Analytic Hierarchy Process Analysis on the Economic Effects of the Film Development Fund in Korea

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Abstract— **The film development fund was established to enhance the quality of film art and promote motion pictures and video products. To secure the policy feasibility of the film development fund and enhance the effectiveness of the support, the economic effects of the film development fund should be analyzed. Our main purposes in this study are to develop a quantitative model for analyzing the economic effects of the film development fund in the motion picture industry and to conduct an empirical analysis using actual data.**

Index Terms—**analytical hierarchy process, economic analysis, film development fund, motion picture industry**

I. INTRODUCTION

In recent years, the cultural content industry has attracted attention as a new growth engine for national development. In particular, the motion picture industry, which grows together with many related industries, is attracting much attention. The motion picture industry has a significant cultural and economic effect and plays a leadership role in the content industry. Advanced technologies, such as the 3D engine, are first piloted in the motion picture industry and then evolve as they spread to other industries, such as games and dramas. Therefore, the Korean government has introduced various support systems to promote the quality and quantity of movies produced by the film industry.

In 2007, the Korean government revised the 'PROMOTION OF THE MOTION PICTURES AND VIDEO PRODUCTS ACT (Article 23, Paragraph 1)' to establish and operate a film development fund to support the motion picture industry. The film development fund planned to raise 500 billion KRW by collecting 200 billion KRW from government contributions, 200 billion KRW from taxes on movie tickets, and 100 billion KRW from the balance of the existing film development fund. This was the third largest such fund at that time, behind the 590 billion KRW national sports promotional fund and the 520 billion KRW tourism promotion and development fund. When the law was introduced, the taxes on movie tickets, which are a main resource of the film development fund, were intended to expire in 2014, but now that expiration has been extended to 2021 because it is agreed that there have been the positive effects of the Film Development Fund on the Korean motion picture industry.

The Film Development Fund aims to improve the quality of film arts and to promote and develop the Korean film and video industries, thereby creating a stable investment environment and promoting additional markets, securing the diversity of Korean films and enhancing publicity, assisting in the export and international exchange of Korean motion pictures, and strengthening video technology and film policy research. To support the diverse sectors of the motion picture industry, the Film Development Fund has spent an average of 50 billion KRW annually from 2007. That support has strengthened the domestic film industry and stimulated new development in the motion picture industry. However, even though an analysis of the effects of this large-scale public fund is imperative, no research has yet been published about its economic effects. In spite of a positive evaluation of the effectiveness of the Film Development Fund, there is a growing need to reconsider a perception of the Film Development Fund's importance, role, and effects. Therefore, to secure the policy validity of the Film Development Fund and enhance the effectiveness of its support, it is necessary to study the fund's economic effects on the development of the Korean motion picture industry.

In the past decades, research on the film industry has been active due to the recognition of the industry's importance to the global economy and its key role in the entertainment market [1, 2, 3]. Research topics with a viewpoint of economic and managerial aspects ranges from the value chain of the motion picture industry [4], to the effects of celebrity to economic performance [5, 6], to the forecasting of economic performance [7, 8, 9], to marketing [10], and to the government policy [11, 12]. Among those various research areas, the research areas related to the economic effects of the film development fund to be analyzed in this study are the value chain of the motion picture industry, an economic analysis, and government policy.

In this study, we develop a quantitative model for analyzing the economic effects of the Film Development Fund in the motion picture industry with a new perspective of value chain of industry and an application of multi-criteria decision making method. Our model considers the film

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industry value chain and enables a quantitative analysis of the fund's economic effects by using actual data. For this purpose, we divided the value chain of the film industry, considering investment and production as the supply phase and distribution and exhibition as the demand phase. We then developed a model to assess the economic effects based on both the proportion of support from the Film Development Fund relative to the total input of each value chain phase and the relative contribution of each value chain phase to the total economic performance of film industry. In particular, in the process of assessing the economic effects using the quantitative model developed in this paper, we applied Analytic Hierarchy Process (AHP) method, which is one of the most popular method of multi-criteria decision making analysis, in order to quantify the values which can be determined by the subjective judgement of film industry's experts systematically. Using the model and data gathered from market and expert survey, we evaluated the effects of the Film Development Fund on the economic performance of the Korean film industry.

