

Qualitative Indicator Development of National Award for Innovation Leading Company

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국가상 혁신기업선정을 위한 정성지표의 개발

이재하

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Abstract This study focuses on the development of simple qualitative indicators for evaluating and selecting innovation leading companies that challenge National Award. Another purpose of this study is to complement the aspect in which the innovative or value of the companies' products, technologies, and services is only quantitatively evaluated. Existing evaluation indicators of national award have too many evaluation items and were not suitable for innovation-based company evaluation. The research approach is to select category for developing qualitative indicators based on previous studies and TF discussion. From the input-process-output-outcome point of view, we have set up an indicator system as a series of flows. Finally, five categories such as creativity, system excellence, customer value, performance, and ripple effects are selected as qualitative indicator. For these selected indicators, conceptual definitions and the main points of evaluation are described. And the system level evaluation and the ADLI approach are presented for reference. The appendix also includes examples of qualitative and quantitative evaluation of real companies using these indicators. However, this study implies the possibility that the evaluation results may vary depending on the level and perspective of the evaluator. We hoped that detailed research on candidate indicators that can be used as qualitative indicators and research on the development of mixed indicators(qualitative and quantitative) will continue in the future.

Key Words : National award, Indicator development, Performance indicator, Qualitative indicator, Innovation leading company, ADLI approach

요약 본 연구는 정부에서 수여하는 국가 상(賞)에 도전하는 혁신선도기업을 평가 및 선정하기 위한 정성지표개발에 초점을 맞추고 있다. 혁신선도기업을 지나치게 계량적으로 평가함에 따라 제품이나 기술, 서비스 등의 혁신성이나 가치 등이 평가가 절하되는 측면을 보완하는 것이 본 연구의 목적이기도 하다. 기존의 국가상 평가지표는 장점도 있지만 평가 항목이 너무 많아 혁신선도기업을 평가에는 적합하지 않은 측면이 있었다. 연구의 접근방법은 선행연구와 TF토의를 바탕으로 정성지표개발을 위한 항목을 선정하는 것으로 하였다. 기본적으로 투입-과정-산출-효과로 이어지는 일련의 흐름으로 지표항목의 체계를 갖추도록 하였다. 최종적으로 창의성, 시스템우수성, 고객가치, 기업성과, 파급효과 등의 5개 정성지표항목이 선정되었다. 선정된 5개 지표항목에 대해서는 개념적 정의와 평가시 주안점 등을 서술하였다. 그리고 시스템 수준평가와 ADLI 접근방식도 제시하였다. 부록에는 본 연구에서 제시한 정성지표를 활용하여 실제기업을 정성적, 정량적 양식에 따라 평가한 사례도 수록하였다. 그러나 본 연구는 혁신선도기업을 정성적인 접근방식으로 평가하는 것으로 설계되어 있어, 평가자의 수준과 관점에 따라 평가결과가 변동되는 가능성을 갖는 한계점이 내포하고 있다. 향후에는 정성지표로 활용될 수 있는 후보지표들에 대한 세부연구와 혼합지표(정량, 정성)의 개발에 대한 연구가 지속되기를 기대한다.

주제어 : 국가상, 지표개발, 성과지표, 정성적 지표, 혁신선도기업, ADLI 접근

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1. Introduction

Most companies are engaged in activities to increase their competitive advantage in technology and markets. Especially in the era of the 4th Industrial Revolution, the government interest in companies leading innovation is increasing. The government is also seeking policy development and support to foster companies that are leading the way in technological innovation.

As a method of selecting a support company, the Malcolm Baldrige National Quality Award (MBNQA) standard has been applied. And the evaluation indicators have been improved according to the National Award purpose. It has shifted from the manufacturer's point of view to the customer's point of view, and now places more emphasis on the quality and value's point of view[1].

