municipalities and fire-related related institutions, etc., with more than 300 experienced subjects, and expected sales of 240 units (4 per demand) when considering more than 28% of the purchase weight.

It is assumed that the maximum market share will be achieved in 2026, at the end of the growth period. The market share in 2026 was estimated to be 5% based on the domestic market structure for descent devices and the assessment of experts participating in this assessment. This is because the marketability analysis of this valuation report shows that the market share of the technology to be valuated is expected to be at the level of the middle group of the target market, and the total sales of the descent market participants are not grasped because the market size of the descending life line is not large. Based on the assessment of the market share, the market share for the middle group is estimated to be around 5%.

In addition, there are 14 companies participating in the market for descending life line products, and the average level of market share, including the technology products to be valuated, is 7.14% (=100%/14). Considering these points comprehensively, the market share for the technology to be valuated was estimated conservatively to be 5% based on the inputs of experts participating in this assessment.

Market share in the years 2024-2025 is estimated to increase by 1.54%p year-on-year, assuming an equal increase in market share from 2023-2026.

The maturity period of 2027-2028 applies the same market share as the end of the growth period of 2026, and the period of decline, viz. 2029-2031, is estimated to see a 1% year-on-year decline in market share.

The estimated market share based on the above criteria is as shown in the table below.

<Table 3-36> Results of Market Share Estimation

(Unit : %)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Market Share	0.014%	0.369%	1.91%	3.45%	5.00%	5.00%	5.00%	4.00%	3.00%	2.00%

Note: The market share in 2022 is the market share from July 2022, excluding the commercialization preparation period (2022.01~2022.06).

C. Estimation of Sales

The projected turnover of the business entity estimated by the above basis is as shown in the table below. After generating 5 million won in 2022, the initial year of revenue generation, the business entity is expected to generate sales of 1,463 million won in 2031, when the economic life expectancy ends.

<Table 3-37> Estimation of Sales

(Unit: Million Won)

Category	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Market Size (A)	36,054	39,004	42,194	45,646	49,379	53,419	57,788	62,515	67,629	73,161
Market Share (B)	0.014%	0.369%	1.91%	3.45%	5.00%	5.00%	5.00%	4.00%	3.00%	2.00%
Sales (C=A×B)	5	144	806	1,574	2,469	2,671	2,889	2,501	2,029	1,463

2.3.2.5.3. Estimation of Cash Flow (Extracted from an in-depth report)

(1) Estimation of Major Financial Ratios

A. Cost of Sales and Management Expenses

If it is possible to estimate the characteristics of the target technology product directly, it is desirable to calculate the cost of sales and the cost of commissioning directly. If the business entity has a track record of commercializing the technology or similar technology in the past, it shall be calculated using data on the business entity's cost of sales rate or commissioning ratio. If it is difficult to obtain data on the cost of sales rate and commissioning ratio for the target technology or business entity, it shall be calculated by referring to the sales cost ratio and commissioning ratio data for 3-5 representative companies that commercialize similar technologies. If it is difficult to obtain data from similar companies, it is calculated referring to the cost of sales rate and commissioning ratio based on the average financial information of the same industry.

In this assessment, the business entity is a start-up company, and the competitive companies don't operate a single business with the target business item, so it was estimated by referring to the average financial information for the peers. The average financial information for the industry was sourced from the average data of the last 3 years (2017-2019) for the C291 (General Purpose Machine Manufacturing) industry, as presented in the Bank of Korea Corporate Management Analysis. According to this study, the average cost of sales ratio for the last three years (2017-2019) of the C291 (General Purpose Machinery Manufacturing) industry is 80.20%, and the sales management ratio is 13.84%.

<Table 3-38> C291 Financial Ratio

(Unit: %)

Category	Year 2017	Year 2018	Year 2019	Average
Cost of sales	80.14	80.22	80.23	80.20
Depreciation ratio (Cost of sales)	1.58	1.62	1.59	1.60
Adjusted cost of revenue	78.56	78.60	78.65	78.60
Sales management ratio	13.19	14.03	14.29	13.84
Depreciation ratio (crown fee)	0.36	0.40	0.47	0.41
Intangible asset amortization ratio (fee of judges)	0.20	0.18	0.19	0.19
Fixed pavilion rate	12.62	13.45	13.64	13.24

Source: Bank of Korea, each year.

The cost of sales and commission expenses include depreciation and amortization of intangible assets, which are as follows. Since it was estimated by classifying the cost separately in 'Depreciation Expense etc.', it is reasonable to apply a ratio excluding the depreciation expense (1.60% cost of sales, 0.41% commission fee) and intangible asset amortization expense (0.19% commission fee). Therefore, the adjusted cost of sales ratio is 78.60%, and the adjusted commission ratio is 13.24%.

On the other hand, the proportion of materials in the same industry (C291) was an average of 44.81% in the last three years (2017-2019), and the business entity expects to maintain the material cost at 30% by reducing the component cost with the integrated rope and fastener. Therefore, the cost of sales ratio is expected to be about 15%p lower than the industry average. In view of this, the material cost reduction rate of the valuated technology is conservatively viewed as 5%p in consultation with the experts participating in this assessment, and the material cost reduction rate for the valuated technology is subtracted from the average adjusted cost of sales rate (78.60%) for the industry and the material cost reduction rate for the valuated technology is subtracted by 5%p and 73.60% is applied as the cost of sales rate. Next, the 'mechanism depreciation expense' estimated in ' Depreciation Expenses, etc.', was added to the cost of sales.

<Table 3-39> Comparison of Material Ratios of C291 and Material Ratios of the Business Entities

Category	Peers (C291)				Estimated Material Ratio for the Business Entity
	Year 2017	Year 2018	Year 2019	average	
Material ratio	45.32%	44.71%	44.42%	44.81%	30.00%

Source: Bank of Korea, each year.

The sales management ratio used to estimate the sales management cost is 13.24%, subtracted from 13.84% by 0.60% (= 0.41% + 0.19%). Next, 'Depreciation of Intangible Assets and other Capital Expenditures' estimated in 'Depreciation Expenses, etc.', were added to the commission expenses.

The estimated sales were multiplied by the cost of sales ratio and the sales management ratio respectively to calculate the cost of sales and the sales management cost. Furthermore, the operating profit calculated by subtracting the cost of sales and the sales management cost from the sales was the same as shown in the table below.

<Table 3-40> Estimation of Operating Profit Statement

(Unit: Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Sales	0	5	144	806	1,574	2,469	2,671	2,889	2,501	2,029	1,463
Cost of sales	0	4	106	594	1,170	1,838	1,987	2,148	1,861	1,514	1,098
Variable ratio (73.60%)	0	4	106	593	1,159	1,817	1,966	2,127	1,840	1,493	1,077
Depreciation	0	0	0	1	11	21	21	21	21	21	21
Crown fee	0.3	12	31	122	228	350	366	396	345	282	207
Variable ratio (13.24%)	0	1	19	107	208	327	354	383	331	269	194
Depreciation	0.3	12	12	15	19	23	13	14	14	14	14
Operating profit	-0.3	-11	7	90	177	281	318	346	295	232	158

B. Corporate Tax

In this valuation, the corporate tax is calculated based on the current corporate tax rate. As of 2021, the corporate tax rate is 10% if the operating profit is less than or equal to 200 million won, 20% if the operating profit is more than 200 million won or less than 20 billion won, and 22% if the operating profit is more than 20 billion won and less than 300 billion won, and 25% if it exceeds 300 billion won. In addition, when calculating corporate taxes from future cash flows, the local income tax, calculated by applying the relevant tax rate under the local tax law to the corporate tax standard, was added to the corporate tax expense.

<Table 3-41> Applicable Corporate Tax Rate

Taxation Standards	Tax Rate History	Corporate Tax Rate (including local income tax)
Less than 200 million won	10/100 of the taxation standard	11%
More than 200 million won Less than 20 billion won	20 Million Won + (20/100 of the amount exceeding 200 million won)	22%
More than 20 billion won and less than 3,000 billion won	39.8 billion won + (22/100 of the amount exceeding 20 billion won)	24.2%
More than 3,000 billion won	655.8 billion won + (25/100 of the amount exceeding 3,000 billion won)	27.5%

Source: Article 55 of the Corporation Tax Act, Article 176 of the Local Tax Code.

C. Capital Expenditures

Capital Expenditure (CAPEX) means the amount of investment in tangible and intangible assets required for business activities. A tangible asset is an asset that is held for a long period of time for the purpose of use in business activities, and refers to an asset with a tangible nature, represented by land, buildings, machinery, fixtures, and constructs. Intangible assets have no physical entity and are held over a long period of time for the purpose of use in business activities, such as goodwill, industrial property rights, licenses and franchises, copyrights, computer software, development costs, leasehold rights, mining rights and fishing rights.

Capital expenditures are calculated based on the market size of the technology products to be valuated, the market share of the enterprise, the timing of supply, the size of the future sales vision, the current size of tangible and intangible assets, the investment plan, the production capacity of the enterprise, etc., taking into account the land, buildings and constructions, machinery, etc. It is desirable to make a direct estimate of intangible assets, other capital expenditures, etc. Land may be included as a capital expenditure on the premise that it is applied in the process of commercialization of the technology to be valuated, but is not subject to depreciation. Assets that are already held by a company may be treated as capital expenditures, assuming that the company reinvests as much as the remaining value of the assets as of the date of valuation in a way that contributes to the commercialization of the technology to be valuated.

The technology to be valuated is currently in the development stage, with plans to invest 8 million won from November 2021 to the end of December 2021 and 50 million won in research and development expenses from January 2022 to June 2022, for applying it as an intangible asset.

Land and buildings are leased and used, so they are not planned to be invested. The business entity plans to outsource production in 2022 and 2023, and invest 10 million won in 2024 and 100 million won in 2025 and 2026, respectively. Estimates were made to reflect the investment plan. Estimation of other capital expenditures was based on the fact that the business entity has not presented an investment plan, but expects to acquire vehicle carriers, fixtures, etc., so the industry (C291) average for other capital expenditures versus sales in the last 3 years (2017-2019) was used for calculations. The ratio (2.35%) was estimated by multiplying the increase in sales by 2028, when increase in sales is expected. In principle, after the expiration of the content training period, the disposal of the old facility and the replacement investment of the new facility will occur. The capital expenditure estimate is shown the table below.

<Table 3-42> Capital Expenditure Estimates

(Unit: Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Machinery	-	-	0	10	100	100	-	-	-	-	-
Intangible assets	8	50	-	-	-	-	-	-	-	-	-
Other capital expenditures	0	0.3	3	16	18	21	5	8	16	18	21
Sum	8	50.3	3	26	118	121	5	8	16	18	21

On the other hand, it was assumed that these capital expenditures would be recovered through depreciation and that the balance would be fully recovered at the end of the economic life of the technology.

D. Depreciation Costs, etc.

Depreciation is not an expense for which outflow of real money occurs, but is treated as part of the cost of sales and sales management expenses, which include depreciation expenses, thereby reducing the operating profit. Therefore, depreciation expense should be added when calculating excess profit, which is cash flow, and amortization expenses for intangible assets should be added when calculating excess profit because it is the same as depreciation expense without cash outflow.

The depreciation expense for machinery is based on the investment plan, and applies the reference content training and content training range table of the assets for each industry in accordance with Article 15 (3) of the Enforcement Rules of the Corporation Tax Act to the investment balance of the relevant year. According to the Enforcement Rules of the Corporation Tax Act, the reference age of assets in the C29 (Other Machinery and Equipment Manufacturing) industry is 8 to 12 years, and in this assessment, the average value is 10 years. Intangible assets and other capital expenditures have been subjected to 5 years of content training in accordance with the Technology Valuation Practice Manual (Korea Institute of Industry and Technology Promotion, 2020). The timing of capital expenditures was assumed to occur at the beginning of the estimated year. In general, depreciation expense is calculated by the straight line depreciation method or the flat rate method, and in this assessment, the straight line depreciation method was used in accordance with the Korean Adopted International Accounting Standards (K-IFRS).

The depreciation expense for year 2021 was estimated by multiplying (1/6) (=2 months/12 months) of the estimated depreciation expense (KRW 1.67 million) for 2021, taking into account that the period of use is two months (November to December 2021) from the date of valuation. The results of the depreciation expense calculation are shown in the table below.

<Table 3-43> Estimate of Depreciation Expense

(Unit: Million Won)

Category	Contents	Amortization way	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Machinery	10 years	Straight line depreciation method	0	0	0	1	11	21	21	21	21	21	21
Intangible assets	5 years	Straight line depreciation method	0.3[1)]	12	12	12	12	11	0	0	0	0	-
Other capital expenditures	5 years	Straight line depreciation method	0	0	1	4	7	12	13	14	14	14	14
Sum			0.3	12	12	16	30	44	34	35	35	35	35

Note: Since the valuation reference date is November 1, 2021, 1/6 (2 months/12 months) applies (=8 million won÷5 years×1/6).

E. Increase and Decrease of Net Driver Bond

Working Capital; WC) refers to the bonds, liabilities, etc. that occur in the course of business activities such as receivables, inventory assets, purchase liabilities, etc., and when calculating cash flows, the increase in the number of receivables, inventory assets, etc(+) in the working capital like the increase in the number of receivables, inventory assets, is subtracted, and (-) of the working capital like the purchase debt, outstanding debt, is added. The Technology Valuation Practice Guide recommends that the increase and decrease in net working capital be calculated by applying direct estimation first, and in the event of difficulties due to lack of data, the financial ratio of similar companies or the financial ratio for reference such as standard financial information should be used.