II. Model

A. Film industry value-chain model

To determine the effects of the film development fund on the domestic film industry, we first analyze the value chain and then evaluate the economic effects at each value-chain step. In addition, we need to identify the value chain and major business leaders. The value chain for the general merchandise industry consists of production, distribution, and consumption. Similarly, the film industry's value chain is composed of investment, production, distribution, and exhibition.

In the investment stage, investors from diverse backgrounds, such as the government, venture capital companies, and normal investors, participate and jointly undertake film investment. The production stage is directly related to all the actions required for film making, including film scripts, market research, and casting actors. The distribution stage includes promotional activities such as advertisement, marketing, and film distribution rights, as well as distributing the film to movie theaters. The exhibition stage covers selling the movie content using channels such as on-line digital, broadcasting, and exporting. Major business leaders in the film industry can also be divided into four sectors: investors, producers, distributors, and theaters.

Projects supported by the film development fund can also be classified according to the sectors of the film industry's value chain. The investment sector includes investments and financing enterprises. The production sector includes supporting film production, enhancing planning and development, developing human resources, supporting digital cinema, and managing the Namyangju studio. Distribution activities include supporting the distribution of the film industry as a whole, improving the distribution structure, and supporting overseas expansion. The fourth sector, exhibition, includes managing movie information systems and improving the exhibition environment. Some projects, such as assistance to private organizations, film supporting policy, improvements to the right to enjoy motion

pictures, and international film festivals, are difficult to classify in the value-chain model, so we clustered them into *others*. From 2008 to 2011, the largest average annual budget allocation was in investment, followed by production, distribution, exhibition, and others.

B. Economic effects analysis model

We can evaluate the effectiveness of the film development fund to some extent by reviewing how the film industry has grown, which assumes that increases in the funds dispersed by the film development fund are related to the overall performance indicators of the film industry. Our final goal in this research is to analyze the effectiveness of the film development fund across the entire film industry; however, it is rational to think that each stage of the value chain could react differently to support from the film development fund. Therefore, we set two assumptions for this study.

● Assumption 1: The performance of the entire film industry equals the sum of the performance at each stage of the value chain.

● Assumption 2: The film development fund's effects on the performance of a particular step in the value chain increase with the proportion of the fund's input to the total investment (from all sources) in that step of the value chain.

According to Assumption 1, it is possible to divide the performance of the entire film industry into the individual value chain sectors (investment, production, distribution and exhibition). However, it is difficult to identify the data directly related to the performance of the individual value chain sectors. In this study, we collect extensive opinions from experts in the film industry to determine the relative contributions of the relevant fields, and then we multiply the results of those calculations by the entire performance of the film industry to estimate the performance at each stage of the value chain.

Assuming that the performance of the film industry can be meaningfully categorized by value chain area, the effect of the film development fund can be estimated using the following formula, which considers the proportion of film development fund support relative to the total cost of each value chain area.

Economic effect of the film development fund
$$\sum_i (E \times \alpha_i^k) \times \frac{F_i}{I_i} \tag{1}$$

E: Economic performance (total sales revenue)
i: sector of the film industry's value chain
I_i : Input of the i-th value chain sector
F_i : Film development fund contribution to the i-th value chain sector
α_i^k : Relative contribution of the value chain's i-th sector to economic performance

III. ANALYSIS

A. Data

We use total sales revenue as the economic performance indicator for our quantitative analysis of the effects of the film development fund. <Figure 1> shows the annual total sales revenues of the film industry in Korea from 2008 to 2014, corresponding to E in Equation (1).
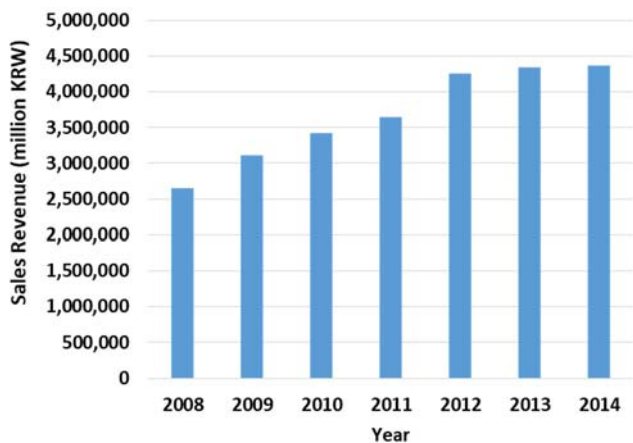