While the various features of these indicators have a positive aspect of company evaluation and selection, and the direction of company development, it is not easy to apply these indicators to companies focused on new technological innovation in the fourth industrial revolution era. It is no exaggeration to say that the existing evaluation system has been mainly applied to companies with above-average and formal organizations and systems. Therefore, there were parts that could not be applied to various evaluation items, so there was an unreasonable aspect for the organization hosting the award or the companies applying.

Existing National Award indicators are not suitable for evaluating innovative companies because they have many evaluation category and focus on company maturity. Most of the existing indicators of corporate evaluation for the National Award are quantitative indicators, and target companies of a certain size or more. Technological innovation-oriented firms are

calling for the development of evaluation indicators that are appropriate for their companies and the development of qualitative indicators.

This study focuses on the development of qualitative indicator of National Award for innovation leading company. Quantitative access to innovation leaders can worsen future development and growth potential. And the perspective of indicator development focuses on input-process-output-outcome approach and the future development possibility of the company. Therefore, the purpose of this study is to suggest a conceptual direction on the development of qualitative simple indicators for the National Award for innovation leading companies.

2. Theoretical Review

2.1 National Award

The government has enacted the Productivity Award in 1987 and the Quality Management Award in 1994 to find these outstanding companies. Since the 2000s, governments, public agencies, media organizations, associations and consumer organizations have created and operated various awards, and the company has continued to challenge awards that match the characteristics of its products or services to demonstrate its excellence[2].

Internationally, Japan has established and operated the Deming Application Award in 1951 & Japan Quality Award (JQA) in 1996, the United States in 1987 with Malcolm Baldrige National Quality Award (MBNQA), and Europe's 1992 European Quality Award (EQA). These awards are aimed at enhancing the competitiveness of related industries by finding and sharing excellent companies. These awards have been continuously developed to reflect the

interests of the times in developing indicators and items for corporate evaluation and selection[3].

Today, the use of the term excellence instead of the term quality in the MBNQA and EQA should be noted that the competitive advantage of product or service quality must be linked to corporate competitiveness[4]. In this respect, attention should be paid to the development of evaluation indicators to measure not only the quality but also the excellence of technological innovation companies.

The Korea Quality Awards are composed of evaluation categories that include leadership & strategy, customer and market, measurement/analysis and knowledge management, human resources, operation management, and management performance[5]. In the Korea Productivity Awards, the evaluation category consists of leadership, customer, innovation, process, measurement/analysis, knowledge management, and management performance[6]. The evaluation categories for these awards are similar because they are based on MBNQA and have been slightly modified in accordance with the award criteria of the host institution. This study is based on Korea Productivity Awards categories as a starting point.

2.2 Innovation Leading Company

As the 4th industrial revolution entered the era, the government began to pay attention to innovative leading companies. Innovation leading companies are collectively encompassing venture companies, INNOBIZ companies, and management innovation companies.

According to Korea Productivity Award Guidebook[6], Innovation leading companies means that they seek to digitize manufacturing and services beyond the existing system, manufacturing and service methods, and collectively

refers to companies with new competitiveness or high potential. These companies are not existing large or midsize companies and are small but can be seen as having new competitiveness and development potential in their industries. Therefore, these companies are not limited to a specific industry but can be regarded as small and medium-sized enterprises with their own corporate competitiveness.

This study focuses on developing indicators to swim National Award in order to find and encourage innovation leading companies that can grow and develop[7]. For these indicators, it is necessary to consider the results of research that the development of indicators that complement qualitative and process aspects is required[8]. In particular, it is important to see if a new technology(product, service etc) innovation company has creativity and a system that can produce distinct results.

3. Selection of Indicator's Items

3.1 TF operation for indicator development

The TF was operated for 5 months (2018.11~2019.03) for the development of the indicator. The TF included the head of this study, the KPC(Korea Productivity Center) indicator team and four experts of indicator development. After 5th discussions, the TF assisted in setting the direction and developing the framework for indicator development. The following category were derived in the direction for the development of these indicators.