Since the business entity is a start-up company and no competitive companies run single business related to target business products, the inputs on increase and decrease in working capital was sourced from the financial data for the last 3 years (2017-2019) of the Bank of Korea Corporate Management Analysis on C291 (Other Machinery and Equipment Manufacturing), which is a business of the same industry. The calculated average receivables turnover (4.90), inventory asset turnover (8.37) and purchase debt turnover (9.18) were estimated by multiplying the estimated working capital requirement rate (21.44%) with the increase or decrease in sales. It was assumed that the working capital is also a cash expenditure that is necessarily accompanied by an increase in sales and is fully recovered in the last year of the cash flow estimation period. The data used in this assessment related to the driver's capital of the same industry and the calculation of the increase and decrease of the driver's capital are as shown in the Tables below.

<Table 3-44> Estimated Driver's Bond Requirement Rate for C291

Category	Year 2018	Year 2019	Year 2020	average
Accounts receivable turnover	4.89	4.87	4.95	4.90
Inventory asset turnover	8.88	8.37	7.87	8.37
Purchase debt turnover	8.89	9.16	9.49	9.18
Driver's bond requirement rate	$\frac{1}{4.90} + \frac{1}{8.37} - \frac{1}{9.18} = 21.44\%$			

Source: www.cretop.com

<Table 3-45> Calculation of Driver's Bond Reduction

(Unit: Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Sales	0	5	144	806	1,574	2,469	2,671	2,889	2,501	2,029	1,463
Increase or decrease in sales	0	5	139	662	769	895	202	218	-389	-472	-566
Driver's bond requirement rate	21.44%										
Driver's bond reduction	0	1	30	142	165	192	43	47	-83	-101	-121

F. Payback

The amount of depreciation residual (total of capital expenditures - sum of depreciation expenses, etc.) and the total amount of the increase and decrease in the driver's capital expenditure were assumed to be recovered in the last year of the economic life of the technology, and the return on investment was calculated accordingly. The fixed asset recovery amount deducted from the total amount of capital expenditures minus the depreciation total amount was 107 million won, the working capital recovery was 314 million won, and the total return on investment was estimated to be 421 million won.

<Table 3-46> Estimation of Return on Investment

(Unit: Million Won)

Total Capital Expenditure (A)	Depreciation Total Amount (B)	Fixed assets Recovery solution (C = A-B)	Driver's Bone Increase or decrease (D)	Payback (E=C+D)
394	287	107	314	421

(2) Estimation of Discount Rate

A. Basis for Estimating Discount Rate

The discount rate used to valuate the technology refers to the reduction rate used to convert future cash flows to the present value, which is a quantification of the risks associated with the commercialization of the technology, so the results for the analysis of the business risk of the target technology should be reflected in the discount rate.

The Weighted Average Cost of Capital (WACC), which is primarily used as a discount rate in corporate valuations, consists of a weighted average of the cost of equity and the cost of other capital, reflecting the various risks posed by the overall operating activities of the company. The weighted average capital cost of a publicly traded company can be calculated using the latest time series data collected in the capital markets, but for small and medium-sized enterprises, the weighted average cost of capital cannot be calculated, so a substitute value should be used. Therefore, the following weighted average capital cost, which reflects the risk of commercialization of the technology in the equity cost of the existing weighted average capital cost, is used as a substitute for the discount rate in the valuation of the technology.

Weighted Average Cost of Capital (WACC) = Cost of equity × Equity composition ratio + Other capital expenses × Other capital composition expenses × (1-Corporate Tax Rate)

Cost of equity for SMEs = CAPM for listed companies + Privately held scale risk premium + Technology commercialization risk premium

Cost of Capital of Other Enterprises of SMEs = Cost of other capital of listed companies + Additional risk spreads`

In this assessment, the discount rate was estimated by applying the discount rate value provided by the Technology Valuation Practice Guide, and the rate is as shown in the table below.

The technology to be valuated was developed by a privately held start-up company in the C29 (other machinery and equipment manufacturing) category.

<Table 3-47> WACC by Industry Codes

Industry	Cost of equity						Equity ratio (privately held)	Other Pre-tax Capital Expenses				
	Listed CAPM	Privately held company size premium				Commercialization Risk P						
		Large	medium	Small	Start-up			Listed	Large	Medium	Small	Start-up
10	6.68	7.06	7.94	9.14	10.16	-	63.89	3.98	4.91	5.98	7.22	8.65
11	5.89	6.26	7.13	8.32	9.33	-	71.23	5.38	6.31	7.38	8.61	10.05
12	7.19	7.67	8.80	10.34	11.65	-	64.05	4.70	5.63	6.70	7.93	9.37
13	6.20	6.53	7.32	8.40	9.31	-	56.70	3.89	4.81	5.89	7.12	8.56
14	8.19	8.85	10.39	12.50	14.29	-	68.61	5.47	6.39	7.46	8.70	10.13
15	7.19	7.67	8.80	10.34	11.65	-	71.71	4.70	5.63	6.70	7.93	9.37
16	7.19	7.67	8.80	10.34	11.65	-	52.48	4.70	5.63	6.70	7.93	9.37
17	6.99	7.49	8.65	10.23	11.57	-	60.41	3.77	4.69	5.76	7.00	8.43
18	7.19	7.67	8.80	10.34	11.65	-	51.84	4.70	5.63	6.70	7.93	9.37
19	7.19	7.67	8.80	10.34	11.65	-	66.67	4.70	5.63	6.70	7.93	9.37
20	7.29	7.86	9.18	10.99	12.52	-	76.78	4.23	5.15	6.22	7.46	8.89
21	8.66	9.14	10.26	11.77	13.06	-	81.39	5.30	6.23	7.30	8.53	9.97
22	6.33	6.74	7.68	8.96	10.05	-	61.94	4.47	5.39	6.47	7.70	9.14
23	7.54	8.11	9.43	11.23	12.76	-	69.25	4.85	5.78	6.85	8.09	9.52
24	7.21	7.71	8.88	10.47	11.82	-	74.72	4.22	5.15	6.22	7.46	8.89
25	6.85	7.35	8.52	10.11	11.46	-	53.98	4.12	5.05	6.12	7.36	8.79
26	6.62	7.07	8.10	9.52	10.72	-	89.11	4.78	5.71	6.78	8.01	9.45
27	7.07	7.54	8.62	10.10	11.35	-	70.74	5.29	6.21	7.28	8.52	9.95
28	6.97	7.48	8.65	10.24	11.60	-	63.43	4.76	5.68	6.75	7.99	9.42
29	6.83	7.35	8.56	10.21	11.62	-	61.75	5.06	5.99	7.06	8.30	9.73
30	7.37	7.85	8.94	10.44	11.71	-	79.45	4.54	5.46	6.54	7.77	9.21
31	7.61	8.15	9.38	11.07	12.51	-	63.86	4.67	5.59	6.66	7.90	9.33
32	7.13	7.73	9.14	11.05	12.68	-	63.76	4.70	5.63	6.70	7.93	9.37
33	9.08	9.50	10.46	11.77	12.89	-	62.18	5.84	6.76	7.83	9.07	10.50
34	7.19	7.67	8.80	10.34	11.65	-	77.68	4.70	5.63	6.70	7.93	9.37

Source: Ministry of Industry, Trade and Resources (2020).

When the discount rate is applied, the other post-tax capital expense i.e., the other pre-tax capital expense × (1-T), T = corporate tax rate + resident tax rate.

B. Technology Commercialization Risk Premium

The commercialization risk premium is estimated based on the results of the analysis of technicality and marketability. The technical risk assessment item is used to valuate the risk level after exploring the risk factors in carrying out commercialization from a technical point of view, and the market and business risk assessment item is used to valuate the risk level after exploring the risk factors from the market and business perspectives. The valuation uses a 5-point scale, and the assessment can be selected from one decimal place. The results for the assessment of the commercialization risk premium were valuated at 30 points as shown in the table below, and the corresponding technology commercialization risk premium was estimated to be 5.10%.

<Table 3-48> Technology Commercialization Risk Premium

Contents	Valuation Items	Scoring					Score
		Very bad	Bad	Moderate	good	Very good	
Technical Risks	Differentiation	1	2	3	4	5	3
	Technology competition strength	1	2	3	4	5	2
	Technology commercialization environment	1	2	3	4	5	2
	Imitation difficulty	1	2	3	4	5	2
	Stability of rights	1	2	3	4	5	3
Market and Business Risks	Market entry potential	1	2	3	4	5	3
	Strength of market competition	1	2	3	4	5	3
	Market growth prospects	1	2	3	4	5	3
	Ease of production	1	2	3	4	5	4
	profitability	1	2	3	4	5	5
Overall Rating	30 points						
Risk Premium	5.10%						

Source: Author

<Table 3-49> Technology Commercialization Rating and Risk Premium

Score	RiskP	Score	RiskP	Score	RiskP
Less than 20	N/R				
20	10.01%				
21	9.33%	31	4.75%	41	1.99%
22	8.72%	32	4.42%	42	1.76%
23	8.15%	33	4.10%	43	1.55%
24	7.62%	34	3.80%	44	1.33%
25	7.14%	35	3.51%	45	1.13%
26	6.68%	36	3.24%	46	0.93%
27	6.25%	37	2.97%	47	0.73%
28	5.84%	38	2.71%	48	0.54%
29	5.46%	39	2.46%	49	0.36%
30	5.10%	40	2.22%	50	0.18%

Source: "Technology Valuation Practice Guide", Ministry of Industry, Trade and Resources, 2020.12

C. Estimation of Discount Rate

Since the technology to be valuated corresponds to “Other Goods Handling Equipment Manufacturing (C29169)” by the Korean Standard Industry Classification, the CAPM+ scale risk premium, technology commercialization risk premium, other capital costs, equity ratio, etc. corresponding to privately held start-up companies in the C29 industry category are obtained from the discount rate calculation table for each industry. The discount rate was obtained by applying the discount rate (WACC) calculation formula [=cost of equity × ratio of equity capital + cost of other capital × ratio of other capital × (1-corporate tax rate)].

The cost of equity is 16.72%, taking into account the CAPM+ scale risk premium of 11.62% and the technology commercialization risk of 5.10% associated with privately held start-ups in the C29 (Other Machinery and Equipment Manufacturing) industry category. Taking into account the equity ratio of 61.75%, the cost of capital before tax of 9.73%, and the corporate tax rate (including resident tax) of 13.74%, the discount rate was calculated as 13.53%.

<Table 3-50> Estimate of Discount Rate

Cost of equity (Ke)	CAPM+ Scale Premium	Technology Commercialization Risk Premium	Sum
	11.62%	5.10%	16.72%
Other Capital Costs (Kd)	9.73%	Average Corporate Tax Rate (t)	13.74%
Equity Ratio Ⓚ	61.75%	Other Capital Ratios	38.25%
WACC	Ke×Ks+ (Kd×(1-Ks))×(1-t) = 13.53%		

Source: Author

(3) Estimation of Cash Flow

Cash flow, which is cash that a company can use freely while maintaining or expanding its operating activities, is calculated by adding depreciation expense to its after-tax operating profit and deducting the increase or decrease in capital expenditure and working capital respectively. The sum of future cash flows over the economic life of the assessed technology was calculated to be KRW 1,631 million.

<Table 3-51> Estimation of Cash Flow

(Unit : Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Pre-tax operating profit (A)	-0.3	-11	7	90	177	281	318	346	295	232	158
Corporate tax expenses (B)	0	0	0	9	19	40	48	54	43	29	17
After-tax operating profit (C=A-B)	-0.3	-11	7	80	158	241	270	292	252	203	141
Depreciation expense, etc. (D)	0	12	12	16	30	44	34	35	35	35	35
Capital Expenditure (E)	8	50	3	26	118	121	5	8	16	18	21
Net driver bond increase and decrease (F)	0	1	30	142	165	192	43	47	-83	-101	-121
Return on Investment (G)	0	0	0	0	0	0	0	0	0	0	421
Cash flow (H=C+D-E-F+G)	-8.3	-51	-14	-71	-95	-28	255	271	354	321	697

Source: Author

2.3.2.6. IP Valuation

Technology valuation is carried out on the basis of income approach, market approach, cost approach, etc. to determine the appropriate technology fee or equity by calculating the economic value of the technology to be transferred or commercialized in monetary terms.

In general, the value of a technology or intangible asset is calculated using an income approach that valuates the economic benefits that are estimated to be generated during the content period of the asset in terms of the present value at the time of valuation, and the discount rate after estimating the economic benefits that will be incurred by commercialization of the technology during the economic life of the technology. A market approach-based royalty deduction method is utilized to estimate and valuate similar technical assets by using an income approach that is applied and converted to the present value, or by comparing the price of assets exchanged between buyers and sellers who voluntarily trade technical or intangible assets.

In view of the intent of the commercialization entity and the degree of refinement of the plan, this research will carry out value calculation using the income approach and the royalty deduction method in consultation with the commercialization entity and the valuation team.

2.3.2.6.1. Income Approach (DCF-based) (Extracted from an in-depth report)

The income approach focuses on the future economic profit-making capability of the target technology and is a method of converting future economic benefits to the present value, which requires estimations of the following: the future economic benefits of the target technology; the expected revenue period; capital spent; discount rate; costs; and the discount rate.

After calculating the business value of the technology using the income approach by the cash flow discount method, the final technology value is calculated by applying the technology contribution.

