

THE INTRODUCTION METHOD OF TECHNOLOGY MANAGEMENT IN THE OIL AND GAS PLANT INDUSTRY

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Abstract

Recently orders of projects in the field of oil and gas plants have increased due to rising oil prices and consumption. The markets of oil and gas plants are expanding into the Middle East area and all over the world. Because the oil and gas markets have a lot of overseas construction operations, competition among advanced companies is more important. However, companies in the period of growth have not had enough competitive powers of license in the design phase. Therefore, they are faced with difficulty of adopting the technology which is maximizing the effect of investments, and scheduling of a long-range plan.

In order to achieve adequate technology management and competitive power, this study considers a long-range plan through an analysis of an appropriate introduction and the strategic planning process of technology management.

Keywords: Oil and Gas Plant, Technology Management, Technological Competitive Power

1. Introduction

Recently orders of projects in the field of oil and gas plants have increased due to rising oil prices and consumption. The markets for oil and gas plants are expanding into the Middle East, Brazil, Russia, India and China. In the world market, which experiences intense competitiveness among companies, project success depends on the achievement of technological capabilities and granting of licenses for the manufacturing and the progress of refineries. A core technology related to projects decides work processes of Engineering, Procurement and Construction, and the influence on competitive power of businesses. The Plant industry has a lot of overseas construction operations, so an achievement of core technology and technology management which maximizes the effect on the investment of technology is essential for increasing international competitive power. However, companies in the period of growth have had difficulty in adapting management of technology and scheduling of a long-range plan, due to financing problems and a lack of understanding about technology management.

In order to achieve international competitive power, this study considers an introduction method and strategic planning process of technology management. First of all, a definition and purpose of technology management is reviewed. Then, this paper investigates problems which must be solved for the induction of technology management, and makes an analysis of Korean companies having oil and gas plants, in order to better understand the

technological environment. Lastly, we consider an introduction and strategic planning process through items of diagnosis and the extraction matrix of core technology.

Phases of adoption may be summarized as follows:

- (1) Analysis of levels of technology and diagnosis of technology management;
- (2) Extraction of a promising core technology;
- (3) Establishment of the introduction process;
- (4) Establishment of the strategic planning process;
- (5) Planning of research expenses of technological development.

2. Background of Technology Management

2.1 Definition of Technology Management

In many ways, management of technology is not a new field. The beginnings of technology management can be traced to the 1950s, when R&D management ideas were developed; this was a period characterized by plentiful resources for R&D. During the 1960s and 1970s, there was interest in understanding innovation. Stanford University's Technology Management Program course adopted Management of Technology in the middle of the 1980s. Then, in the beginning of the 1990s, MIT (Massachusetts Institute of Technology) made an established usage of the Management of Technology Program course.

The various organizations and definitions of management of technology are given below in table1.

Table 1. Definition of Management of technology

Organization	Definition
The National Research Council, 1987	Management of technology links engineering, science and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational goals of an organization.
F. Betz, 1987	Management of technology is an activity which is able to develop the competitiveness of organizations through new technology.
Stanford Research Institute(SRI), 1989	The purpose of technology management maximizes the effects of investment in technological development.
Khalil, 1993	A field of knowledge concerned with the setting and implementation of policies to deal with technological development and utilization, and the impact of society, organizations, individuals and nature. It aims to simulate innovation, create economic growth, and to foster responsible use of technology for the benefit of humankind.

The three important ideas incorporated in the preceding definitions are worthy of repetition:

- The emphasis in the management of technology is to accomplish the goals of an organization.
- Technology management focuses on the development of technological capability and its implementation or deployment in products and processes.
- Technology management within corporations is linked to other management activities.

2.2 Purpose of Technology Management

The plant industry needs domestic workers as well as local workers. Therefore, it has to form strong relationships between stakeholders who may be clients, designers, builders or subcontractors. Because implementation of projects requires the use of labor and financial resources, the goals of technology management must be suggested in order to fulfill the business strategy. Table 2 presents the goals of technology management and their details.