- ① Qualitative approach rather than quantitative
- ② Abbreviation of existing National Award category
- ③ Focus on newness(tech. service, system, product etc)
- ④ Consider Input/Output/Outcome flow scheme

- ⑤ Future growth & possibilities of development
- ⑥ Derivation of general indicators(category)

3.2 Category for indicator development

After 5th discussions of TF, the main categories were identified by reducing the variables used in the existing National Productivity Award. The final five categories of qualitative indicators are summarized in Table 1.

Table 1. Category for Indicator development

Major Category		
Korea Productivity Award	TF discussion	TF discussion
	1st-3rd	4th-5th
Leadership ¹⁾	-	-
Innovation	Innovative & Creativity	Creativity (Innovative)
Measurement/Analysis	Operation System	System Excellence
Customer	Customer	Customer Value
Human Resource ²⁾	-	-
Process	Process System	System Excellence
Management Performance	Output	Performance
	Outcome	Riffle Effect

1), 2) : Most of the technology companies applying for National Awards are small and medium in size but excellent in leadership and human resources. These are treated as default categories.

The category selection of indicator in line with the purpose of this study is the core of this research. What we consider first as the category of the indicator is creativity or innovative. The creativity or innovative of individuals, organizations is the biggest feature of technology innovation companies[9,10]. It is a general orthodox idea that creativity or innovative activities have a positive effect on its performance. The trend of patent application, which is the result of R&D activities,

significant in explaining sales and innovation performance by type[11]. And Innovators can also find examples of evidence of innovation and creative imitations of their approach to other companies or sectors.

The second category is the excellence of the system. It is impossible to generate results without a good system(R&D process or management system etc.). Previous studies show that system maturity has a positive effect on corporate performance[12,13]. Innovation leading companies are also difficult to secure competitiveness without systems.

Third, we can think about customer value because customer value is the most important factor for survival in the technical field and market. Research has shown that customer value positively impacts business performance[14,15].

Fourth, we can consider the indicator category related to the output based on the input and the process of the superior system. The government will be interested in finding companies with high output and promoting and sharing them[16].

Finally, we can envisage an category of indicator about the ripple effect of the output being applied to the relevant company or market. The ripple effect can also be considered as an economic ripple effect. Research on the ramifications of specific technologies or products is readily available[17]. The government is also trying to find the excellence of innovation leading companies that have received National Award.

4. Indicator Development

The conceptual definitions that make up the indicators are summarized in Table 2.

Table 2. Conceptual Definitions of Indicator Category

Classification	Define
Creativity (Innovative)	The extent to which new or improved developments have been made in terms of the quality of products, technologies, services, etc., compared to existing outcomes and levels.
System Excellence (Operation & Process)	Systematic ability of companies to manage their tangible and intangible resources to actually implement new technologies, products, customer values and services.
Customer Value	New achievements generated from new technologies, new products, new services, etc., and the extent to which our service operation system contributes to customer value creation
Performance (Output)	Qualitative / quantitative performance through the implementation process and results of new technologies, products, customer values and services
Ripple Effect (Outcome)	The extent to which the outcomes (results) generated as a result of qualitative/quantitative performance are spread (proliferation possibility) to the same industry or other industries.

Fig. 1 shows the category of indicator as a model of one process. This is because input, output and ripple effects can be seen in a series of flows in selecting excellent companies. The ranges or boundaries for each category in the flows below reflect the views of the researcher and may vary depending on the point of view.

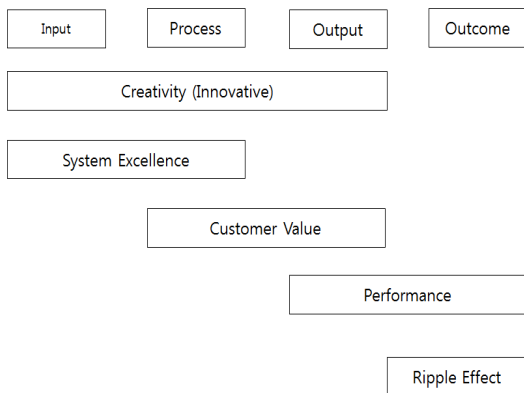


Fig. 1. Conceptual Model

5. Evaluation Criteria

To assess the level of applied companies based on indicator category, this study devised

detailed question items as follows Table 3. Based on these items, the company's level can be estimated and the evaluation grade can use the most common 5-point or 7-point scale, if necessary, the 100-point(or 1000-point) scale can be used.