$V = \sum_{t=1}^{T} \frac{FCF_t}{(1+r)^t} \times T.F.$	V : technology value t : the period for which the cash flow estimate is made n : Estimated cash flow period taking into account the economic life of the technology CF_t : Cash flow for the period of t r : Discount rate Technology contribution (T.F) : The percentage of business value that technology contributes

(1) Estimation of Business Value

The business value of the technology to be assessed is calculated through the present value of the future spare cash flow, which means the net cash inflow after subtracting the total cash outflow from the total cash inflow generated by the operating activities, to obtain the cash that the company can freely use while maintaining or expanding its operating activities. Margin cash flow is estimated by preparing and analyzing estimated financial statements, such as an estimated income statement and an estimated financial position statement, for a certain period of time in the future, or taking into account the growth rate of revenue, operating margin of revenue, corporate tax rate, working capital investment, and tangible fixed asset investment, which are essential for estimating the margin cash flow. According to the ‘Technical Valuation Practice Guide’, the margin cash flow can be estimated as follows:

Cash Flow = After-tax operating profit (Sales - Cost of sales - Fees - Corporate tax)
+ Depreciation - Capital expenditures - Increased and decreased working capitals

The estimated business valuation amount for the technology to be valuated, based on the valuation reference date of November 1, 2021, is shown in the table below, with a period of 10.17 years from November 2021 to November 2021. The financial ratio was applied to the financial ratio of the corresponding industry code.

<Table 3-52> Business Value Analysis

(Unit : Million Won)

Category	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Pre-tax operating profit (A)	-0.3	-11	7	90	177	281	318	346	295	232	158
Corporate tax expenses (B)	0	0	0	9	19	40	48	54	43	29	17
After-tax operating profit (C=A-B)	-0.3	-11	7	80	158	241	270	292	252	203	141
Depreciation expense, etc. (D)	0	12	12	16	30	44	34	35	35	35	35
Capital expenditure (E)	8	50	3	26	118	121	5	8	16	18	21
Net driver bond increase and decrease (F)	0	1	30	142	165	192	43	47	-83	-101	-121
Return on Investment (G)	-	-	-	-	0	0	0	0	0	0	421
Cash flow (H=C+D-E-F+G)	-8.3	-51	-14	-71	-95	-28	255	271	354	321	697
String coefficient (I)	0.9791	0.8623	0.7595	0.6690	0.5892	0.5190	0.4571	0.4026	0.3546	0.3124	0.2751
Present value of margin cash flow (J=H×I)	-8.3	-44	-11	-47	-56	-14	117	109	126	100	192
Business value (K) (K=∑J)	463	-	-	-	-	-	-	-	-	-	-

Notes: 1) Valuation Date: November 1, 2021.
2) The current price calculation applies to the year 0.17 in 2021.

As a result of the valuation, the cash flow and recovery of investment (the amount of the working capital recovered and the total amortization after the estimated period) arising from operating activities for the cash flow estimation period from November 2021 to December 2031 are discounted to a risk-adjusted discount rate of 13.53%. The total present value of cash flow was estimated at KRW 463 million. The multiplier of the discount rate was applied as of November 1, 2021.

(2) Determination of Technical Contribution

A. The Concept of Technical Contribution

The term 'technical contribution' refers to the extent to which the target technology has contributed to revenue generation or cost savings. Technical contribution can be calculated by applying the experience side (25% rule), the technology element law, and the like. In this assessment, it was estimated by applying the Technology Element Law that can simultaneously reflect the characteristics of the industry and the characteristics of the individual technologies. According to the Technology Factors Act, technology contribution pertains to the relative proportion of tangible and intangible assets contributed to the net present value of future cash flows by technology assets (or technology elements). Technology value is created on the premise of technology commercialization, and is obtained by first estimating the future business value expected to be generated by technology commercialization, and then multiplying with the technology contribution factor.

B. Method for Estimation of Technical Contribution Based on Technical Factors

The measurement of technical contribution based on the Technology Element Act consists of deriving industrial technology elements to identify industry characteristics and deriving individual technical strengths to identify the characteristics of individual technologies, and is obtained by the following formula:

Technology Contributions
= Industry Factor (%) × Technology Rating × Technology Rating

The industrial technology element = The maximum realized intangible asset value ratio × The average technology asset ratio

• Maximum realization of intangible asset value ratio	= Intangible asset value / [Corporate market value (Market capitalization) + Total liabilities]
• Average technical asset ratio	= R&D Expenses / (R&D expenses+ Advertising fees + Education and training fees)
• Intangible asset value	= Corporate market value (Market capitalization) – Net asset value
• Net asset value	= Total assets - Total liabilities

Individual technical strength is estimated through technical performance and business performance valuation indicators.

1) Determination of Industrial Technology Factors and Individual Technology Strength

a. Determination of Industrial Technology Factors

Industrial technology elements can be calculated by multiplying the maximum proportion of intangible assets contributing to corporate value within the industry with the proportion of intangible assets contributed to technological assets. Since it is difficult to calculate the value of intangible assets directly, it was calculated by subtracting the net asset value (book value of equity capital + book value of debt) from the market capitalization, which is the total corporate value observed in the capital market. The ratio of technology assets is assumed to be composed of technology elements, market elements, and human factors, and was calculated using the costs of R&D, advertising, and education and training among sales and management costs of KOSDAQ and KOSPI-listed companies.

Industrial technology elements analyzed corporate financial data over the past 10 years (2010~2019) for KOSDAQ and KOSPI-listed companies, and then targeted companies with the top 5% intangible asset value by industry, except for cases where the intangible asset value is negative (-). A total 71.68% of the industrial technology elements of the technology to be evaluated corresponding to “C29 (Other Machinery and Equipment Manufacturing)” were applied.

<Table 3-53> Industrial Technology Elements of the Technology to be Valuated

Standard Industry Classification		Maximum Intangible Assets Value Ratio	Specific Gravity of Technical Assets	Industrial Technology Element
C29	Other machinery and equipment manufacturing industry	74.35%	96.41%	71.68%

Source: Ministry of Industry, Trade and Resources (2020).

b. Valuation of Individual Skill Strength

In the method of measuring the contribution of technology based on the Technology Element Act, the characteristics of the industry are reflected in the industrial technology elements, and the technical and business characteristics of the individual technologies are reflected in the individual technical strengths. Therefore, the assessment of individual technology strength valuates the level of the target technology relative to the industry average technology assets. If the target technology is at a lower level of technical performance and marketability than the industry average technology asset, a value lower than 1 is derived, and the maximum value can be valuated at the level of the industry average for technology assets.

The individual technical strength valuation indicators, which consist of 10 items of technical characteristics and 10 items of business, are used to valuate the technical superiority, entitlement, and commercial potential in the commercialization process of the technology to be valuated, and to assess the extent to which the technology contributes to the creation of business value in the process of commercialization.

Individual skill strength (%) = Total technical score + Business performance score total

The individual skill strength was valuated on a 5-point scale for each valuation indicator. After the investigation and analysis of the technology to be valuated was completed, detailed discussions were carried out with each of the participants in each assessment, and the valuation was carried out on a combined basis. The result was rated at 63 points.

i) Technical Characteristics

① Innovativeness

The assessment of innovativeness divides the technology into grades of Revolutionary, Major Improvement, Minor Improvement (usually an improvement technology), etc., according to the degree of technological innovation, and valuates the expected level of production if the technology were applied to the product. The technology to be valuated is a partial improvement of the existing technology, and innovativeness is judged to be insufficient. The personal portable descent device using alpha technology introduces an improvement in the descent speed control of the frictional stubble using the brake drum, and is a partial improvement of the existing technology.

② Differentiation

Differentiation is analyzed in terms of the business superiority of the technology (competitiveness of the technological product) compared to similar or competitive technologies, based on the characteristics of the differentiation (price premium, quality, ease of use, etc.). It assesses whether those characteristics have a business advantage. The technology to be valuated resolves the problems of controlling the descent speed and improving the ease of use offered by the existing descending life line. Since the function and performance are similar compared to the competing technology, it is difficult to consider the discriminatory properties to be strong, and the differentiation is judged to be at a normal level.

③ Potential for Replacement

The potential for substitution is analyzed to valuate the competitive nature of the technology by assessing the existence and emergence of a competitive (similar) technology that can replace the technology to be valuated. The technology to be valuated uses a method of braking in the descent period using the installation of magnetic components, and given the possibility that another innovative technology will be developed, it is highly likely that an alternative technology will emerge in the next 3 years.

④ Usability

Assessment of utilization is the valuation whether it is a technology that provides economic benefits to the business strategy of the entity that introduced the technology (product) to be valuated or how important it is to maintain the current business strategy. The technology to be valuated is a peripheral (composition) technology using a contact-type magnetic rotational brake and its usefulness to the business entity is judged at the usual level.

⑤ Ripple Effects

The assessment of ramifications is carried out to examine the markets and products to which the technology to be valuated can be applied at the moment, and to analyze the potential (breadth and depth of the technology) of the valuated technology to be extended to other products and markets in the future. Since the technology to be valuated is likely to be specialized only in descent devices such as lifesaving devices or goods transfer devices, the possibility of its application to other products and markets is judged to be low.

⑥ Possibility of Obsolescence (Technical lifespan)

The possibility of obsolescence is about how the technology can become obsolete, what the reasons are, and when the cliché will proceed. The obsolescence of the target technology or application has a negative impact in terms of value. As a result of valuating the obsolescence of the technology according to the criteria set forth in the distribution of the Q2 value in the TCT index, the median TCT A62B (apparatus, apparatus or method for lifesaving) of the valuated technology is 10 years, and the probability of technical obsolescence is judged to be low.

⑦ Difficulty of Imitation

The difficulty of imitation is about whether the device can only be developed by the technology holder due to the high level of technical complexity, or whether it is easy to imitate the technology, whether there is a possibility of imitation using external public data or through reverse engineering of the released product. The assessment is carried out to valuate the possibilities of imitation products reaching the market, etc. Although the patent for the valuation of the technology has not yet been published, it is judged that the complexity of the technology is not high, and it will be relatively easy to imitate for a research developer in the same industry.

⑧ Strength of the Protection of Rights

By assessing whether the scope of rights is clear and wide, and analyzing the strength of protection of the claim scope, the patent to be valuated is judged to have a moderate level of scope of rights because the scope of rights is structured to the extent that it can protect only the main functions and products of the core production line. After examining whether there are components that are limited to the claim or whether the technical core components are mentioned in the claim, the technology to be valuated is judged to have a level at which the claim protects only the key functions and products of the core production line in the field of technology to which the patent belongs.

⑨ Stability of Rights

Valuation of the stability of a right is performed to analyze the likelihood that a registered right will remain stable without being invalidated (taking into account the possibility of filing an invalid judgment, the results of investigations into prior work, etc.) The patents to be valuated are analyzed as having some similarities with the prior literature on comparable technologies and as well as differentiations, so it is unlikely that the patent rights will be invalidated by the prior documents. In addition, since it can be maintained through the reduction of the scope of claims, the stability of the rights is judged to be at a moderate level.

⑩ Ease of Identification and Proof of Infringement

Identification and verification of infringement pertain to the determination and valuation of how easy it is to identify patent infringement and how much efforts and expenses are required to prove patent infringement. Since infringement on the technology to be valuated can be detected and proved through precise experimentation or investigation, the ease of infringement detection and verification is judged to be moderate.

<Table 3-54> Technological Scoring

Valuation Items	Scoring					Score
	Very bad	Bad	Moderate	Good	Very good	
Innovation	1	2	3	4	5	2
Differentiation	1	2	3	4	5	3
Potential for replacement	1	2	3	4	5	2
Usability	1	2	3	4	5	3
Ripple effect	1	2	3	4	5	2
Obsolescence	1	2	3	4	5	4
Difficulty of imitation	1	2	3	4	5	2
Strength of rights protection	1	2	3	4	5	3
Rights stability	1	2	3	4	5	3
Ease of identification and verification of infringement	1	2	3	4	5	3
27 points						

ii) Business Characteristics

① Possibility of Entering the Market

The possibility of entering the market depends on factors such as barriers that make it difficult to enter a new market (barrier to entry), the presence of a market-leading company, the differentiation factor of the product based on the technology to be valuated, the robustness of the competitors' distribution network, the size of the capital required, and the law· It is used to analyze and valuate institutional obstacles.

In order to enter the relevant market, it is essential to obtain the recognition of the type approval (KFI) for fire-fighting supplies from a reliable organization, and the distribution network of existing competitors acts as a barrier to entry, so the possibility of entering the market is judged to be at a moderate level.

② Demand Sensitivity

A comprehensive assessment of demand sensitivity is used to understand how sensitive the demand for a target product is to economic fluctuations, price, quality, design, etc. The technology to be valuated is used for emergency escape in the event of a fire in a multi-story building, and evacuation equipment is installed and maintained in furnace facilities (1st to

10th floor), multi-use businesses (2nd to 4th floor), etc. · It is stipulated to be managed, and the demand sensitivity is judged to be low.

③ Expected Market Share

The expected market share is assessed taking into account the number of competitors in the market, the competitive situation, the competitiveness of the target technology product, and the commercialization capability of the business entity, etc.. It is valuated through the maximum market share that the target technology product can occupy in the target market during the cash flow estimation period. The technology to be valuated can also be applied to buildings with more than 11 floors, and considering that the existing descending life line market is divided by 14 companies, it is believed that the expected market share at the time of market entry will be about halfway through the target market.

④ Preparation Period for Commercialization

The required time for commercialization is calculated to determine the additional time required to develop the technology and reach the stage of full commercialization. The technology to be valuated requires product improvement through safety certification and fair valuation, so a preparation period of less than 6 months to 1 year is required for the commercialization of the technology.

⑤ Capital Required for Commercialization

The amount of capital required for commercialization is calculated to determine the amount of capital required to implement the technology. After the introduction of semi-automated facilities for the commercialization of the technology to be valuated, the company's plan to introduce automation facilities from 2024 is expected to take about 2.1 billion Won, and the amount of capital investment expected to be spent on the commercialization of the technology is judged to be at the normal level.