Table 2. Goals of Technology Management

Goals of technology management	Detail of goals
Management of Research	<ul style="list-style-type: none"> • Market analysis • Competition analysis • Investment of research & quantitative evaluation • Quest for new technology
Connection between Management Strategy and Technology Strategy	<ul style="list-style-type: none"> • Connection between strategies • Dominant competitive power • Strategy of globalization
Establishment of Technology Strategy	<ul style="list-style-type: none"> • Employment of chief technology officers • Presentation of vision • Long-range plan of technology strategy
Efficiency of Investment Technology	<ul style="list-style-type: none"> • Support system of R&D • Reinforcement of R&D • Technical cooperation • Evaluation of investment
Development of Technological Talents	<ul style="list-style-type: none"> • Encouragement of creativity • Introduction of Balanced Score Card • Acquirement of technical experts • Fulfillment of talent educational program
Efficient use of Management Resources	<ul style="list-style-type: none"> • Use of external technology • Management of intellectual property • Knowledge Management • Reinforcement of financing

3. Analysis of the technological environment to introduce technology management

Korean companies which are suitable for making a comparison between advancing companies and companies in the period of growth, so they have been chosen for the purpose of analyzing the technological environment.

3.1 Technological environment of companies in the growth period

Korean companies with oil and gas plants do not use the original technology of the LNG process. However, they do possess some basic engineering technology. Considering the business record of oil refining and petrochemistry operations, the project management of detailed engineering and construction is deemed to have remained professional.

Nevertheless, their profits are less than those of advancing companies. While advancing companies have their own licenses and basic engineering technology for the LNG and GTL (Gas to Liquid) disciplines, companies in the period of growth have had the capability to do detailed engineering and construction, which is not a relatively higher value-added business. One of the reasons they have different technological capabilities is that companies in the growth period have not invested sufficiently in technological development, due to financing problems and a deficient technological mindset.

Table 3. Technological level of Korean companies in the growth period

Field of Chemistry		License (Origin of Technology)	Basic Engineering	Detailed Engineering	Project Management	Commissioning
LNG		0	50	80	90	90
GTL	Syngas Production	0	0	90	90	90
	F-T Synthesis	0	0	0	0	0
	Reforming	0	0	90	90	90
Oil Refining		30	80	95	100	100

3.2 Problems to be solved in the introduction of Technology Management

The oil and gas plant industry requires human resources composed of engineers, as well as core technology, which is able to fulfill projects successfully. These factors have an enormous effect on the performance of projects and subsequent potential profits. Therefore, the business mind of engineers and technology management is more important than in other industries. Table 4 presents problems which must be solved while introducing technology management.

Table 4. Problems to be solved in the introduction of Technology Management

Division	Problems
Technological Capability	<ul style="list-style-type: none"> • Lack of system engineering • Evasion of core technological assistance • Difficulty of doing compound technological development • Lack of a National Research fund
Technological Investment	<ul style="list-style-type: none"> • Evasion of new technological investment • Long-term of withdrawal of funding
Administration	<ul style="list-style-type: none"> • Expectation of short-term performance • Negative administration • Excessive competition • Weakness of financing and information management
International Cooperation	<ul style="list-style-type: none"> • Difficulty of technical cooperation with developed companies
License	<ul style="list-style-type: none"> • Restrictions on use of technology

4. The introduction method of technology management in the oil and gas plant industry

Advanced companies in the oil and gas plant industry make efforts to acquire competitive power. Their means are M&A, technical cooperation, technical development, turnkey, project management system, customer service, localization, management innovation, and others. Acquisition of technical capability and management strategy is essential in realizing these efforts. This chapter includes a proposal for a suitable introduction and strategic planning process, through the extraction matrix of a promising core technology.