In particular, innovation leading companies have their own technologies, products, or services development systems, which can be viewed as a result of creative performance[18]. However, cognitively, the categories presented in this study are marked as distinct, but they can be regarded as a series of interrelated flows in reality.

In addition, the growth and development potential of the leading company depends on the evaluator's expertise in consideration of quantitative data. And it is necessary to pay attention to analyzing the level of system construction and operation of applicants for the National Award, and the criteria in Table 4 below are worth referencing.

Table 4. System Level

System Operation & Analysis Level	S				90%	100%
	A				70%	80%
	B				60%	70%
	C	30%	40%	50%	60%	70%
	D	20%	30%	40%	50%	60%
System Construction Level		D	C	B	A	S

* D: Lowest level, B: Fair level, S: Higher level
(The higher the percentage, the higher the level of system construction, operation and analysis)

And the quality of management should be good for innovation leading companies to be excellent enough to receive National Award. At this time, as applied by MBNQA, it is also necessary to evaluate to what extent the cycle of ADLI (Approach, Deployment, Learning, Integration) is settled in the applicant company[19]. In general, the more well-organized the ADLI cycle is, the more likely it is for innovative results.

Table 3. Itemized Questions(IQ) and Evaluation Points(EP)

Classification		Contents
Creativity (Innovative)	IQ	<ul style="list-style-type: none"> •What is the level of individual capacity, education, etc. to increase creativity? •What is the level of support and investment in the organization to increase creativity? •Is the level of innovation for creativity really competitive? •Do you think your technology or product is creative in the same industry or global market?
	EP	<ul style="list-style-type: none"> •Competitive advantage technology and product development based on fresh and unique ideas •R&D capability (levels) and activities to develop new technologies & products, and new service •Whether to develop products by utilizing new technologies such as AI, IoT, Big data, AR, VR, etc. •Collaboration with customers, partners (open innovation activities)
System Excellence (Process)	IQ	<ul style="list-style-type: none"> •Is the level of system currently running in the enterprise to maintain its competitiveness? •Are the capabilities of the people who operate the system of the company and the level of investment (management) of the company excellent? •Is the current system consistent from corporate strategy to performance management and performance evaluation? •Does the current system have a comparative advantage over other companies in the industry?
	EP	<ul style="list-style-type: none"> •Process of operation, improvement and development of new system established to effectively manage and operate our tangible and intangible resources •Improvement activities for management processes to improve technology level and product quality •System to build an innovative organizational culture, such as the operation of an incentive system that encourages innovation •Performance of system operation for collecting, processing and responding to environmental changes and customer needs (measurement and analysis)
Customer Value	IQ	<ul style="list-style-type: none"> •Is the level of activities such as collecting and analyzing customer data systematically to create customer value? •Is the level of utilization and response to customer requirements excellent for the collected and analyzed customer information? •Are the internal customer's level of competence to enhance customer satisfaction and create customer value? •Is the evaluation of newly created customer value in the industry or global market excellent?
	EP	<ul style="list-style-type: none"> •Providing value that customers value or proposing new value that customers expect •Performance to provide new customer service and create customer satisfaction (level) •Activity performance for customer satisfaction such as handling customer complaints, responding to customers, and prompt service (level) •Presence of organizations to identify and respond to customer and market needs
Performance (Output)	IQ	<ul style="list-style-type: none"> •Is the level of goal setting of the company set up to generate the result excellent? •Are the activities performed to achieve the set goals varied and effective? •Has the performance achieved varied in both quantitative and qualitative terms? •Was the generated corporate performance ultimately linked to the competitive advantage of the company?
	EP	<ul style="list-style-type: none"> •Increasing sales, cost reduction and value added as financial performance •Patent registration (number) and brand image enhancement according to technology development •Reduced delivery time, reduced defects, energy savings •Company's Achievements Seen as Productivity Performance
Ripple Effect (Outcome)	IQ	<ul style="list-style-type: none"> •Are you creating social contributions such as new technology creation, employment, and regional economic development? •How much did it contribute to national productivity, economic development, industrial competitiveness, and increased exports? •Are the outcomes of the case spread (probable) and shared with other companies and industry? •Are the outcomes (results) of the case spread (probable) and shared with other industries?
	EP	<ul style="list-style-type: none"> •Social contributions such as creating jobs and revitalizing the local economy. •National productivity improvement, economic development, industrial competitiveness improvement, export increase, etc. •Achievements of our innovation cases spread to related industries and companies •Records of innovations shared by the company (case presentations, benchmarking, etc.)