⑥ Ease of Production

Ease of production is assessed by taking into account matters related to production activities (availability of production personnel, stability of material and component prices, supply and demand stability, number of suppliers, procurement speed, logistics costs, etc.). The raw materials for the production of the valuated technology, such as gears, bobbins, brake drums, wire rollers, wires, bearings, magnetic weights, etc., have 4 items related to ease of production in that the distribution structure is clear, multiple suppliers exist, and the items can be procured quickly and at low logistics cost. It is satisfactory and the ease of production is judged to be excellent.

⑦ Economic Lifespan

Valuation of economic longevity is an assessment of the economic lifespan of a technology product to determine its business feasibility. The economic lifespan of the technology to be valuated is expected to be 9.5 years in the medium to long term, taking into account the economic lifespan of individual technologies based on the TCT index.

⑧ Trend of Sales Growth

Revenue growth trends are valuated by comparing the average annual sales growth rate during the cash flow estimation period of the target technology product with the average annual sales growth rate of the industry for the last 3 years. The average annual revenue growth rate during the estimated cash flow period of the assessed technology is expected to be more than three times higher than the peer (C291) average (2017-2019) (3.36%) considering the product life cycle.

⑨ Profitability

Operating profit is derived by the deduction of sales (manufacturing) costs and commission costs from sales, and is an indicator that has no business value if there is no margin, no matter how high the sales volumes are. The operating profit margin of the assessed technology estimated in this assessment is 11.43%, which is expected to be more than 20% higher than the industry (C291) average (2017-2019) (5.97%).

⑩ Derivative Sales

Derivative revenue is to be assessed by the extent to which the generation of derivative revenue in other industries will be attributed to the positive impact associated with the introduction or use of the technology to be valuated. The technology to be valuated can be applied to a goods transfer device in addition to a lifesaving device, and since there is a possibility of derivative sales in 1 industry, the possibility of derivative sales is judged to be low.

<Table 3-55> Business Feasibility Scoring

Valuation Items	Scoring					Score
	Very bad	Bad	Moderate	Good	Very good	
Market entry potential	1	2	3	4	5	3
Demand sensitivity	1	2	3	4	5	4
Expected market share	1	2	3	4	5	3
Preparation period for commercialization	1	2	3	4	5	3
Commercialization capital	1	2	3	4	5	3
Ease of production	1	2	3	4	5	4
Economic lifespan	1	2	3	4	5	4
Revenue growth trend	1	2	3	4	5	5
Profitability	1	2	3	4	5	5
Derivative sales	1	2	3	4	5	2
36 points						

The proportion of technology (the share of intellectual property protection) value refers to the proportion of the total product (or service) that is used to estimate the turnover to be protected by intellectual property rights such as patents. The details of the technology that makes up the entire product are classified and the proportion is calculated through the proportion of costs, the proportion of purchasing factors for consumers, and the qualitative valuation of experts.

By applying the Entire Market Value Rule used for patent litigation in U.S., if a technology protected by the subject intellectual property is determined to be the basis of a consumer's purchasing factor, or is considered to create real value for a product, the proportion of the technology may be reflected as 100%. In this assessment, the proportion of the technology was determined to be at the level of 66.0% by the consensus of experts, as shown in the table below.

<Table 3-56> Technology Proportion of Technologies to be Valuated

Classification	Ratio (A)	Sub-classification	Ratio (B)	Protected	A*B
Manufacturing Device Technology	40%	Bobbin	20%	1	8.0%
		Brake drum	25%	1	10.0%
		Magnetic churn	15%	1	6.0%
		Wire	15%	1	6.0%
		Drive gear	15%	0	0.0%
		Operating lever	10%	0	0.0%
		Subtotal			30.0%
Performance Maximization Techniques	60%	Descent speed control technology	40%	1	24.0%
		Anti-tilt technology	20%	1	12.0%
		Easy installation technology	20%	0	0.0%
		Friction heat dissipation technology	20%	0	0.0%
		Subtotal			36.0%
The weight of technology					66.0%

iii) Calculate Technical Contribution

As the industrial technology element corresponding to the “C29 (Other Machinery and Equipment Manufacturing)” industry based on the standard industry classification is 71.68%, and the individual technical strength finally calculated through the valuation of technical and business ability is rated at 63 points, the contribution of the technology to be valuated is 45.16%. In addition, the proportion of technology contribution (66.00%) in the target product was further applied, and the final technical contribution was calculated as 29.80%.

<Table 3-57> Calculation of Technical Contributions

Industrial technology factors (%)	71.68%
Individual skill strength (points)	63 points
The weight of technology	66.00%
Final technology contribution (%)	Industrial technology factors × Individual technology strength × The proportion of technology 29.80% = 71.68% × 63 points × 66.00%

(3) Calculation of Technical Value

The amount of technology value taking into account the technology contribution was calculated as 138 million won for the business value of KRW 463 million, which is the sum of the present value of the margin cash flow, multiplied by the technical contribution of 29.80%. Accordingly, the technology value was calculated as KRW 138 million.

<Table 3-58> Technology Value by DCF-based Income Approach

Technology Value Calculation	$V = \sum_{t=1}^{T} \frac{FCF_t}{(1+r)^t} \times T.F.$
Business Value	463 million won
Technical Contributions	29.80%
Technology Value	138 million won

2.3.2.6.2. Relief from Royalty (RR) (Extracted from an in-depth report)

(1) Valuation Procedure Using the RR Method

The RR is a method of estimating the royalty payments that would have to be paid if the technology license was acquired from a 3rd party, and converting them to the present value by estimating the royalty payments that could be saved by the technology owner. In order to use the RR method there must be a large quantity of comparable technical transaction royalty data in the technology trading market, and if the comparable technical transaction royalty data is insufficient, royalty statistics by industry or the trade practice law royalty statistics can be used.

The Value of Technology = $\Sigma_{t=1}^{n} \frac{Sales(t) \times RR \times PT \times AC \times P \times (1 - tax\,rate)}{(1+r)^t}$

- n: Estimated cash flow period taking into account the economic life of the target technology
- t: t year
- r: Discount rate
- RR(Baseline Royalty Rate): The median (or average) of the similar-case royalty rate or industry-specific royalty rate statistics.
- PT(Proportion of Technology): The proportion of the target technology among the total technologies that make up the target technology product (service)
- AC(Adjustment Coefficient): A coefficient for adjusting the reference royalty rate based on the valuation of the factors impacting the increase and decrease of the royalty rate
- P(Pioneering rate): Adequate level of commercialization (Commercialization costs (0-100%))

The value of a technology under the RR method can be calculated by multiplying the turnover by the royalty rate of the comparative technology, and then discounting it to the present value, which can be calculated by adjusting the difference between the comparable technology and the technology to be valuated.

(2) Determination of the Applicable Royalty Rate

A. Standard Royalty Rate

The Relief from Royalty method includes the Royalty Payments Saved method, which calculates the value of the technology by determining the appropriate royalty rate of the technology to be valuated through cases of similar technology asset transactions (licensing), and the Rule of Thumb is to distribute the profits contributed by the patented technology between the parties. Another approach is based on the Value by a Profit Split method that calculates the value of a technology by determining the royalty rate. In this assessment, the Royalty Payments Saved method was applied to calculate the value of the technology.

In this assessment, the standard royalty range for the technology to be valuated was determined using the trade case royalty statistics for each industry presented in the Technology Valuation Practice Guide. Since the industry of the technology to be valuated corresponds to C29 (other machinery and equipment manufacturing), the median is 3.00%, and the lower limit (Q1) and upper limit (Q3) are 2.00% and 5.00%, respectively.

<Table 3-59> Royalty Statistics for Trading Cases of Large Commercial Category (C29)

(Unit: Gun, %)

Category	Number of Sources	Q1	median	Q3
C29 (Other Machinery and Equipment Manufacturing)	109	2.00	3.00	5.00

Source: Ministry of Industry, Trade and Resources (2020).

B. The Weight of Technology

The share of technology refers to the proportion of the total product (or service) used to estimate the turnover that is protected by intellectual property rights such as patents. By classifying the detailed technologies that make up the entire product, the proportion of the cost ratio, the proportion of the consumer's purchasing factors, and the qualitative valuation of the expert can be calculated. By applying the Entire Market Value Rule used for patent litigations in U.S., if the technology protected by the subject intellectual property is determined to be the basis for the consumer's purchasing factor or if the subject technology is assessed to create substantial value for the product, the proportion of the technology may be reflected as 100%. Since the technology to be valuated may also be some of the technologies that make up the target product, it is necessary to take into account the cost ratio or economic contribution of the technology to be valuated. The proportion of the technology to be valuated among the total detailed technologies constituting the target product using the valuated technology was determined to be 66.00%.

C. Adjustment Coefficient

Adjustment coefficient is intended to adjust the reference royalty rate considering factors that may affect the target technology and the reference royalty rate. That is, the adjustment coefficient refers to the adjustment rate that causes the reference royalty rate to increase or decrease. Adjustment Coefficient calculates the adjustment ratio through scoring based on a rating valuation model for key items that may affect the royalty rate from the perspectives of technicality, entitlement, marketability, and business. In order to determine a reasonable royalty rate, an additional valuation of the adjustment coefficient was carried out.

<Table 3-60> Adjustment Coefficient Calculation Table

Category		Influence Factors	Score				
			-2	-1	0	1	2
Technical skills	Usefulness of the technology	Innovation		●			
		Usability			●		
	Competitiveness of the technology	Differentiation			●		
		Technology competition strength		●			
		Potential for replacement		●			
		Difficulty of imitation		●			
Entitlement	Stability of rights	Rights stability			●		
	Broadening-narrowing of the scope of rights	Strength of rights protection			●		
	Fidelity of rights	Detection of infringement and ease of admission			●		

<Table 3-60> Continued

Category	Influence Factors	Score				
		-2	-1	0	1	2
Marketability/Business feasibility	Strength of market competition			●		
	Demand sensitivity			●		
	Expected market share		●			
	Commercialization capital		●			
	Revenue growth trend				●	
	profitability				●	
Sum	Subtotal (item)	0	4	8	1	2
	Subtotal (Score)	0	4	0	1	4
	Amount	1				
Adjustment Coefficient		1.03=1+(1/30)				

D. Pioneering Rate

Pioneering rate is an indicator that takes into account the impact the level of cost or investment size in the process of commercializing a target technology has on the royalty rate. Even if the amount of funds required is large, if the business entity can afford it, the pioneering rate can be calculated as 100%. The pioneering rate can be adjusted in the range of 50% to 100% in the event of requiring a huge cost for commercialization or a special situation in which marketing, dissemination, etc. are costly.

Since an investment of about 2.1 billion won is required for the development of the technology products to be valuated and the construction of mass production facilities, and a small amount of funds are required for safety certification and promotion for marketing, which are at a level that the business entity can afford, the pioneering rate was estimated to be 100%.

E. Estimate the Final Royalty Rate

Based on the standard industry classification, the target technology corresponds to C29 (manufacturing of electronic components, computer, video, sound and communication equipment), and the median royalty rate is based on 3.00% in the scope of the transaction case royalty, the proportion of technology is 66.00%, the adjustment coefficient is 1.03 points, and the pioneering rate is 100%. The final royalty estimate obtained by applying 100.00% was 2.05%.

<Table 3-61> Estimating the Final Royalty Rate

Baseline Royalty Rate	3.00%
Technology Ratio	66.00%
Adjustment Coefficient	1.03 points
Pioneering Rate	100.00%
Final Royalty Rate	2.05%(=3.00% × 66.00% × 1.03 × 100.00%)

(3) Calculation of Technical Value

A. Royalty Income

Royalty income was calculated by multiplying the sales of the target product by a reasonable royalty ratio.

<Table 3-62> Royalty Income Calculation

(Unit: Million Won)

Contents	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Sales	0	5	144	806	1,574	2,469	2,671	2,889	2,501	2,029	1,463
Royalty coverage rate	2.05%										
Royalty income	0	0	3	16	32	51	55	59	51	42	30

B. Corporate Tax

The corporate tax rate applied the same criteria as the DCF-based income method. After-tax royalty income was calculated by subtracting corporate taxes from royalty income.

C. Calculate the Discount Rate

The discount rate was calculated by the same as DCF method. In other words, the industry-specific discount rate calculation table presented in the Technology Valuation Practice Guide was used, and the technology commercialization risk premium applied the same value. However, in the case of the effective corporate tax rate, since the corporate tax calculated is different from the tax obtained when the profit approach was used, the discount rate was reclaimed as follows. The results of the discount rate estimation are shown in the table below.

<Table 3-63> Discount Rate for RR Model

Cost of equity	CAPM+ Scale Premium	Technology Commercialization Risk Premium	Sum
	11.62%	5.10%	16.72%
Other capital costs	9.73%	Average Corporate Tax Rate	11.00%
Equity ratio	61.75%	Other Capital Ratios	38.25%
WACC	Ke×Ks+ (Kd×(1-Ks))×(1-t) = 13.64%		

Source: Author

D. Estimation of Technology Value

The final royalty rate of 2.05%, the effective corporate tax rate was applied, and the discount rate was 13.64% for the category of 'Other Machinery and Equipment Manufacturing (C29)'. Thus, the valuation under the RR method was calculated at KRW 130 million.