4.1 The introduction process of technology management

4.1.1 The diagnosis of technology management

In order to apply the technological administration process, oil and gas companies must first analyze their own technical environment, and select their own promising technology. For this selection, an index which suits the purpose of management must be used. This evaluation index is able to examine the administrative environment in detail. It was written as a basis of the SRI (Stanford Research Institute)'s report.

Table 5. Diagnosis items of technology management

Division	Detailed evaluation index
Development of Technological Talents	Expert(18), Interchange of personnel(8), Incentive program(10), Personnel management(10)
Investment of Technology	Standard of investment(22), Resource leveling(10), Decision making of investment(14), Benchmarking(16)
Development Capability of Technology	Organizing ability(10), R&D ability(20)
Information	IT capability(10), Utilization of external information(22)
Technical Cooperation	Partnership(14), Utilizable performance of external resource(20), Technical transportation(8), Encouragement of research(18)
Technology Strategy	Capability of fulfillment(24)
Internal Atmosphere	Esteem of technology(12)
CEO Mind	Business mind(8)
Outcome of R&D	Performance of R&D(18), Competitiveness of R&D(18)
Globalization	Global marketing(26)
Superiority of Competition	Comparison of Competitiveness(18), Financial structure(8)

The total score of the index reflects on a situation of technological administration. Table 6 shows the results of evaluation.

Table 6. Evaluation of the total score

Grade	Total score	Evaluation	Grade	Total score	Evaluation
AA	400~300	The highest level	C	49~-50	Middle level
A	299~150	Higher level	D	-51~-150	Low level
B	149~50	High level	E	Under-151	The lowest level

4.1.2 Extraction of the core technology

To select a promising technology a work list must be written based on the market stream, technology and technical effects. It needs a preceding analysis of required technology. This analysis should be considered by way of a matrix consisting of such things as the target market and project phase.

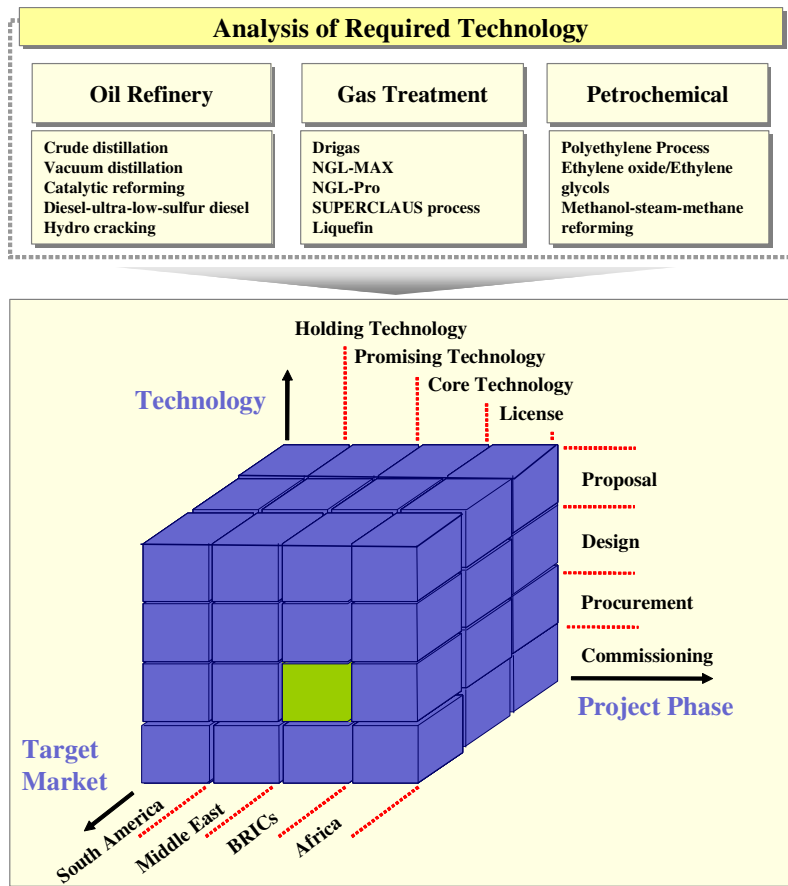


Figure 1. Extraction Matrix of Technology

4.1.3 Establishment of the introduction process

Diagnosis of management and a promising technology should be chosen to introduce technology management. Decision-making in technical development is performed by a technical report; economic trends and the advice of experts should follow up the long-range road map. The introduction process will involve changing from a promising technology to a core technology through various phases, such as decision-making, selection, examination, and negotiation.

