

Valuation about Korean LNG carriers

Presenter : Korea Invention Promotion Association

Intellectual Property Valuation Center

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Part I

Introduction of Valuation



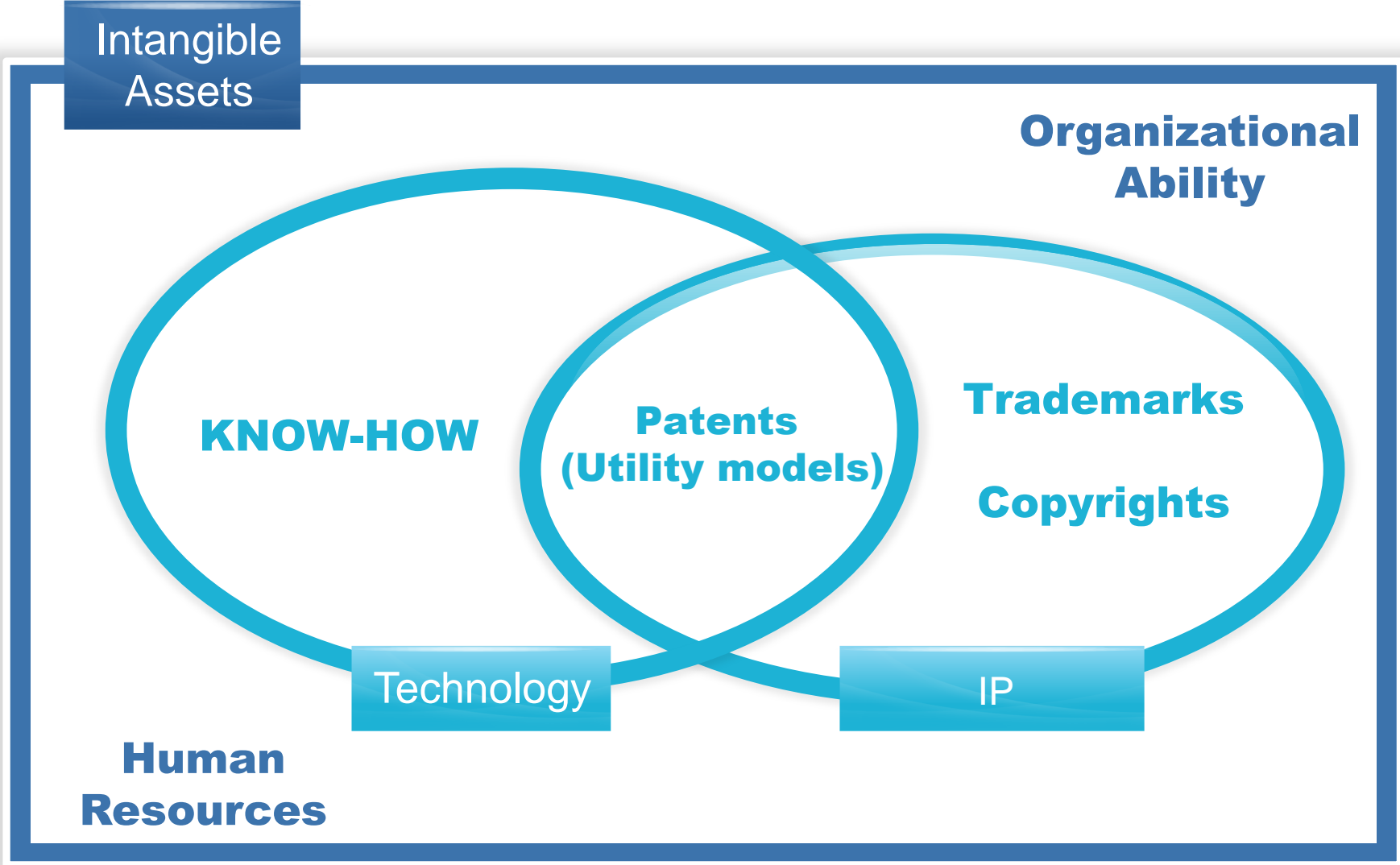
1. Introduction of Valuation

► Overview: Science, Technology, Knowledge, and Business

- **Technology: How to produce and process scientific knowledge**
- **Technology as the application of knowledge for useful purposes and Technology is created by adding new technical or scientific knowledge to existing technology. In addition, the criterion of successful technology is usability, and it is distinguished from science in that technology that is useful to ignorant users should be useful, and that any useful technique is inevitably obsolescence.**
- **Business is a quantification process. When you want to know the value of something, you need a numerical answer (monetary value). Of course, the value of technology can also be numbered. Technology valuation is the process of expressing technology as business language (numerical value).**

(F. PETER BOER(1999). The valuation of technology: business and financial issues in R&D.)