<Table 3-64> Valuation Result of RR Model

Contents	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Turnover (A)	0	5	144	806	1,574	2,469	2,671	2,889	2,501	2,029	1,463
Royalty coverage rate (B)	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%	2.05%
Royalty income (C) (=A×B)	0	0	3	16	32	51	55	59	51	42	30
Corporate taxes, etc. (D)	0	0	0	2	4	6	6	7	6	5	3
After-tax royalty income (E) (=C-D)	0	0	3	15	29	45	49	53	46	37	27
String coefficient (F)	0.9789	0.8614	0.7581	0.6671	0.5870	0.5166	0.4546	0.4000	0.3520	0.3098	0.2726
Present value (G) (G=E×F)	0	0	2	10	17	23	22	21	16	11	7

Notes: 1) Valuation Date: November 1, 2021.
2) The current price calculation applies to the year 0.17 in 2021.

2.3.2.6.3. Valuation Results (Extracted from an in-depth report)

The technology to be valuated relates to a personal portable descent device using alpha technology, and is planned to be commercialized as a descent device for fire escape in high-rise buildings.

At present, in the case of the fire escape descending life line technology, there are few products that can be used on the 11th floor and above, the user's descent speed is not slowed down to a safe level, it is not easy for beginners or children to use, and the descent speed is not controlled in the event of wear and tear of the brake drum and brake pads. There is a problem that it cannot incorporate fixtures that improve safety and convenience, and the demand for descending life lines that can be applied to high-rise buildings is high.

The technology to be valuated is applied to a product that can be used to descend safely. Furthermore, it is easy to control the descent speed, easy for beginners and children to use, offers cost reduction compared to the existing descending life line, etc., thus ensuring quality and price competitiveness. In addition, the technology can be used for the 11th floor where it is difficult to use the existing descending life line. It is believed that it can also be used in taller buildings, so that it can expand its market entry and market share while replacing the existing descending life line and creating new demand based on buildings with more than 11 floors. Therefore, the feasibility of promoting the business is valuated as high.

In the assessment, the value of the technology was calculated by the income approach and the royalty deduction method. The income approach was estimated based on the technology contribution, and the royalty deduction method was estimated by multiplying the value calculated by the royalty reduction method with the adjustment coefficient. The results of calculating the technical value according to the above method can finally be summarized as follows.

<Table 3-65> Valuation Results of DCF and RR Models

How to Valuate	Technology Value Estimate
DCF	138 million won
RR	130 million won

The valuation result based on the income approach was 138 million won, and the result of the royalty deduction was estimated at 130 million won. In conclusion, the market value of the patents to be valuated was estimated to have a value between KRW 130 million and KRW 138 million.

The results of the valuation are aimed for application in the descent market among the domestic evacuation organizations, and are made under the appropriate assumptions of the business owner's business plan and the relevant market share. It should be noted that if the prerequisites and conditions vary, the technology value is likely to be adjusted.

3. Implications for IP Valuation in ASEAN Member States[8]

3.1. Current Status of IP Valuation in ASEAN Countries

Understanding the current status of IP management and valuation in ASEAN member states should be based on an analysis to derive implications for the development of IP valuation models and related systems in ASEAN countries.

Through collaboration with local experts, the local situation regarding intellectual properties in ASEAN member states was identified and related information was collected. More specifically, local consultants were requested to gather and share information on ASEAN member states' IP management and valuation status (i.e., status of IP management and IP management systems, IP valuation models, valuation purpose, valuation usage status, development status of (e)valuation-related systems, etc.). In addition, they were requested to investigate the government policy related to IP valuation in the ASEAN member states and the direction of IP related support for SMEs.

3.1.1. Malaysia

Currently, MyIPO (The Intellectual Property Corporation of Malaysia) is involved in capacity development for IP personnel in Malaysia. The IP Academy of MyIPO and the Business Development Division of MyIPO have developed several training programs to improve the management of IP in the government and private sector.

The IPVM (IP valuation model) mainly uses the income approach and uses the market approach for cross-check.

In general, the Relief from Royalty (RR) technique is chosen to be used among other techniques of the income approach. The RR approach determines the present value of the IP by applying a market royalty rate to a projected future income stream, which is the hypothetical relief that the business is relieved from paying because it owns the IP.

By producing the income projections of the particular IP, calculating the Weighted Average Cost of Capital (WACC) of companies in the same technology, considering the royalty rate, the terminal growth rate and also the future tax rate, a Discounted Cash Flow valuation model is generated and the Net Present Value (NPV) is calculated based on all of

8 Myanmar and Brunei were omitted from the report due to the lack of relevant information and response from the countries.

the assumptions. The NPV is considered the value of the IP on the date of valuation.

With regard to the “Web-based Valuation Systems”, currently there is no such web-based system available in Malaysia. Currently, the IP valuation reports are being used for various purposes such as technology licensing, calculating damages, outright sale of IP and also for merger and acquisition of companies. Furthermore, external sources/databases are being used to obtain the royalty rates and deal values. As for the royalty rates, databases such as Royalty Source, ktMine and RoyaltyStat are being used. Furthermore, S&P Capital IQ database and also Refinitiv Eikon (Thomson Eikon) are being used for the financial information.

3.1.2. Philippines

There are only a couple of online databases that are available to the public. One is the patent search database where inventors can register their patents and also allow other stakeholders to check if patents for certain technologies have been granted already. The second is the IP Depot, a digital platform that IP owners can utilize to promote their registered IP assets. Both databases do not have requirements to disclose information on the valuation of the IPs concerned.

The DOST-TAPI also has a database of valuation reports and fairness opinions reports, though this is neither online nor available to the public. The database has information on the minimum/maximum value of IPs, royalty rates, upfront fee, etc.

DOST-TAPI has an offline and online database, (System for IP Applications and Grants) SIPAG and iSIPAG, respectively. The SIPAG is an offline tool for managing, evaluating, and monitoring granted and filed IPs. On the other hand, the iSIPAG is the online version of the SIPAG that enables clients to access and monitor IP applications easily. (http://www.tapi.dost.gov.ph/news/64-dost-tapi-culminates-technology-transfer-and-commercialization-projects).

An appropriate valuation approach is selected depending on the type and the stage of development of the IP asset that is being valued. Usually, if the IP is ready for commercialization or is generating cash flows, the Discounted Cash Flow (DCF) approach is used. Often, the Relief from Royalty (RR) method is used particularly when valuing trademarks and brands. The Multi-period Excess Earnings Method (MEEM) is also used if sufficient information is available.

Cross-checks such as the market and cost approaches are also used though usually not as primary approaches.

The IP Valuation Manual prepared by DOST-TAPI aims to facilitate the preparation of fairness opinion reports, which is a crucial element in technology commercialization. However, the manual was originally developed as part of rendering thesis opinion to be used by the Fairness Opinion Board and not intended for recommendation. (Source: Preface to the IP Valuation Manual of DOST-TAPI).

Common users of IP valuation reports include:

- Investors like PEs, VCs and other investors;
- Financiers/funders like banks and other financial institutions;
- Lawyers to assess IP infringement damages;
- Regulatory agencies particularly the DOST-TAPI (for funding purposes as well), the Bureau of Internal Revenue (BIR), the PSE and the SEC.

While the TAPI has allocated 12% of its annual operations fund to assist inventors in the initial experiments and prototype development, there is no funding specifically to assist inventors in the implementation of IP valuation. However, DOST-TAPI can assist inventors in approaching Government Financial Institutions (GFI) to raise funds for the venture where "ownership of a valid IP" is one of the requirements. According to DOST-TAPI, banks are no longer extending loans with IP as collateral. In this situation, the inventor will have to obtain a fairness opinion supported by an IP valuation report to be submitted to the GFI. The DOST-TAPI convenes the independent third party experts, which usually include (1) IP expert or IP lawyer, (2) expert in finance and (3) industry or technical expert.

Both the DOST-TAPI and IPOPHL conduct capacity building activities related to IP valuation:

- DOST-TAPI
  - Published an article mentioning its recent activities in 2019 for the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development, and in 2020 for the Philippine Council for Industry, Energy, and Emerging Technology Research and Development and the DOST NCR office (14 July 2021)
  - Hosted a knowledge-sharing webinar on IP Valuation on 26 July 2021, discussing topics on IP rights, freedom-to-operate, IP valuation, and valuation methods (17 July 2021)

- IPOPHL
  - In 2020, IPOPHL invited guest speakers and conducted the Licensing, Audit, and Valuation IP 101 seminar series for business and IP owners.
  - There are regular webinars/training sessions conducted by the IPOPHL such as:
    - Beyond IP Master Course, which includes a session on IP Valuation: Theory and Practice on Valuing IP Assets
    - IP Academy – WIPO-IPOPHL Summer School
  - The IP Academy will hold an upcoming seminar in July 2022 on Intellectual Property, and Technology Laws and Monetization of IP Assets and IP Valuation Techniques will be part of the curriculum.

Qualitative assessment like the Likert scale is not commonly used in the Philippines. However, CPVAs from IPOPHL and DOST-TAPI use the Patent Valuation Gauntlet (PVG) published by the Business Development Academy. The major components of the gauntlet can be found in Attachment 14 (http://www.patentvaluationgauntlet.com/toc.php). This qualitative assessment of the IP is used by the valuation analyst as a guide when valuing IPs, particularly patents. The PVG discusses patent issues/questions such as the length of patent claims or existence of prior work, which are being assessed by the analyst to determine whether to discount or add a premium to the patent's value.

3.1.3. Thailand

The Thai Department of Intellectual Property (DIP) has established IP management tools, specifically, IP registration and enforcement databases on trademarks, copyrights, patents, and petty patents. Additionally, the Thai Intellectual Property and International Trade Court (IP&IT Court) has litigation case databases containing information on IP- and IT-related cases and court proceedings.

Currently, there is no specific IP valuation database available to the public. However, there is a database for security contracts that is updated manually by the DBD. This database is used when utilizing IP assets as collateral for obtaining loans. Currently, there are only four security contracts using IP assets as collateral. However, such database does not contain specific information about IP valuation.[9]

According to the DIP's Guidelines on IP Valuation, both quantitative and qualitative analysis approaches are used as part of IP evaluation models.[10] Quantitative IP valuation

9 Interview with the officer of the Department of Business Development, May 2022.

10 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

involves three main approaches, which are the cost approach, the market approach and the income approach. The DIP's Guidelines indicate that determining the value of an IP asset based on the initial costs of acquiring the IP asset may only be suitable for the early stages of the development of such IP. Although the quantitative approach is simpler compared to other valuation approaches, the final value obtained from this type of analysis carries the risk of not always being indicative of an IP asset's actual current value.[11]

The DIP deems the market approach method to be rather complex given the differences in the nature of each type of IP asset. In addition, as IP subject matter and related information tend to be confidential in nature, there is a lack of disclosure of the specific details of such IP asset, which causes difficulties when seeking to compare IP assets on the market, especially for IP assets that are considered to be part of a 'niche market'. Therefore, the market approach method is not commonly used in IP valuation.[12]

Lastly, under the income approach, the fair value of an IP asset is measured through an analysis of the royalty rates charged by third parties for the use of similar IP assets. Since the entity already owns the IP assets the entity is relieved from having to pay a royalty to a third party for the use of the IP assets. The DIP is of the view that this method can be used commonly in business valuations since the value reflects the benefits and results of the IP asset, rather than the initial costs of acquiring such IP. Since the information used to conduct a valuation is comprised of mainly business data, this method is considered to be simpler than other methods. However, the DIP's Guidelines recommend that the valuation should be based upon the income's net present value to mitigate any potential risks of rate fluctuation and financial costs that may arise in the future.[13]

On the contrary, qualitative IP valuation involves the analysis of IP factors that affect the value of an IP asset. As a result, a score or level is provided to indicate the value of such IP. This method is useful in that the score provided may be used to compare and contrast the IP to be valuated with other types of IPs.[14] According to the DIP's Guidelines, a valuer conducting a valuation under this approach must assess how the IP fulfills factors that need to be considered for such IP and indicate the assessment results and ways by which the IP can be improved as part of the qualitative evaluation. The DIP's Guidelines also indicate factors that a valuer must take into account, for example, whether:

- The IP is novel or new, or has been developed from an existing IP

11 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

12 ibid.

13 ibid.

14 Thailand Development Research Institute, "Report on IP Valuation Program," 2017.03.

- The IP belongs to a company, an entrepreneur, or an inventor of the IP who is employed by the company
- The IP is in its early stages of development to assess if it will be commercially viable in the near future or if it can be used for commercial exploitation.
- The IP has been registered, and if so, in how many countries and for how long
- Whether there are any risks of infringement to the IP The IP has been licensed for use by third parties
- The IP is commercially viable

IP valuation has been done in Thailand, although mostly in the private sector. In practice, there is an established system to apply for loans by using IP as collateral. It should be noted that the ecosystem of IP valuations in Thailand has not been well established as yet to a level that would facilitate IP financing. There is no publicly available IP transaction database on IP valuations conducted in Thailand. In addition, data on IP assets are not synchronized, are not in real time and are updated manually by the government authorities. Furthermore, there are insufficient incentives for IP owners or financial institutions to conduct IP valuations, which are costly for small to medium businesses.

With regard to the professional valuer companies' own internal management, the companies conduct IP valuation based on internationally recognized methods and update the information and standards used for IP valuation on a regular basis.

In Thailand, IP valuation results are mainly used by IP owners, including individuals who use their IP assets as collateral for loan approval, or by business enterprises that plan to trade, sell, license, or commercialize their IP assets. Furthermore, financial institutions also use IP valuation results to determine whether to grant approval to requests for using IP assets as collateral for loan approvals.