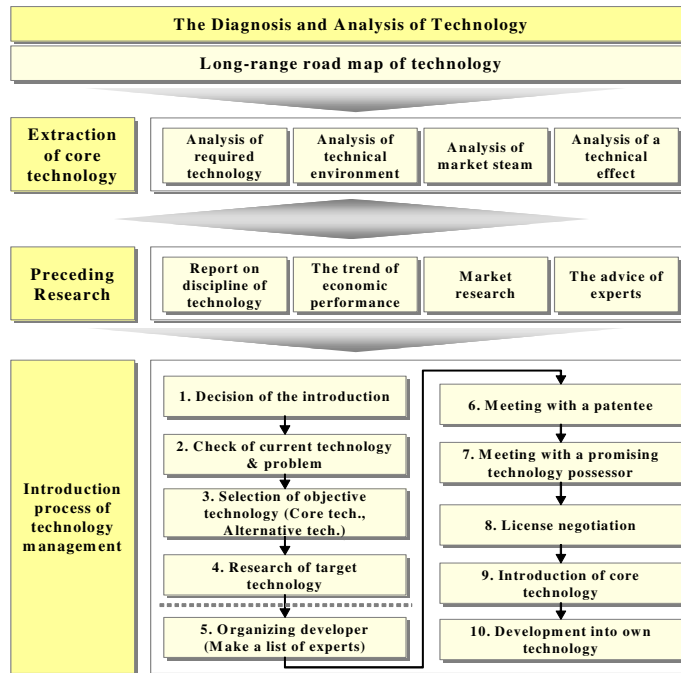


Figure 2. Introduction process of Technology Management

4.2 Establishment of the strategic planning process

After developing the introduction process, a promising technology becomes a strategic subject. The technical planning department and the research institute is established for drafting the business program chosen on the road map. Then, a drafting plan of business must consider reduction of risk. This will be carried out via R&D, technical cooperation, investment in facilities and Information Technology.

Figure 3 shows the strategic planning process of technology management.

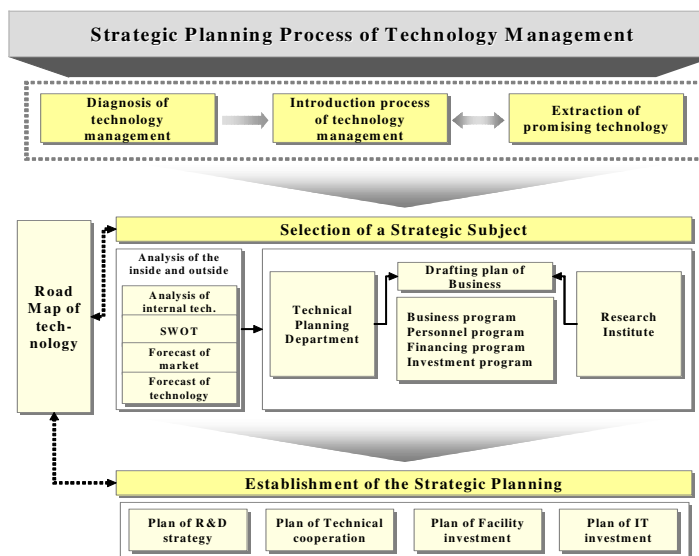


Figure 3. Strategic planning process of Technology management

4.3 Planning of research expenses of technological development

After the selection of the technical subject, research is beginning in earnest. In the stage of commencement of research, research expenses could be secured easily. But, the risk insufficient funding occurs during the experimental and the application stages. It is at these stages that a long time is required for fund-raising. Therefore, in order for continuous R&D and stabilization of technology management, an administrator should consider the planning of funding cautiously. For a smooth stream of research expenses, an educational-industrial-governmental complex must establish a research support system, as well as a mutual fund system.