► **Differentiation among Intangible Assets, IP, and Technology**



► Utilization of Technology Valuation

Utilization and perspective of technology valuation

In order to make an economic decisions

① For using as key information for IP backed loans, technology transfer and financing, technical transactions, negotiation of management strategies, and other economic decisions

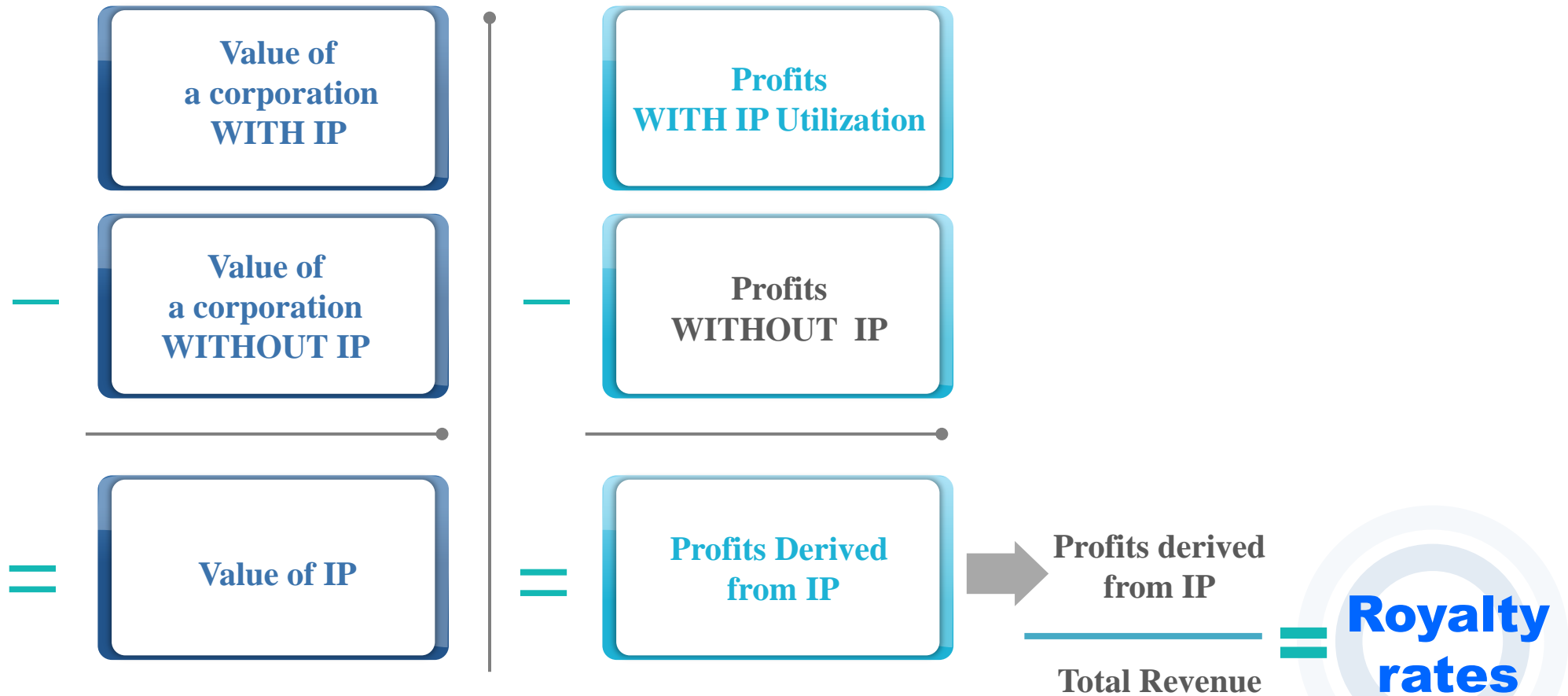
Suitability for purpose of rational decision making is important