Nowadays, IP valuation is most often conducted as a preliminary step before two or more parties engage in joint venture agreements or business deals. With regard to innovative IP, IP valuation is often conducted before the purchase or sale of IP assets between universities and big companies.[15]

Furthermore, most IP valuation results were being used as part of Purchase Price Allocation Reports, which were part of the Standards for Financial Reports Edition 3 (As Amended in the Year 2015) regarding business deals/agreements, where the most common intangible assets were trademarks. In addition, IP valuation results were also being used to

15 Interview with a researcher from Thailand Development Research Institute, May 2022.

assist in the determination of licensing fees/prices for the rights to use trademarks amongst affiliate companies or subsidiaries, to value the IP assets to be transferred amongst affiliate companies or subsidiaries, and, lastly, to support the recognition of fair value for the preparation of financial statements.[16]

In the Thai government's 20-Year Intellectual Property Roadmap guidelines (2016), there are examples of IP valuation case reports published under the DIP's IP Mart project. The IP Mart is an online platform used by IP owners who wish to present and sell their IP products to consumers, and is aimed at promoting IP valuation activities for commercial use through an IP marketplace.

The Thai government has been at the forefront of developing infrastructure to promote the use of IP assets in the process of commercialization. In 2003, the Thai government set a policy to promote the use of IP assets, among other intangible assets, as security for obtaining loans. Importantly, in 2017 the DIP issued the Guidelines on Intellectual Property Valuation[17] to provide comprehensive guidance and support policies for all aspects of IP valuation, including information related to IP-backed lending, IP securitization, IP valuation models and IP valuation systems. Additionally, the Study Report published by the DIP and Thailand Develop Research Institute (TDRI) in March 2017 highlights the importance of IP assets in commercialization and exploitation and provides support policy recommendations to improve the IP valuation ecosystem in Thailand.[18]

3.1.4. Singapore

Although Singapore does have a process for IP Application/Registration and this process can be done electronically and via a mobile app (IPOS GO) or online (Digital Hub, replacing IPOS's previous version of ip2.sg), Singapore currently does not have a favored IP Valuation model. The applicable model depends on the preference and discretion of the IP valuer engaged. Singapore is however working closely with various professional valuation organizations including the IVSC to create a set of IP valuation guidelines.

Currently, there are IP management systems offered in Singapore. These IP management systems are offered by private service providers such as Dennmeyer and PatSnap, amongst others.

No IP valuation System is present in Singapore (online or otherwise) as of now. However,

16 Interview with a professional valuation company in Thailand, May 2022.

17 Department of Intellectual Property, "Guidelines on IP Valuation," 2017.

18 Thailand Development Research Institute, "Report on IP Valuation Program," 2017.03.

there exists an online IP marketplace (URL: https://www.ipi-singapore.org/tech-offers) known as the “Intellectual Property Intermediary” (or “IPI”), which offers a “Tech Marketplace” akin to an online classified’s page that lists IP for sale or purchase.

Usage of IP valuation reports for IP Financing (IPFS) under IPOS has been discontinued. IP valuation reports shall be provided to IRAS in the event that a company wishes to apply for WDA under Singapore’s Income Tax Act.

IP valuation reports can be used during the disposal of IP and/or businesses, and will usually be required for disclosure during IP due diligence. As another example, IP valuation reports can be used to determine the pricing of the IP during attempts by the company to monetize its IP, such as on the Tech Marketplace operated by Singapore’s IPI.

At the moment, it is unclear if Singapore’s private and/or public sectors are planning to construct any IP valuation database(s).

3.1.5. Vietnam

Vietnam is currently at its infancy when it comes to IP valuation. Development strategies up to 2030 have been established related to IP valuation, but there are few projects or subsidies that are actually being carried out. It is known that about 300 quantitative or qualitative (e)valuations are conducted every year to (e)valuate intangible and tangible assets, but there are few (e)valuations involving the government. Almost all the (e)valuations are conducted by private sector entities.

In private sector entities such as companies, IPs are required to be (e)valuated and submitted to the Ministry of Science and Technology, but the relevant DBs are not well collected. Under this circumstance, the Ministry of Science and Technology is interested in establishing an IP valuation system at the government level.

It is known that the entities that valuate IPs use the income approach, the market approach, and the cost approach, but among them, the income approach is the most used. There is no web-based valuation system.

3.1.6. Indonesia

In Indonesia, there is no official valuation model or practice guide that is currently in use. About 60 to 130 valuations of intangible assets are conducted every year for IP collateral loans or other purposes, but there seem to be no set rules yet. Some valuation is being conducted in the private sectors, but more importantly, there is a demand that public valuators should be appointed, trained and their capabilities utilized well for fair application.

3.1.7. Cambodia

In Cambodia, the final stage is underway to establish a government-level IP valuation policy. The Ministry of Industry (more specifically, the national IP committee) is carrying out the groundwork, and it is expected that specific government-level plans will be revealed when the policy is completed and announced. There is no known valuation performance or model used in the country yet. There are institutions dealing with patents, trademarks, and design rights, but they are not unified. It is also known that related matters are being sorted out by the Ministry of Industry.

3.1.8. Lao

Currently there is no firm or agency conducting IP Valuation in Lao PDR. It is known that "Draft Intellectual Property Development Plan toward 2030" is planned as part of mid-to-long-term policies to revitalize IP valuation, but the relevant details are unknown.

3.2. Implications for Development of IP Valuation Models and/or Related Systems in ASEAN Countries

After identifying the current status of local IP management and IP valuation in ASEAN member states in collaboration with local experts and analyzing IP valuation case studies of Korea, this research team proposes matters to consider when developing an IP valuation framework in ASEAN Member States according to individual ASEAN member states' intellectual property databases, valuation models and the development status of related systems.

3.2.1. Malaysia

IP Valuation has gained interest among many parties in Malaysia e.g., technology transfer professionals, inventors, investors, accounting firms, property valuers, etc. Thus, development of relevant infrastructures will benefit Malaysia's businesses and economy in the long run.

The various IP valuation systems, techniques and guidelines introduced by interested parties in Malaysia will provide users with choices and this development will improve the valuation techniques and practices in Malaysia.

In general, most valuation techniques apply the income approach using Discounted Cash Flows (DCF), which is a good sign. This will be a perfect common ground for discussion among practitioners.

3.2.2. Philippines

While the Philippines has IP valuation manuals prepared through APEC and also by DOST-TAPI, the country still does not have adequate IP valuation infrastructure. There are laws encouraging innovation and commercialization of IPs but without proper support on valuation, it will be difficult for investors and funders to understand the commercial potential of the subject IP. The following are the recommendations related to IP valuation that may be considered to encourage innovation:

- Designation of an appropriate organization that will lead the IP valuation standards and requirements
- Accreditation of IP valuation specialists
- Subsidy in the professional fees for the valuation of IPs
- Establishment of an IP valuation database, preferably web-based, which should include data on royalty rates, market comparables, etc.
- An accredited center for capacity building or incorporation of IP valuation in the IP professionals training curriculum
- Linking of key employees in the relevant government agencies with counterparts with more advanced IP valuation/commercialization infrastructure
- Knowledge sharing/collaboration with more advanced economies with developed IP infrastructure
- Other suggestions for successful commercialization of IP assets:
- Risk sharing between the government agencies and the funders/financiers when lending/investing based on IP assets
- Providing tax benefits to investors/inventors and other IP innovators/supporters
- Establishment of a "Silicon Valley" zone in the Philippines to encourage innovation and to form a community of IP developers/inventors

3.2.3. Thailand

While Thailand currently has IP registration and enforcement databases on trademarks, copyrights, patents, petty patents, and IP litigation, there are no publicly available IT systems, or related IP transaction databases on IP valuation. Due to the confidentiality of the IP subject matter, previous attempts to construct databases for IP valuation were unsuccessful, and the Thai DIP has not established an IT system to record sales, offers or IP transactions in Thailand. As such, as a common practice, companies refer to information from benchmarking (global edition) and adjust such information to suit the IP being valued. Considering the aforementioned factors, this research team suggests that Thailand continue to develop and establish IT systems or related databases for IP valuation in order to improve the IP valuation ecosystem in the country.

3.2.4. Singapore

It is believed that having a STAR-Value System in Singapore (similar to the system in Korea) would indeed be beneficial.

It is evident that the initial hesitancy or aversion shown by companies to IP valuation is caused by the upfront costs required to engage professional IP valuers and pay for the production of their IP valuation reports. This is further exacerbated as there does not seem to be (or has already been retired) any scheme and/or grant that would assist companies to procure the said IP valuation reports.

However, the requirement that companies using the Online IP Valuation System still engage “expert[s] to maximize accuracy of the data” could be costly and prohibitive to the applicant companies. The suggestion therefore would be to have experts (referred to as “System Expert”) associated with or directly employed by the Online IP Valuation System to provide assistance to companies at a low or nominal fee.

The System Expert will also have the ability and responsibility to scrutinize all the data input by the applicant companies to ensure its accuracy, and ultimately ensure the credibility of the resultant IP Valuation Report (i.e. this is an effort to prevent any inadvertent or fraudulent inflation of the value of the target IP).

It is believed that having a preferred/standard IP valuation model (or models, with the maximum being 2 preferred models) would be beneficial in Singapore.

Due to the independent and scattered nature of IP valuers, it is up to their discretion and familiarity when it comes to applying/using a suitable IP valuation model during the valuation process.

Having guidance on the appropriate IP valuation model would therefore bring uniformity and certainty to the IP valuation ecosystem in Singapore.

As for which exact model(s) to use, further analysis has to be conducted to see if the Discounted Cast Flow (DCF) Model and/or the Relief from Royalty (RR) Model are suitable for Singapore, or whether localization or alternative models are required.

3.2.5. Vietnam

Though Vietnam's Ministry of Science and Technology is interested in IP valuation, there is no government-level standard for valuation yet. In this case, the valuation processes might proceed too subjectively, causing confusion in the technology market. The Vietnamese government needs to respond to these processes, analyze the problems and lay the foundation for reasonable and smooth technology transactions, technology commercialization, and technology financial markets.

3.2.6. Indonesia

There may be patents, brands, and trademarks that can be set as collateral for valuation, and specifically, research is needed on what can be held as collateral.

Further, IP valuation requires research on its use from various perspectives, such as financial perspectives, technological perspectives, and legal perspectives.

Since Indonesia is still at a beginner stage in valuation, it is necessary to conduct research on general IP valuation methods, understand important points to be considered from a commercialization point of view, and develop know-how related to performing valuation. In addition, the valuation methodology for IPs with high risk in the early research stage should be well organized, considering that there are a number of IPs in the early research stage.

3.2.7. Cambodia

Once the IP valuation policy in Cambodia is organized, the country can initiate the next stage of developing and establishing models and practice guides to be used when conducting IP valuation led by the Cambodia government.

3.2.8. Lao

The Department of Intellectual Properties (DIP) is interested in setting up an IP valuation system in Lao PDR in the near future. Therefore, it is suggested that Lao pursue cooperation with South Korea to assist with setting the policy direction on this matter.

In addition, it is necessary to assess the needs for Lao government by sharing information on the following matters related to IP valuation.

- IP valuation sample reports
- Brochures of IP valuation
- Capacity building on IP valuation
- IP valuation awareness for public and private sectors

4. Conclusion and Suggestions

4.1. Research Conclusions

In order to develop models and systems to perform IP valuation effectively, it is necessary to establish DB to be used in the model. Representatively necessary DBs include the economic life DB of technology, financial information by company, financial information by industry, and running royalty rates. In some countries, the above-mentioned data are already well organized, and some other countries may not have well developed databases. Especially for countries that do not have well organized DB, the establishment of related DBs will be the first step toward IP valuation. The direction of developing the model is expected to vary depending on the type of DB that can be used and how well organized the DB is.

Since the DB required for valuation has already been established and various models using it have been well developed in Korea, it is expected that valuation models and DBs can be developed according to the development level of each country by referring to the Korean IP valuation models and related systems.

Malaysia seems to have relatively well-established IP valuation models, practical guides, and related DBs available, but no web-based valuation platform are available even though the needs exist.

The Philippines currently does not have a web-based IP valuation system. It does not have a system similar to STAR-Value in Korea and does not have plans to establish one yet. However, according to a representative (Ms. Brianne Nicole Sanchez) from the IPOPHL, the country is open to collaborate if a similar web-based system is provided or made available in the Philippines, and the representatives from IPOPHL are receptive to knowledge-transfer/sharing for a similar initiative in the Philippines.

In Singapore, the offered and/or eventually transacted prices of the listed IP are not transparent or disclosed openly. Pricing may be obtained only upon enquiry. Furthermore, there doesn't seem to be any transparency in terms of how the IP is valued and/or priced at the initial stage. It would therefore take a serious enquirer/purchaser some steps (e.g. IP due diligence or independent valuation) before a IP valuation report may be produced/created.

The main impediment to businesses/companies proceeding to obtain IP valuation would be the high-initial costs to engage valuers for producing an IP valuation report for these companies. There must therefore be some corresponding financial benefit for businesses/companies in this aspect to generate further endorsement and support for the development and establishment of such a DB. Essentially, the DB shortens the time required for valuers to undertake their work and provides a beneficial resource in the form of past similar IP/transactions that can guide/inform their subsequent IP valuations. This would in turn save costs for businesses/companies availing such services.

There are also surrounding factors that could contribute to the success and benefits of having such a DB. The question could therefore be phrased thus: "does the lack of IP valuations hinder the liquidity and disposal of IP assets?" or "does the lack of a vibrant marketplace hinder the liquidity and disposal of IP assets?" Whichever the case, both must be built up simultaneously and both most co-exist at the same time (regardless of which came first) in order for IP assets to ultimately achieve liquidity and transactional viability. This research team believes that such a DB would therefore help to achieve the following purposes: (a) as a repository and record of all past IP transactions and (b) as a means of promoting further IP transactions (for the reasons given previously).