Fig. 1. Total sales revenues of the Korean film industry (million KRW)

There are no direct data on the amount spent in the film industry each year by value-chain area. Therefore, for the production, distribution, and exhibition steps, we use the net sales ratio and average net sales to net profit ratio from the 2010 Film Industry Survey and Korean Film Investment Profitability Analysis. We calculated the amount spent in the investment step using the total video investment in the combination scale proposed in the "2011 Korean Film Yearbook." Table 1 summarizes the inputs for each value chain area during the analysis period.

The film development fund, which provides support in each value-chain area, with unclear projects classified as *other*. These other areas of business affect all sectors, not just those related to investment, production, distribution, or exhibition. Therefore, we added the other sector's subsidies to each of the named sectors using the proportion of subsidies they received. Those results are shown in <Table 1>, which corresponds to F_i in Equation (1). <Table 1> shows the input by value chain area and the total film development fund by value-chain sector. <Figure 2> shows the sum of the input and total development funds, which corresponds to I_i in Equation (1).
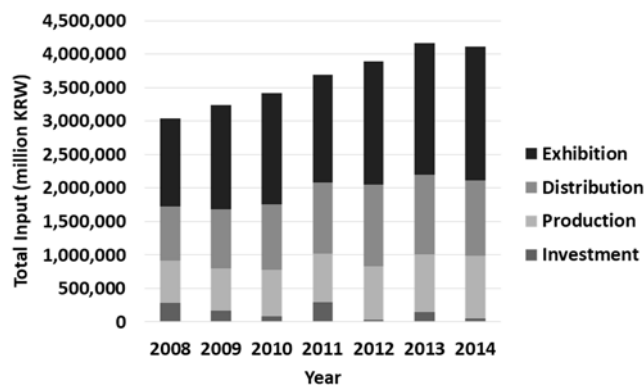

Fig. 2. Total input by value-chain sector (million KRW)

B. Determining the relative contribution factors

In our economic effects model, described in Equation (1), it is necessary to determine the values of the relative contribution factors of each sector in the value chain for each economic performance index (a^k). However it is difficult to find objective data to measure the relative contribution of each value-chain sector to the overall economic performance of the film industry. To determine the relative contribution factors, we used asked experts to complete a questionnaire. To estimate the opinions of the experts more systematically, we evaluated the values of the relative contribution factors using a method similar to that used in decision science to calculate the relative weights of decision factors using pairwise comparisons based on the AHP (analytic hierarchy process) technique.

The AHP provides a systematic and objective approach to multi-criteria decision making [13]. The strength of the AHP approach is its systematic breakdown of complex decision-making problems into many small but related sub-problems to form multiple levels of a hierarchy. The hierarchical structure of the AHP model permits decision-makers to effectively compare different evaluation criteria and alternatives. It offers an analytic tool to set relative importance or preferences based on experts' subjective judgments. Hence, we applied the AHP to determine the contribution factors by simply replacing the concept of relative importance in the AHP with the concept of relative contribution in our model.

In this study, the hierarchical structure is modeled using the value chain of the film industry, as shown in <Figure 3>. At the top level is the goal of the AHP analysis: to evaluate the contribution of each value-chain step to the economic performance of the film industry. At the second level of our hierarchy, the entire value chain is divided into supply and

TABLE I
Input: Film development fund in the film industry (million KRW)

	Investment		Production		Distribution		Exhibition		Total	
	Input	Fund	Input	Fund	Input	Fund	Input	Fund	Input	Fund
2008	260,100	19,574	617,709	14,354	801,362	10,766	1,311,867	3,806	2,991,038	48,500
2009	146,950	19,083	621,460	12,938	873,461	7,331	1,545,174	7,547	3,187,045	46,900
2010	69,000	16,281	677,776	11,7223	977,063	7,707	1,646,169	7,489	3,370,008	43,200
2011	235,600	55,231	711,572	19,228	1,049,069	7,514	1,605,673	3,205	3,601,914	85,200
2012	30,000	5,821	776,939	18,896	1,209,899	13,931	1,835,482	4,657	3,852,320	43,305
2013	134,000	11,836	845,061	16,703	1,175,075	14,873	1,965,093	2,722	4,119,229	46,134
2014	39,000	11,883	916,243	23,066	1,106,747	14,791	1,997,054	1,911	4,059,044	51,651