In order to require a law

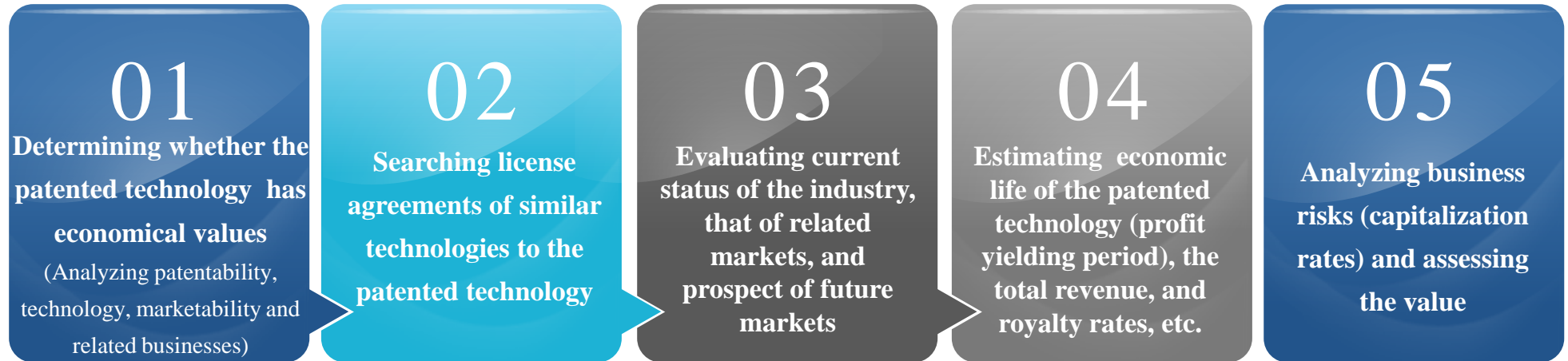
- ② If necessary for payment in kind by intellectual property, commercial law, accounting standards, tax purposes to determine the valuation in accordance with relevant legislation
- ③ If the amount of the valuation is determined in accordance with the legal provisions stipulated in the Patent Act etc.

Fairness is important
Require strict evaluation

► **Valuation Theory**
(Reasonable Royalty Approach)