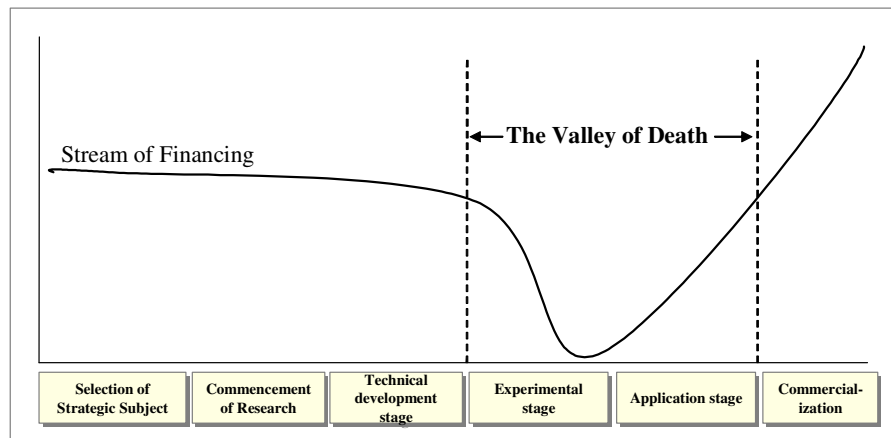


Figure 4. Stream of research expense

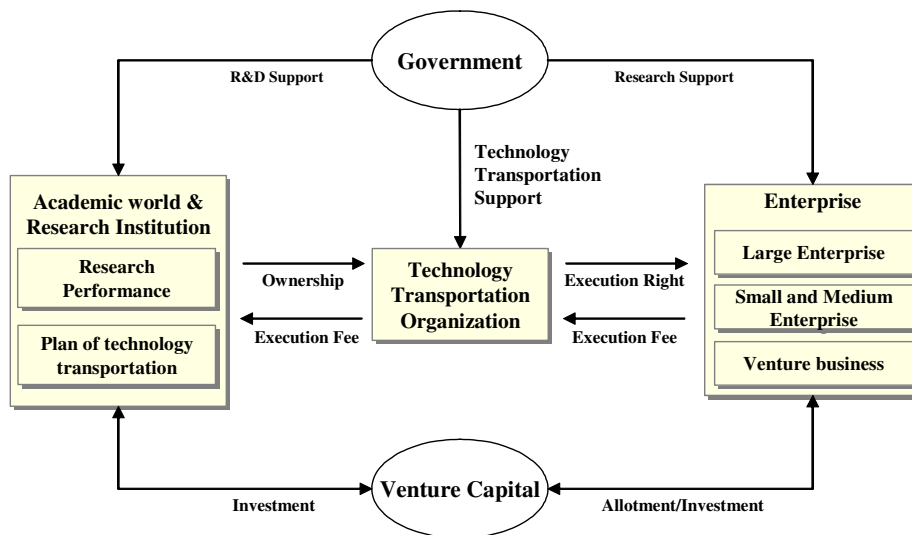


Figure 5. Construction of technical development environment

5. Conclusion

Experts are predicting a stabilized growth rate regarding orders of oil and gas plants. An administration system for technical development is essential to strengthen competitive power in the current international market.

This research investigates problems which must be solved for the induction of technology management, and makes an analysis of Korean companies having oil and gas plants that wish to grasp the technical capacity companies in the recent growth period. We consider a suitable introduction and strategic planning process through items of diagnosis and the extraction matrix of core technology. These processes are able to aid companies which require well-organized technical development and management.

6. Acknowledgements

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