Table 5. ADLI Approach

Cycle	Key Activity
Approach	<ul style="list-style-type: none"> •What is the most important business challenge? •What is the most important issue? •What approach do you use to resolve issues? •Is the approach suitable for issue resolution?
Deployment	<ul style="list-style-type: none"> •Is the approach going well as planned? •Is an effective approach applied across all organizational units?
Learning	<ul style="list-style-type: none"> •Are you evaluating the performance and effectiveness of your approach? •Are you improving and innovating your approach?
Integration	<ul style="list-style-type: none"> •Is the approach aligned across the enterprise? •Are there continuous improvements /innovations to the approach?

6. Conclusions

Entering the fourth industrial revolution era, interest in new evaluation methods for evaluating companies that lead innovations is increasing. Although some of the advantages of traditional metrology-based evaluation methods exist, there is a limit to selecting innovation leading companies. This study focused on the development of simple qualitative indicators for selecting and evaluating these companies that challenge the National Productivity Award.

In this study, five categories were selected based on the results of previous studies in order

to develop a scale applicable to innovation leading companies. Five categories were creativity, system excellence, customer value, performance and ripple effect. The selected indicator items were also linked in terms of input-process-output-outcome. And the indicators were summarized in terms of concepts and evaluation points details. In addition, this paper presented conceptually the evaluation criteria for evaluating the system level of innovative companies and the ADLI Approach that can be used to evaluate the overall management. In this appendix, a case of evaluating the innovation leading company using simple indicators developed in this study is presented.

The academic and practical implications of this study are as follows. A qualitative approach is also available in evaluating innovative leading companies that are challenging the National Award. Also, one criterion was suggested in developing a qualitative evaluation indicator for selecting innovative companies by this study. This aspect of indicator development as a series of flows from an Input /Output perspective is meaningful. However, in practice, the weighting ratios of the indicators can be applied differently in utilizing the indicators suggested in this study. And it is necessary to pay attention to evaluator selection because qualitative evaluation can be influenced by evaluator's professional level.

There are some limitations in this study. Qualitative indicators are categorized based on theoretical studies and TF use in this study, but there are many candidate categories that can be used. In addition, there was a lack of analysis on the definition and characteristics of innovative leading companies emerging with the emergence of the fourth industry.

The future research directions are as follows. In evaluating innovative leading companies that

challenge the National Award, it is necessary to conduct research that develops a mixture of quantitative and qualitative indicators. And the operation of the TF for the development of the indicator was carried out, but further studies using the Delphi method need to be continued. Whether it's a quantitative or simply qualitative assessment of innovative companies that challenge the National Award, it is important to identify and encourage them.