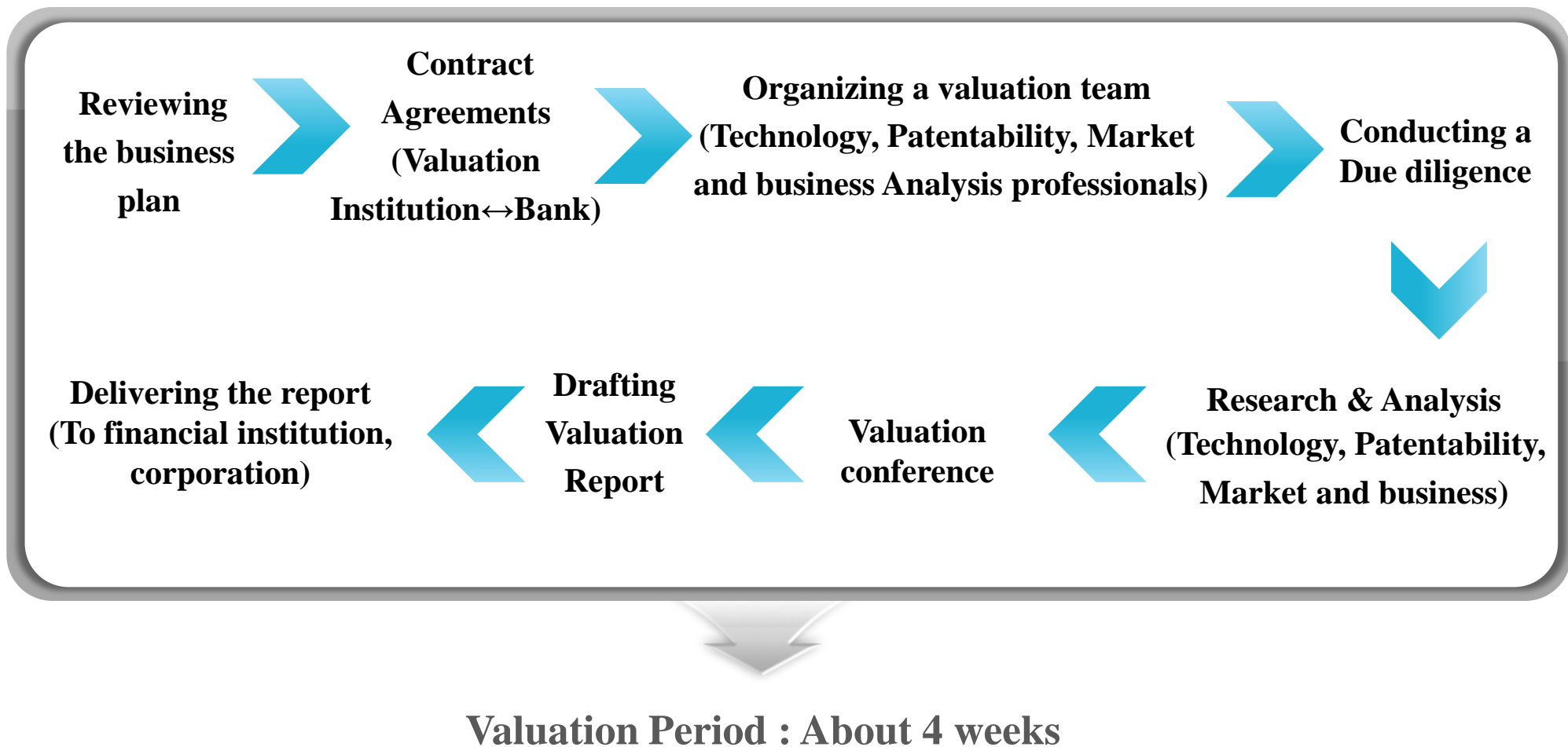


► Patent Valuation process according to royalty approaches



➡ However, it has to be clearly proved that the **valuation targeted patent can yield economical profit**. This means that objective basis has to be shown that the technical business item utilizing the **target patent has proficient business feasibility or the item is generating profits**.

► Valuation Performance Process of a Valuation Institution in Practice



► Contents of Valuation Report

I. Summary of Valuation Result

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- 2. Overview of valuation target technology business
- 3. valuation method, procedure, and primary assumptions
- 4. Summary of valuation result

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 - 1.1. General information of valuation target technology
 - 1.2. Summary and features of a patent
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 - 1.4. Determining application of patent Claims in a product
 - 1.5. Determining breadth of the scope of the Claims
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 - 2.2. Search result
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- 4. Comprehensive Opinion

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 - 1.1. Technology product
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- 2. Status and scale of a market
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 - 2.2. Market status
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 - 3.1. Industry trends
 - 3.2. Analysis on similar businesses
- 4. Comprehensive opinion (SWOT Analysis)

V. Collateral Value Valuation

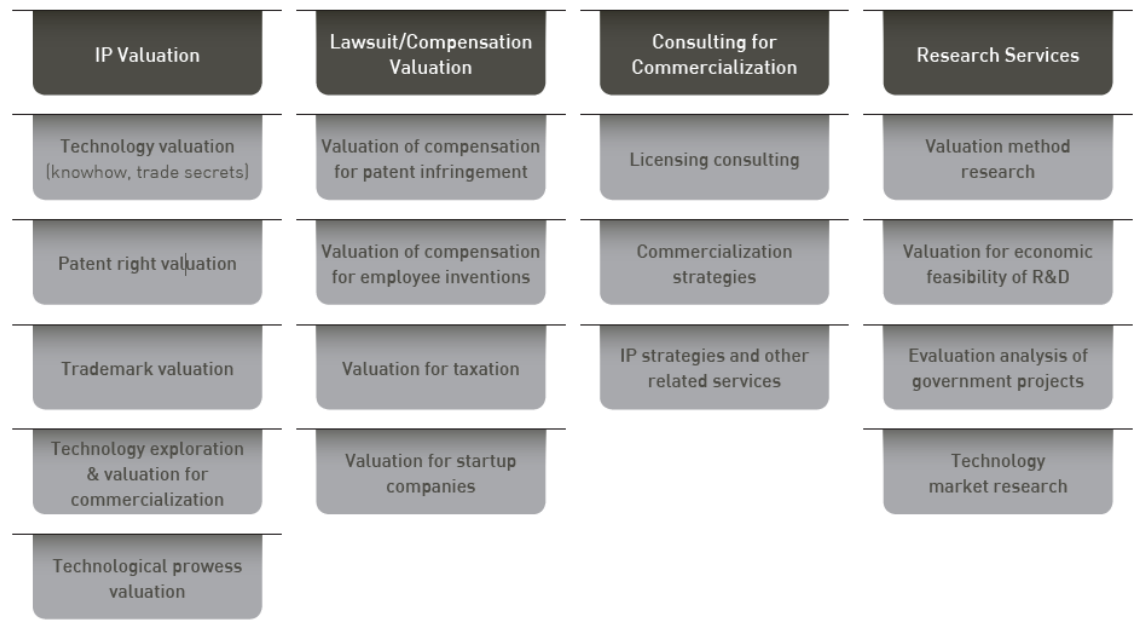
- 1. Business overview
 - 1.1. Businesses
 - 1.2. Business model and performance of the valuation target business
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 - 3.4. Capitalization rate(discount rate)
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<Appendix>Valuation professionals and designated areas