It is also believed that the development and establishment of essential information ("Database" or "DB") would be extremely crucial for the establishment of IP valuation systems in Singapore.

Parties with such information (or with the ability to obtain, collect and collate such information) should be identified as part of the efforts to have such a DB set up. For example, the IPI, which manages an online Tech Marketplace, could be identified as the right entity within Singapore for such a purpose. This is because they would be privy to certain types of essential information (e.g. pricing of IP, transacted prices of IP and potentially the financial information of the disposing/purchasing companies).

In Thailand, the interview with a professional valuer company revealed that IP management is prevalent in large organizations that own a large amount of IP and therefore require proper IP management. In small or medium-sized organizations, proper IP management is not often found. There have been previous initiatives by private sectors to construct DB for IP valuation with information such as financial data, transaction cases with royalty rates, and deal value information. However, due to the confidentiality of the IP subject matter, the attempts to construct DBs for IP valuation have been unsuccessful. The DIP has not put in place a system to record the sales, offers or IP transactions in Thailand. On the other hand, from our interview with a professional valuer company, it was found that the company usually refers to information from benchmarking (global edition) and adjusts such information to suit the IP being valued.

The Vietnamese government is expected to lead the government-led IP valuation area by establishing an IP valuation model and related DB. In this way, it will be possible to assess whether valuation in the private sector is carried out reasonably, increase the reliability of the valuation, and ultimately activate the valuation market itself. For the purposes, active collaboration with other ASEAN member states that already have models and guidelines (or manual) on performing valuation is desirable.

Indonesia seems to have demand to establish an IP valuation methodology for early R&D staged IP. To this end, it is necessary to identify influential factors that reflect the characteristics of the early research stage in the valuation results, in order to make an advanced IP valuation model. It is, however, a prerequisite that a basic and official IP valuation model be established.

Since Cambodia and Lao are at the very early stages in terms of IP valuation, social and national consensus should be reached on the necessity of IP valuation, and after that, the development of valuation methodology for fair results should be carried out and proper application be ensured for purposes such as IP collateral loans, technology transfer, and technology commercialization.

In summary, Malaysia, the Philippines, and Thailand seem to have relatively well-established IP valuation models, practical guides, and related DBs available, but no web-based valuation platform is available even though the needs exist. They also need to upgrade the DB used for valuation. Although Singapore uses IP valuation for various purposes, it seems necessary to make the process more transparent and advanced. In particular, it is crucial to lower valuation costs and shorten the valuation time to activate IP valuation further. Countries such as Vietnam, Indonesia, Cambodia and Lao need to develop IP valuation models customized to their requirements, as well as establish an IP valuation related DB as a starting point.

Moving forward, in developing an IP valuation model for ASEAN countries, it is crucial to ensure the involvement of relevant stakeholders and valuation practitioners. It will be a tough task to satisfy each stakeholder/practitioner since each of them has different preferences. However, it is desirable to learn from best practices followed in Korea such as STAR-Value online system and further apply them in ASEAN countries.

4.2. ASEAN Policy Suggestions

Policy suggestions for ASEAN member states are as follows. It is necessary to develop a government-led IP valuation practice guide. It is also recommended that the reliability of the valuation results be reinforced by developing the valuation model and the DB to be applied to the model at the government level. In particular, it is important to collaborate with organizations that collect and analyze DBs such as financial information and deal values to be used with the model. If necessary, cooperation with private companies dealing with such DBs or founding public institutions that collect such DBs should be considered. On the other hand, countries that have not yet established an IP valuation model or related DB should create a model and collect DBs first, by methods that are suitable for each country through cooperation between the government and the private sector.

It is proposed that the development of models and related essential DBs be expedited by conducting consulting projects with countries that possess advanced IP valuation infrastructures such as Korea, which has already conducted, and utilized IP valuation nationwide for decades.

In addition, it may be necessary to make it mandatory for related parties to perform IP valuation when governmental fund is provided for IP-based collateral or any kind of IP-based governmental support. In this case, active cooperation with financial institutions is essential.

Furthermore, if ASEAN countries intend to provide quick support to small and medium-sized enterprises using IP, it may be necessary to develop a 'quick' service system such as an online valuation system. It should be noted that all the ASEAM member states agreed that SMEs ought to have access to a quick and more cost-friendly online IP valuation system. Furthermore, in order for IP valuation to settle early in ASEAN member states, the concerned governments will need to establish an IP valuation support policy such as providing full or partial support for valuation costs, since financial assistance from the government should help businesses/companies overcome the hurdle of the high initial costs for IP valuations.

STAR-Value is an IT-based valuation platform in which a number of countries continue to show much interest. It offers a great advantage in that it has the effect of simplifying the complexity of valuation and shortening the valuation time. It can be utilized for the areas that require an approximate amount (or an amount expressed in range) although an in-depth valuation should be performed if an accurate value outcome is required. In other words, it would be meaningful to establish a policy, for example, of prioritizing projects in national research institutes or of using the values as references to support small and medium-sized enterprises financially, to develop and utilize IT valuation programs suitable for each AMS member country to revitalize the various field related to IP valuation.

One of the problems Korea has faced with financing based on IP technologies is that the valuation time and costs are high. Since rapid valuation and reasonable costs can help obtain financial support quickly, it is expected that financing work based on IP technology can be carried out smoothly by creating a policy to establish an IT-based valuation platform.

Securing professional valuation personnel is essential for IP valuation to be activated. Valuation models suitable for each country can be developed only when the human resources capable of performing the valuation are secured first. They can participate in professional education programs offered by advanced countries in terms of valuation. It will be possible for these initial batches of trained human resources to train the subsequent human resources. If necessary, it may be more effective to send trainees to developed countries for them to learn and experience IP valuation. In order to vitalize technology transactions, technology financing, establishment of research institutes and companies, or technology commercialization using IP valuation, a certain level of financial support is essential, and its ripple effect is expected to be quite high.

It is suggested that countries that do not have a proper valuation model or countries that do not have an IT valuation platform organize a consortium according to each country's valuation model or development status of IT systems and conduct cooperative projects at the AMS level.

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Appendix

Valuation Report Sample (From STAR-Value Online Valuation System)

STAR VALUE 5.0 PLUS

www.starvalue.or.kr

Comprehensive Technology Valuation Report

Applicant	LG Energy Solution, Ltd.
Date of Application	2018.11.06.
Application No	16611126
Patent Publication No	-
Patent Registration No	11258056
Client	DTI, Inc.
Purpose of Valuation	In technology transfer negotiation
IPC Code	H01M
Remaining Patent Life	16 years 8 months
Date of Valuation	2022. 03. 14.
Print Date	2022. 03. 14.

Korea Institute of Science and Technology Information

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Subject Technology

Patented/Unpatente	Patented		
Technology title	Positive electrode material, positive electrode, and lithium secondary battery		
Technology description	The present disclosure relates to a positive electrode material including a spinel-structured lithium manganese-based first positive electrode active material and a lithium nickel-manganese-cobalt-based second positive electrode active material, wherein the first positive electrode active material includes a lithium manganese oxide represented by Formula 1 and a coating layer which is disposed on a surface of the lithium manganese oxide, the second positive electrode active material is represented by Formula 2, and an average particle diameter of the second positive		
IPC code	H01M	Date of application	20181106
Patent publication	-	Patent registration	11258056
Applicant	LG Energy Solution, Ltd.	Remaining patent	16 years 8 months

Premise of Valuation

Sector	Manufacture of accumulators	Time to market	2 years
Date of Valuation	2022. 03. 14	Cost to market	600 (Korean mil. Won)
Estimated period of	9 years	Adjusted discount	11.33%

Valuation Method

Discounted cash	Real-options	Royalty payment	Value by a profit	Comparable	Market	S/W Valuation
O	-	O	-	-	-	-

Valuation Results (Korean mil. Won)

Discounted cash	Real-options	Royalty payment	Value by a profit	Comparable	Market	S/W Valuation
7,380	-	10,324	-	-	-	-

Disclaimer

The above valuation results are generated by KISTI's STAR-Value System using relevant reference data and the scope and limitations set by the valuator. The result may therefore be different when any changes are made to the selected or entered options and information.

Basic Information

Technology title	Positive electrode material, positive electrode, and lithium secondary battery		
IPC Code	H01M		
Publication No		Registration No	11258056
Applicant	LG Energy Solution, Ltd.	Remaining Patent	16years 8months

User Information

Company name	DTI, Inc.
Purpose of	In technology transfer negotiation
Patented/Unpatente	Patented

Patented Technology

Technology code	H01M
Patent title	United States | Positive electrode material, positive electrode, and lithium

Estimated Period of Return

Estimated Period of	9 years

Main Product & Industry Classification

Main product	Positive electrode material, positive electrode, and lithium secondary battery which include
Industry	Manufacture of accumulators(C28202)

Criteria to search similar companies for financial data

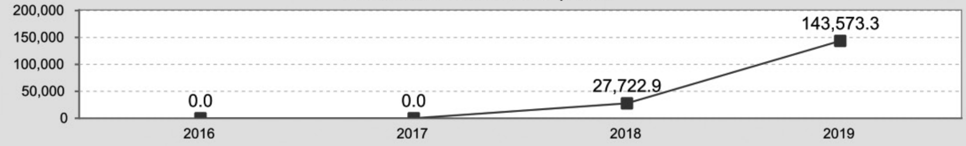
Similar companies	Dongah Battery Co.,Ltd., SK IE TECHNOLOGY CO.,LTD.,
Company entity	privates, general corporations, non-profit corporations, and public institutions
Company size	Large ,Medium,Middle-market company,Any
Incorporated / Unincorporated	Unincorporated private enterprise,Corporation
Public offering	Sole proprietorship,Registered corporation,Unregistered corporation,KOSDAQ,KOSPI,KONEX,
Company type	Stocks, privates, limited, associations, organizations, government-invested institutions,and others
***Risk-free interest**	1.39 %
Anticipated	Top 25%

Time and cost to market

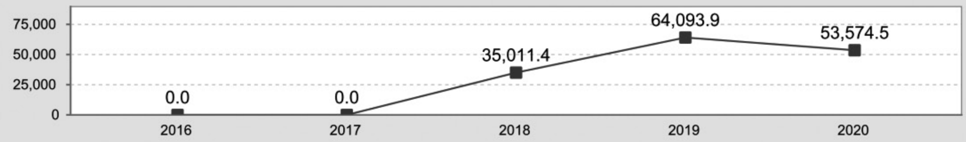
Time to market	2 years
Cost to market	600 (Korean mil. Won)
Profit strategy	Penetrating Existing Market

Growth trend of the targeted market

Growth trend of similar companies



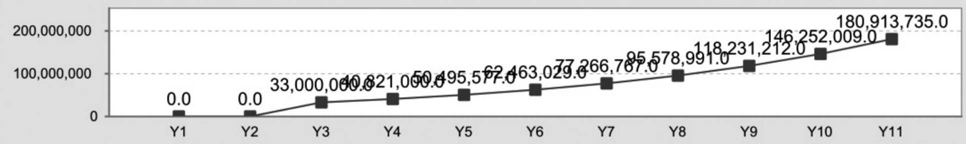
Growth trend of similar industries



Estimated market size

Total market size (unit : Korean mil. Won)	
Y1	0
Y2	0
Y3	33,000,000
Y4	40,821,000
Y5	50,495,577
Y6	62,463,029
Y7	77,266,767
Y8	95,578,991
Y9	118,231,212
Y10	146,252,009
Y11	180,913,735

Total market size



Market share (%)	
Y1	0.00
Y2	0.00
Y3	0.003
Y4	0.015
Y5	0.075
Y6	0.12

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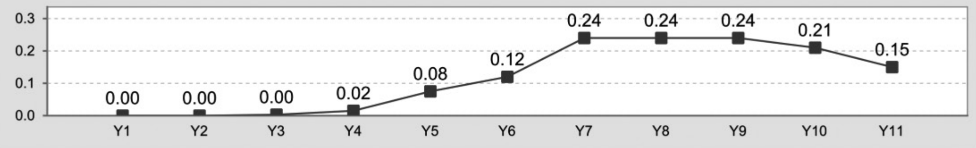
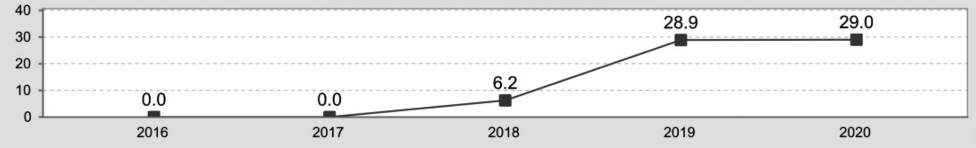
Market share (%)	
Y7	0.24
Y8	0.24
Y9	0.24
Y10	0.21
Y11	0.15

Market share

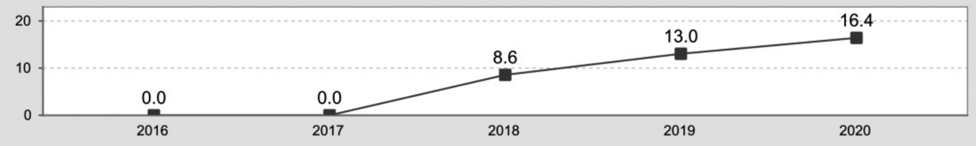


Estimate profit structure (unit : %)