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Appendix A (Example of Qualitative Approach based on a score of 1,000)

Item	Evaluation Score		Evaluation Opinion					
	Creativity (200)	Very Good	100%, 95%	<ul style="list-style-type: none"> Selected as a venture company and Inno - Biz company as a hydropneumatic (high pressure hose) SME The central region has the largest hydraulic components. Training and regular seminar for creativity development 4 times a year Expert advice and consulting for creativity development 	200 점	×	75 %	=
Excellence		94%, 85%						
Fair		84%, 75%						
Poor		74%, 65%						
Very Low		64%, 55%						
Sum		75	%					
System Excellence (200)	Very Good	100%, 95%	<ul style="list-style-type: none"> TPS, TPM, Quality Management, Cost Innovation, etc. for Production Manufacturing Innovation ERP system level and version currently in operation are superior to those in the industry System software upgrade every year 	200 점	×	80 %	=	160
	Excellence	94%, 85%						
	Fair	84%, 75%						
	Poor	74%, 65%						
	Very Low	64%, 55%						
	Sum	80						
Customer Value (150)	Very Good	100%, 95%	<ul style="list-style-type: none"> Reflecting customer value elements to design first when developing products Dedicated team analyzing market and customer information Design review between design, sales, and manufacturing Analyzes/responds to market response to products in real time 	150 점	×	80 %	=	120
	Excellence	94%, 85%						
	Fair	84%, 75%						
	Poor	74%, 65%						
	Very Low	64%, 55%						
	Sum	80						
Performance Output (300)	Very Good	100%, 95%	<ul style="list-style-type: none"> Financial performance has been trending somewhat over the last three years. Productivity and heavy defect rate are decreasing Value-added rate appears to rise gradually 5 patent applications and 2 patent registrations this year 	300 점	×	70 %	=	210
	Excellence	94%, 85%						
	Fair	84%, 75%						
	Poor	74%, 65%						
	Very Low	64%, 55%						
	Sum	65						
Ripple Effect (150)	Very Good	100%, 95%	<ul style="list-style-type: none"> Selected this year as an excellent production innovation company SME high pressure hose field- Mold magazine introduction Recruitment of relevant personnel to strengthen the export sector this year 	150 점	×	70 %	=	105
	Excellence	94%, 85%						
	Fair	84%, 75%						
	Poor	74%, 65%						
	Very Low	64%, 55%						
	Sum	70						
Total Score								745 점

Appendix B (Example of Quantitative Approach based on a score of 1,000)

Item	Criteria (Level)	Scale Point				
Creativity (200)	Innovative of newness, uniqueness of technology, product, service etc.	(50)	40	30	20	10
	R&D Level & Activities	50	(40)	30	20	10
	New Technology(AI, IoT, AR, VR etc.) Utilizing	50	40	(30)	20	10
	Collaboration (Open Innovation)	50	40	(30)	20	10
	Sub Total Score	150				
System Excellence (200)	System Construction Level	50	(40)	30	20	10
	System Operation Level	50	(40)	30	20	10
	System Improvement Activities	50	(40)	30	20	10
	Information Measurement & Analysis	50	(40)	30	20	10
	Sub Total Score	160				
Customer Value (150)	Discover New Customer Value	40	(32)	24	16	8
	Meet Customer Expected Needs, Service etc.	40	(32)	24	16	8
	Customer's Organization & Strategy	40	(32)	24	16	8
	Handling Customer Complaints	30	24	(18)	12	6
	Sub Total Score	114				
Performance Output (300)	Financial Performance	80	(64)	48	32	16
	Intellectual Property Performance	80	(64)	48	32	16
	Productivity Performance	80	64	(48)	32	16
	Company Reputation Performance	60	64	48	(32)	16
	Sub Total Score	208				
Ripple Effect (150)	Spread to the Same Industry(Companies)	40	(32)	24	16	8
	Spread to Other Industry(Companies)	40	32	(24)	16	8
	Contribute to Local and Industrial Economies	40	32	(24)	16	8
	Secure Future Competitiveness	30	(24)	18	12	6
	Sub Total Score	104				
Total Score		736 점				