<Addendum>Prior arts summary list

► Intellectual Property Valuation Center @ KIPA

- The KIPA IP Valuation Center conducts highly respected technology valuations using world-class knowledge from its technology rating professionals who carry abundant experience from their past achievements. Technology valuation estimates the value of patented technology in currency units, making it useful for purposes such as technology transfers/transactions, investments in kind, investment attraction, examinations of business feasibility, IP mortgages, and patent litigation.
- No.1 in the total number of technology valuation cases conducted in Korea for three consecutive years (2014-2016)
- 2014: 197 cases / 2015 : 182 cases / 2016: 192 cases



► Technical valuation demands of industry

| Purpose | Usage |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Transfer & Transactions | Present the appropriate price for the sale of the technology and the determination of the license price |
| Finance | Set up a lien for intellectual property rights (patent rights) or attract technology investment |
| Investment In-kind | Estimate the fair value of in-kind investment of technology or intellectual property rights |
| Strategy | Enhancement of corporate value, commercialization of technology, spin off, establishment of long-term strategic management plan |
| Clearing | Asset valuation and debt repayment planning based on corporate bankruptcy or restructuring |
| Lawsuit | Intellectual property infringement, default, other property disputes |
| Taxation | Establishment of tax planning and payment of taxes for the expiration of technology, disposal, and amortization |
| Miscellaneous | Exclusive listing etc. |

Part II

Valuation about Korean LNG carriers



1. Introduction of Valuation about Korean LNG carriers

▶ Purpose of valuation

- Based on the results of analysis of the technical, IP rights, and marketability of the 'LNG carrier performance and design' technology owned by KOGAS and the current production and operation status and future business plan with present value.

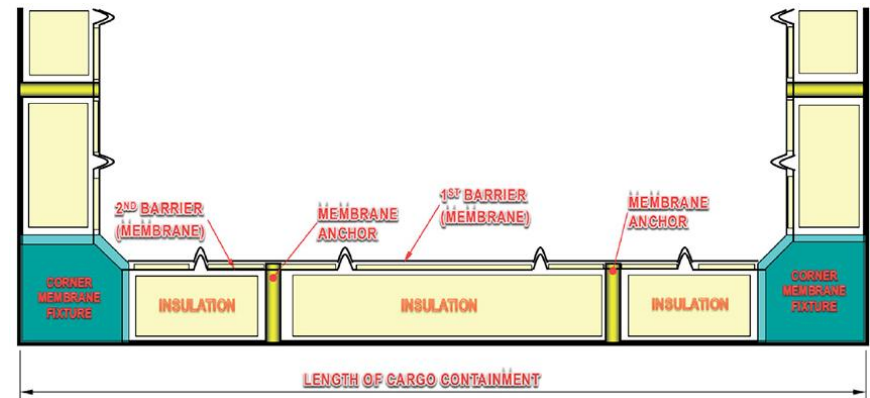
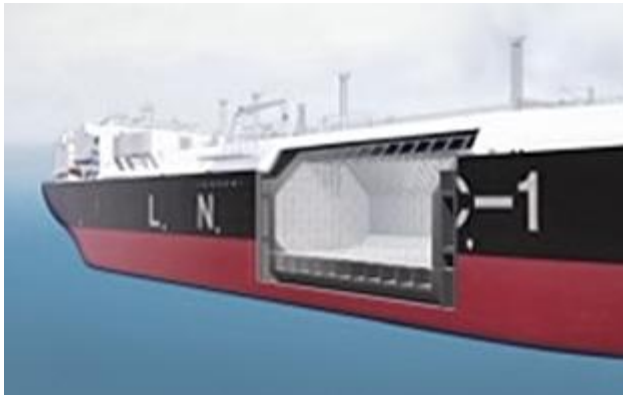
▶ Overview of technology business

- Evaluation target technology: Performance and design technology LNG carriers
- Target Technology Business: This project is to create profit by providing LNG cargo hold technology and technical service using LNG carrier performance and design technology developed by KOGAS. This technology business corresponds to environment consulting and related engineering service industry in standard industry classification.

1. Introduction of Valuation about Korean LNG carriers

► List of subject research projects and Patents

- Based on the results of analysis of the technical, IP rights, and marketability of the 'LNG carrier performance and design' technology owned by KOGAS and the current production and operation status and future business plan with present value.
- The intellectual properties related to this technology are 7 research reports and 28 patents including 14 domestic patents and 14 overseas patents.



< LNG Carrier and Cargo Containment >

2. Technology Analysis

► Overview of Technology (Product)

- This technology relates to the performance and design improvement technology and construction of liquefied natural gas (LNG) transport lines, and more specifically to the optimization of structure of membrane hold, insulation technology, hold technology and pump tower safety improvement technique.