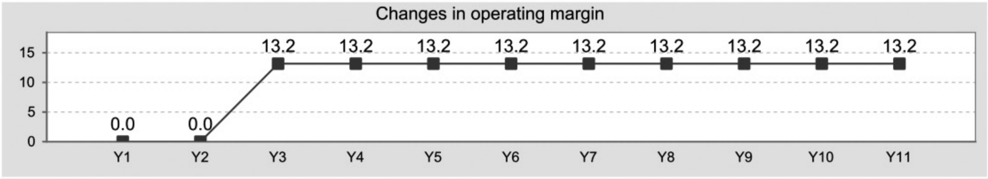
Operating margin of similar companies



Operating margin by industry



Operating profit ratio (%)	
Y1	0.0
Y2	0.0
Y3	13.16
Y4	13.16
Y5	13.16
Y6	13.16
Y7	13.16
Y8	13.16
Y9	13.16
Y10	13.16
Y11	13.16


Changes in operating margin
15
10
5
0
0.0
0.0
13.2
13.2
13.2
13.2
13.2
13.2
13.2
13.2
13.2
Y1
Y2
Y3
Y4
Y5
Y6
Y7
Y8
Y9
Y10
Y11

DCF Model

Technology title	Positive electrode material, positive electrode, and lithium secondary battery		
IPC code	H01M	Date of application	20181106
Patent publication	-	Patent registration	11258056
Applicant	LG Energy Solution, Ltd.	Remaining patent	16years 8months

Pre-launch (unit : korean mil, won)

Year	Sales 100%	COGS	Gross margin	SG&A	EBIT
Y1	0	0	0	0	0
Y2	0	0	0	0	0

Post-launch (unit : korean mil, won)

Year	Sales 100%	COGS 76.88%	Gross margin 23.12%	SG&A 9.95%	EBIT 13.16%	Income tax (legal rate)	NOPAT
Y3	990	761	229	99	130	14	116
Y4	6,123	4,707	1,416	609	806	155	651
Y5	37,872	29,116	8,756	3,768	4,984	1,074	3,910
Y6	74,956	57,626	17,330	7,458	9,864	2,148	7,716
Y7	185,440	142,566	42,874	18,451	24,404	5,444	18,960
Y8	229,390	176,355	53,035	22,824	30,188	6,844	23,344
Y9	283,755	218,151	65,604	28,234	37,342	8,575	28,767
Y10	307,129	236,121	71,008	30,559	40,418	9,319	31,099
Y11	271,371	208,630	62,741	27,001	35,712	8,180	27,532

Pre-launch (unit : korean mil, won)

Year	NOPAT	Depreciation/Amortization cost	CAPEX	Working capital input	Growth in working capital	Recovered investment	FCF
Y1	0	0	500	0	0		-500
Y2	0	0	100	0	0		-100

Post-launch (unit : korean mil, won)

Year	NOPAT	Depreciation/Amortization cost	CAPEX	Working capital input	Growth in working capital	Recovered investment	FCF
Y3	116	38	509	230	230		-585
Y4	651	238	2,863	1,421	1,191		-3,165
Y5	3,910	1,469	17,708	8,788	7,367		-19,696
Y6	7,716	2,908	21,876	17,394	8,606		-19,858
Y7	18,960	7,195	63,706	43,032	25,638		-63,189

Year	NOPAT	Depreciation/Amortization cost	CAPEX	Working capital input	Growth in working capital	Recovered investment	FCF
Y8	23,344	8,900	31,380	53,231	10,199		-9,334
Y9	28,767	11,010	38,817	65,847	12,616		-11,656
Y10	31,099	11,917	23,872	71,271	5,424		13,720
Y11	27,532	10,529	-7,761	62,973	-8,298	202,338	256,459

→ Discount rate: 11.33% = WACC 6.18% + Technology risk premium 4.21% + Size risk premium .94%

Year	Present value factor
Y1	0.8982
Y2	0.8068
Y3	0.7247
Y4	0.6510
Y5	0.5847
Y6	0.5252
Y7	0.4718
Y8	0.4237
Y9	0.3806
Y10	0.3419
Y11	0.3071

Pre-launch

Year	FCF	Present value factor	PV(FCF)
Y1	-500	0.8982	-449
Y2	-100	0.8068	-81

Post-launch

Year	FCF	Present value factor	PV(FCF)
Y3	-585	0.7247	-424
Y4	-3,165	0.6510	-2,061
Y5	-19,696	0.5847	-11,517
Y6	-19,858	0.5252	-10,429
Y7	-63,189	0.4718	-29,812
Y8	-9,335	0.4237	-3,955
Y9	-11,656	0.3806	-4,436
Y10	13,720	0.3419	4,691
Y11	256,459	0.3071	78,758

PV (Total FCF) (Korean mil. Won)	20,285

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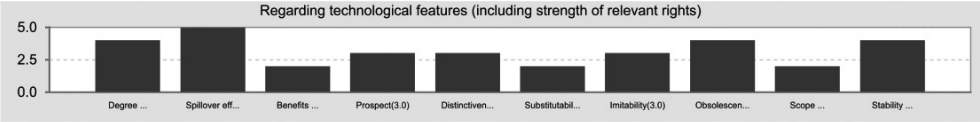
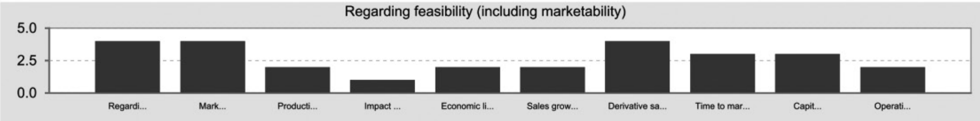
Estimate technology factor by industry factor & technology rating

Technology title	Positive electrode material, positive electrode, and
Industry factor	68.52%
Share of technology	90%
Technology rating	59%
Technology contribution ratio	36.38%





Pre-launch

(unit : korean mil. won)

Year	Sales 100%	COGS	Gross margin	SG&A	EBIT	NOPAT	CAPEX	Depreciation/Amortization	Working capital input	Growth in working	Recovered investme	FCF	Present 11.33%	PV (FCF)
1차년도	0	0	0	0	0	0	500	0	0	0		-500	0.8982	-449
2차년도	0	0	0	0	0	0	100	0	0	0		-100	0.8068	-81

Post-launch

(unit : korean mil. won)

Year	Sales 100%	COGS 76.88%	Gross margin 23.12%	SG&A 9.95%	EBIT 13.16%	Income tax (legal	NOPAT	CAPEX	Depreciation/Am 3.88%	Working capital input	Growth in working	Recovered investme	FCF	Present value 11.33%	PV (FCF)
Y3	990	761	229	99	130	14	116	509	38	230	230		-585	0.7247	-424
Y4	6,123	4,707	1,416	609	806	155	651	2,863	238	1,421	1,191		-3,165	0.651	-2,061
Y5	37,872	29,116	8,756	3,768	4,984	1,074	3,910	17,708	1,469	8,788	7,367		-19,696	0.5847	-11,517
Y6	74,956	57,626	17,330	7,458	9,864	2,148	7,716	21,876	2,908	17,394	8,606		-19,858	0.5252	-10,429
Y7	185,440	142,566	42,874	18,451	24,404	5,444	18,960	63,706	7,195	43,032	25,638		-63,189	0.4718	-29,812
Y8	229,390	176,355	53,035	22,824	30,188	6,844	23,344	31,380	8,900	53,231	10,199		-9,334	0.4237	-3,955
Y9	283,755	218,151	65,604	28,234	37,342	8,575	28,767	38,817	11,010	65,847	12,616		-11,656	0.3806	-4,436
Y10	307,129	236,121	71,008	30,559	40,418	9,319	31,099	23,872	11,917	71,271	5,424		13,720	0.3419	4,691
Y11	271,371	208,630	62,741	27,001	35,712	8,180	27,532	-7,761	10,529	62,973	-8,298	202,338	256,459	0.3071	78,758

Business Value (Korean mil. Won)	20,285
Technology contribution ratio	36.38 %
Technology value (Korean mil. Won)	7,380

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Royalty payment saved model

Technology title	Positive electrode material, positive electrode, and lithium secondary battery		
IPC Code	H01M	Date of application	20181106
Publication No	-	Patent registration	11258056
Applicant	LG Energy Solution, Ltd.	Remaining Patent	16years 8months

unit : %

Royalty rate	2.5%

(unit : korean mil. won)

Year	Sales	Royalties	Income tax	Royalties after tax
Y1	0	0	0	0
Y2	0	0	0	0
Y3	990	24	3	21
Y4	6,123	147	16	131
Y5	37,872	909	178	731
Y6	74,956	1,799	374	1,425
Y7	185,440	4,451	957	3,493
Y8	229,390	5,505	1,189	4,316
Y9	283,755	6,810	1,476	5,334
Y10	307,129	7,371	1,600	5,771
Y11	271,371	6,513	1,411	5,102

→ Discount rate: 11.33% = WACC 6.18% + Technology risk premium 4.21% + Size risk premium .94%

Year	Present value factor
Y1	0.8982
Y2	0.8068
Y3	0.7247
Y4	0.6510
Y5	0.5847
Y6	0.5252
Y7	0.4718
Y8	0.4237
Y9	0.3806
Y10	0.3419
Y11	0.3071

(unit : korean mil. won)

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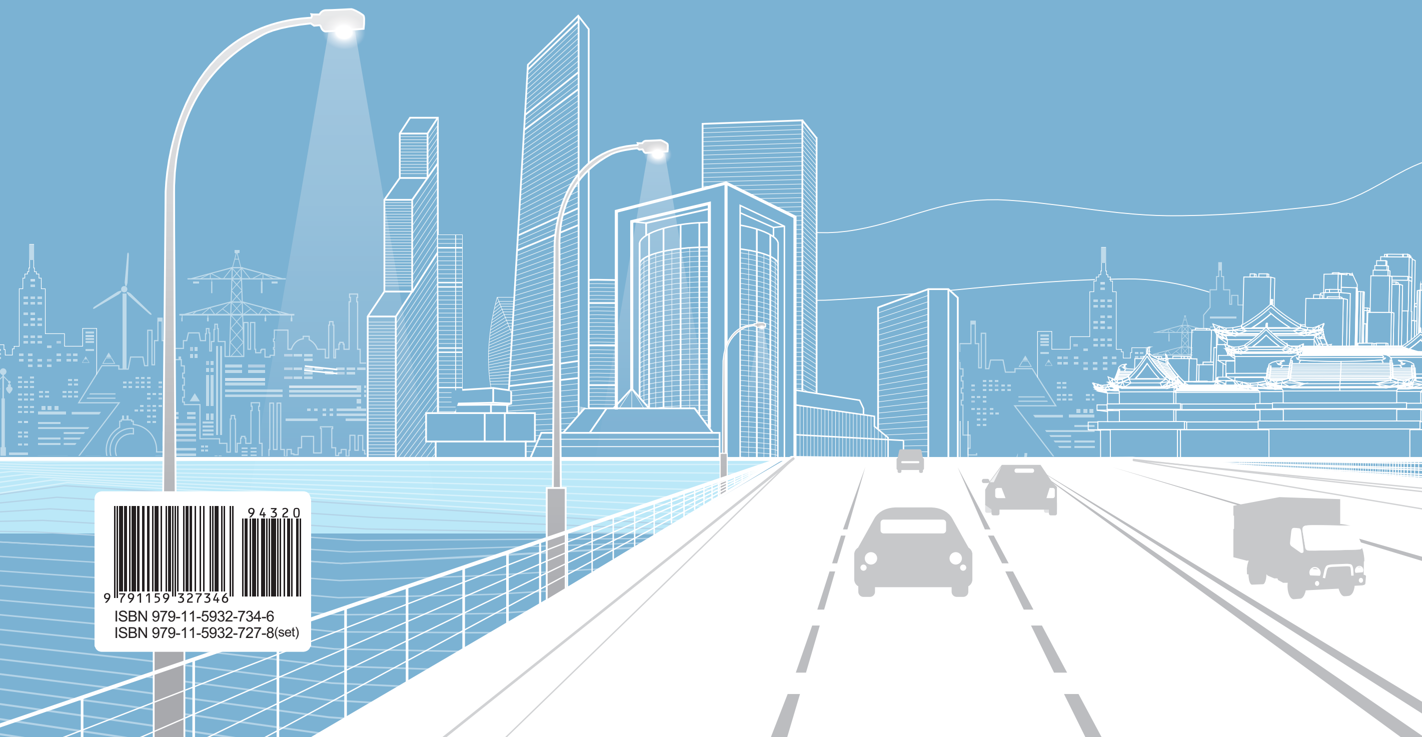
Year	Sales	Royalties	Income tax	Royalties after	Present value	Sum of present values
Y1	0	0	0	0	0	
Y2	0	0	0	0	0	
Y3	990	24	3	21	15	
Y4	6,123	147	16	131	85	
Y5	37,872	909	178	731	427	
Y6	74,956	1,799	374	1,425	748	
Y7	185,440	4,451	957	3,493	1,648	
Y8	229,390	5,505	1,189	4,316	1,829	
Y9	283,755	6,810	1,476	5,334	2,030	
Y10	307,129	7,371	1,600	5,771	1,973	
Y11	271,371	6,513	1,411	5,102	1,567	1,567

Adjusted Royalty rate	2.4%
Technology value (Korean mil. Won)	10,324

Ministry of Economy and Finance (MOEF)
Sejong Government Complex, 477, Galmae-ro, Sejong-si 30109, Republic of Korea
Tel. 82-44-215-7747
www.moef.go.kr

Korea Development Institute (KDI)
Namsejong-ro, 263, Sejong-si 30149, Republic of Korea
Tel. 82-44-550-4114
www.kdi.re.kr

Knowledge Sharing Program (KSP)
www.ksp.go.kr



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