► The degree of technological innovation

- Major improvement technology

► Commercialization stage of technology

- Manufacturing, selling stage

► Application fields of technology (product)

- Primary Application: Cargo tanks for LNG carriers

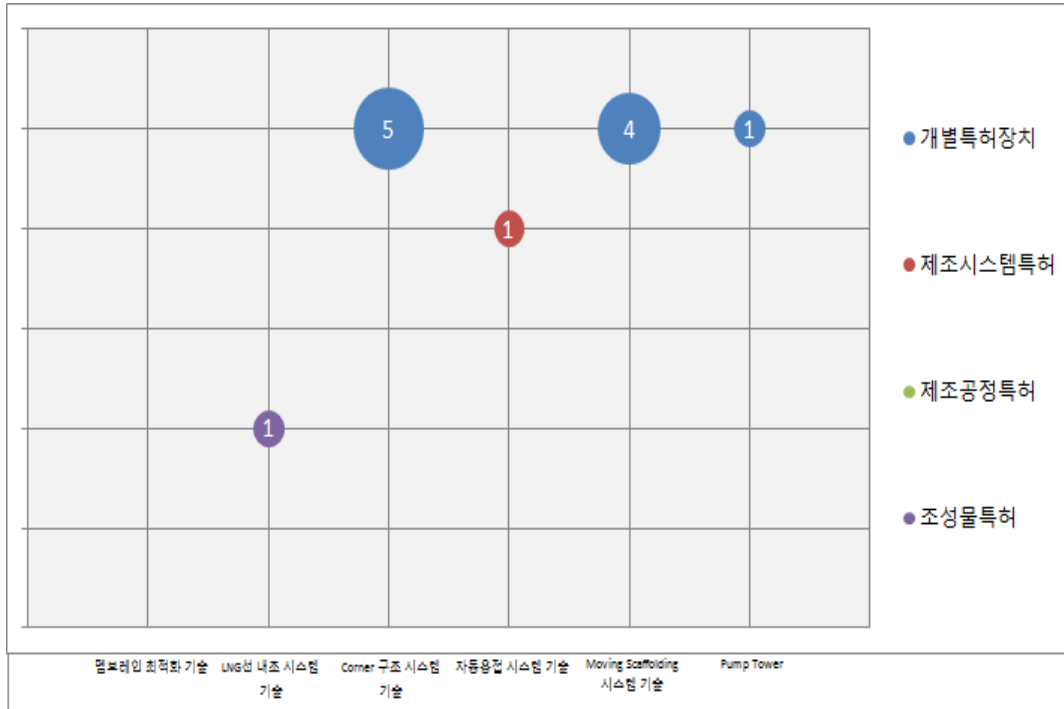
- Secondary application: LNG storage tanks for offshore plants

► Economic life of technology (product)

- The performance and design enhancement technologies of LNG carriers can be used continuously in the future, and as long as new technologies are not developed. It is believed that the economic life span of more than 10 years can be maintained.

3. Patent Right Analysis

▶ Review of patent portfolio related to performance and design technology of LNG carriers owned by Korea Gas Corporation



■ The technologies to be evaluated relate to LNG carrier performance and design techniques,

- 1) Cargo hold construction and insulation technology
- 2) Cargo hold construction technology
- 3) Equipment technology.

■ The intellectual property rights associated with this technology

- 1) 9 domestic registered patents
- 2) 5 domestic patent applications and 14 overseas patent applications

▶ A comprehensive opinion

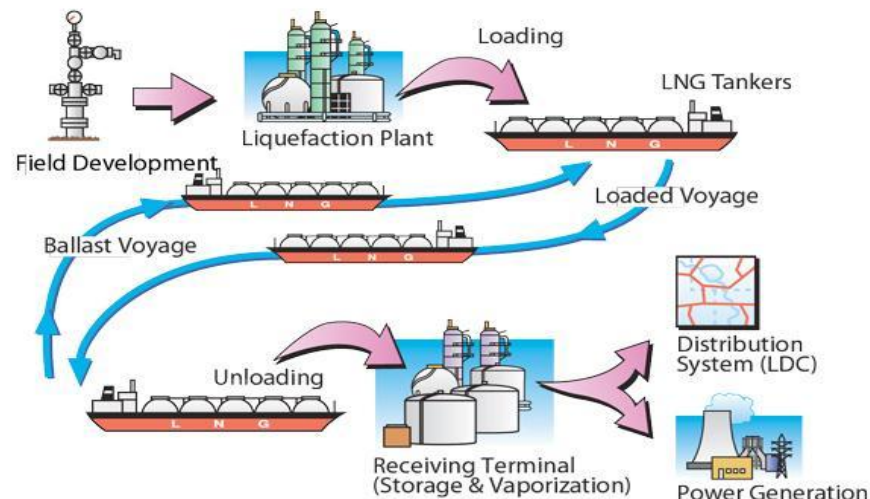
■ The intellectual property rights associated with this technology are high in the stability of rights, and there is a possibility of third party avoidance designing as it involves unnecessarily narrow limitations in limiting the boundaries of the scope of rights and the detailed components of the rights. Target technologies are considered to be highly business related.

3. Marketability Analysis (1)

▶ Market overview

- **Target market: shipping companies / shipyards that need to build LNG carriers**

| Rear industry | Applicable industry | Forward industry |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none">• LNG carrier design and production technology development | <ul style="list-style-type: none">• LNG cargo hold technical service (environmental consulting and related engineering service industry) | <ul style="list-style-type: none">• LNG industry• Shipping (Shipbuilding) Industry |
| <ul style="list-style-type: none">• Studies on LNG carrier production technology• Studies on LNG cargo hold structure and design | <ul style="list-style-type: none">• Design and maintenance of LNG cargo containment• LNG carrier cargo containment production support and technology implementation | <ul style="list-style-type: none">• Ship companies (Hyundai Heavy Industries, STX, Samsung Heavy Industries, Hyundai Mipo Shipbuilding, etc.)• Korea Gas Corporation |



< LNG Process Chain >

3. Marketability Analysis (2)

► LNG Market Status

- **World LNG consumption has been growing rapidly since 2000, and Europe and North America account for more than half of world production and consumption.**
- **According to Frost & Sullivan's analysis of LNG consumption by sub-items in 2015, global LNG consumption in 2015 is 335 Bcf / d, which is expected to increase by 2.59% annually, reaching 382 Bcf / d by 2020**

< World LNG Consumption Trend >

(Unit : Bcf/d)

| Division | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2020 | CAGR(2009-2015) |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|
| LNG Consumption | 287.3 | 304.4 | 315.9 | 322.8 | 327.1 | 328.3 | 334.9 | 382.3 | 2.59% |

3. Marketability Analysis (3)

► Global Market Forecast for LNG Carriers

- The global market for LNG carrier will increase from 14 vessels in 2017 to 36 vessels in 2018 and will maintain 36 vessels by 2025 (Clarkson Research 'Long-term Outlook Report')
- Global LNG Consumption CAGR of 2.59% will increase to 46 vessels in 2035

< Global Market Forecast for LNG Carriers >

(Unit : Ships)

| Division | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|--------------|------|------|------|------|------|------|------|------|------|------|
| World market | 5 | 14 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Division | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
| World market | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |

► LNG cargo containment technology fee World market estimate

- The world market for LNG cargo hold technology fee will increase from 56 billion won in 2017 to 186 billion won in 2035.

< LNG cargo hold technology fee World market estimate >

(unit : 0.1 Billion)

| Division | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Technology fee | 200 | 560 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 | 1,440 |
| Division | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 |
| Technology fee | 1,477 | 1,516 | 1,555 | 1,595 | 1,636 | 1,679 | 1,722 | 1,767 | 1,813 | 1,860 |

4. Business Value / Technology Valuation

► Evaluation Value of ‘LNG Carrier Performance and Design’ Technology Business owned by KOGAS

(unit : 0.1 Billion)

| Divisions | 2020 | 2021 | 2022 | 2023 | 2024 | ... | 2027 | 2028 | ... | 2031 | 2032 | 2033 | 2034 | 2035 |
|--------------------------------------------|-------|-------|-------|-------|-------|------------------|-----------|-------|------------------|-------|-------|-------|-------|-------|
| Sales | 14.4 | 36 | 44.6 | 59 | 89.3 | Mid- omission | 148.5 | 167.9 | Mid- omission | 250.1 | 273.8 | 335.7 | 344.4 | 353.3 |
| Cost of sales | - | - | - | - | - | | - | - | | - | - | - | - | |
| Royalties (income) | 14.4 | 36 | 44.6 | 59 | 89.3 | | 148.5 | 167.9 | | 250.1 | 273.8 | 335.7 | 344.4 | 353.3 |
| Selling expenses & administrative expenses | 3.9 | 9.9 | 12.2 | 16.2 | 24.5 | | 40.7 | 46 | | 68.5 | 75 | 92 | 94.4 | 96.8 |
| Operating profit | 10.5 | 26.1 | 32.4 | 42.9 | 64.8 | | 107.8 | 121.9 | | 181.6 | 198.8 | 243.7 | 250 | 256.5 |
| Corporate tax | 2.1 | 5.5 | 6.9 | 9.2 | 14 | | 23.5 | 26.6 | | 39.7 | 43.5 | 54.4 | 55.9 | 57.5 |
| Operating profit after tax | 8.4 | 20.6 | 25.5 | 33.7 | 50.8 | | 84.3 95.3 | | | 141.9 | 155.3 | 189.4 | 194.1 | 199.1 |
| Capital expenditure | 3 | 4.7 | 2.3 | 3.6 | 7.1 | | 10.2 | 6.1 | | 4.7 | 8.4 | 16.6 | 6.5 | 6.7 |
| Net Operating capital | 1.8 | 2.7 | 1.1 | 1.8 | 3.8 | | 5.3 | 2.4 | | 0.8 | 3 | 7.8 | 1.1 | 1.1 |
| Depreciation cost | 0.2 | 0.5 | 0.6 | 0.8 | 1.3 | | 2.1 | 2.4 | | 3.5 | 3.8 | 4.7 | 4.8 | 5 |
| Return on Investment | | | | | | | | | | | | | | 112.7 |
| Net cash flow | 3.8 | 13.7 | 22.7 | 29.1 | 41.1 | | 70.9 | 89.1 | | 139.9 | 147.7 | 169.6 | 191.4 | 308.9 |
| Capitalization Rate | 9.60% | 9.60% | 9.60% | 9.60% | 9.60% | | 9.60% | 9.60% | | 9.60% | 9.60% | 9.60% | 9.60% | 9.60% |
| Present value Factor | 0.693 | 0.632 | 0.577 | 0.526 | 0.48 | | 0.365 | 0.333 | | 0.253 | 0.231 | 0.211 | 0.192 | 0.175 |
| Present value | 2.6 | 8.7 | 13.1 | 15.3 | 19.8 | | 25.9 | 29.7 | | 35.4 | 34.1 | 35.7 | 36.8 | 54.1 |
| Business value (17.01.01) | 417 | | | | | | | | | | | | | |
| Technology contribution | 100% | | | | | | | | | | | | | |
| Total technology value | 417 | | | | | | | | | | | | | |
| Technology to be evaluated | 100% | | | | | | | | | | | | | |
| Technology Value to be Evaluated | 417 | | | | | | | | | | | | | |

5. Industry association analysis (1)

► Overview of Economic Impact Analysis Based on Technology Value

Reclassification of industry

- Definition of technology to be evaluated
- Standard Industrial Classification (KSCI) Mapping of Target Technology
- Industrial Classification and Korea Bank Product Classification Mapping
- Reclassification of the industry association table

Ripple effect estimate range of analysis

- Cost Benefit Analysis Scope
 - Benefit Analysis
 - Cost Analysis
- Derivation of reclassified industry-specific table induction coefficient
 - Production induction coefficient
 - Value-added induction coefficient
 - Employment induction coefficient
 - Employment induction coefficient

Impact analysis

- Analysis of economic effect through cost benefit analysis
 - Business Value B / C ratio
 - Technical value B / C ratio
- Analysis of Economic Impacts through Industry Linkage Analysis
 - Production inducing effect Value-added effect
 - Employment inducement effect
 - Employment inducement effect

5. Industry association analysis (2)

► Impact analysis

Summary of ripple effects through industry association analysis

| Division | Investment amount | Induced effect | Economic contribution |
|------------------------------|-------------------|----------------|-----------------------|
| Production inducing effect | 21.79 Billion | 2.044 | 44.5 Billion |
| Value-added effect | | 0.631 | 13.7 Billion |
| Employment inducement effect | | 9.382 | 204.42 Person |
| Employment inducement effect | | 7.186 | 156.57 person |

Economic Impact Comprehensive

| Division | | Economic contribution | |
|------------------------|------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------|
| Direct Ripple effect | Technical ripple effect | Technical value | B/C ratio: 1.23 Benefit (present value): 41.7 Billion Cost (present value): 33.8 Billion |
| Indirect Ripple effect | Production inducing effect | 44.5 Billion | |
| | Value-added effect | 13.7 Billion | |
| | Employment inducement effect | 204.42 Person | |
| | Employment inducement effect | 156.57 Person | |



Thank you very much!

“What is essential is invisible to the eye”
-“The Little Prince” by Antoine de Saint-Exupéry