demand. Each side is further divided into two value-chain sectors: investment and production under supply and distribution and exhibition under demand.
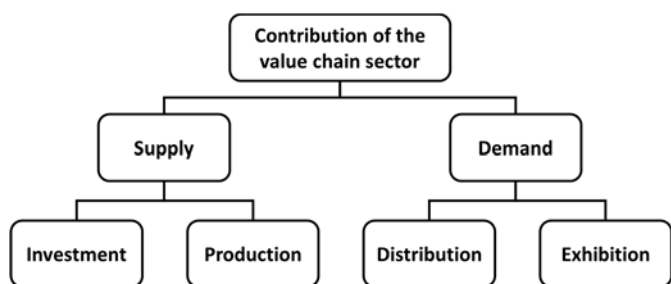

Fig. 3. Hierarchical structure of the film industry

We conducted a survey to collect expert opinions. Quantitative data gathered from the survey were used in calculating the relative contribution factors for each value-chain sector in the AHP hierarchy model. Twenty-one movie industry experts completed the questionnaire. The experts divided the contribution of each value-chain category as follows: investment, 26.9%; production, 11.5%; distribution, 15.4%; exhibition, 11.5%; and others, 34.6%. The experts' average tenure in the film industry was 9.6 years. Based on the results of the expert questionnaire, we constructed a pairwise comparison matrix, calculating and summarizing the relative contribution factors of each layer as shown in <Figure 4>. <Figure 4> illustrates the percentage values of the weights for all the contribution factors in each hierarchy, which we obtained by calculating the weight vectors in the pairwise comparison matrices.

Fig. 4. Weights of contribution factors

<Figure 4> shows that supply-side weights are higher than demand-side weights. Among the value-chain sectors that make up the supply side, the investment sector was rated higher, the distribution sector was rated higher on the demand side, and the investment sector had the largest contribution.

Multiplying the weight of each value chain sector by the weight of its parent factor yields the value of its relative contribution to a particular economic performance indicator of the film industry. For example, the contribution of the investment area to sales performance is 0.430, which is the contribution of the supply side in <Figure 4>, 0.668, times the contribution of investment, 0.643.

We can derive that investment has the highest contribution factor (0.430), followed by production (0.238), distribution (0.190), and exhibition (0.142). Therefore, the total sales revenue presented in <Figure 1> is different from the sales portion attributable to each value-chain sector. This result is separate from how the revenue from a movie is distributed among the value-chain areas of the film industry in reality. It shows how each value-chain area contributes to the economic value generated by a movie. Therefore, the results indicate that the investment and production sectors are more likely to

contribute to audience size than the distribution and exhibition sectors after film production.

C. Economic effects of the film development fund

In this paper, we analyze the economic effects of the film development fund during the seven years from 2008 to 2014 using the model in Equation (1), as shown in <Table 2>. Equation (1) includes total sales revenue <Figure 1>, the total input to each step in the value chain <Figure 2>, the film development fund contribution to each step in the value chain <Table 1>, and the weights of the contribution factors.

TABLE II
Economic effects of the film development fund (million KRW)

Year	Economic Effects				Total
	Investment	Production	Distribution	Exhibition	
2008	79,624	32,933	19,980	5,418	137,956
2009	91,628	35,157	16,238	12,483	155,506
2010	86,745	35,149	18,723	13,610	154,227
2011	274,980	59,796	19,472	6,308	360,556
2012	40,044	68,576	41,092	10,626	160,338
2013	81,206	62,313	44,591	6,381	194,491
2014	82,158	84,783	44,708	4,529	216,179
Total	736,386	378,707	204,804	59,355	1,379,252

<Table 2> shows that the effect of the film development fund on the economic performance of the motion picture industry for the 7 years from 2008 to 2014 is more than 1.3 trillion KRW. This is about 5.4% of the total market size of the Korean film industry based on revenue, which is about 3.7 times the funds invested. This is thus a positive evaluation of the effects of the Korean film development fund on the economic performance of the film industry.

Admission tickets for movie theaters have been a major source of funding for the film development fund since 2007, with 2,606 billion KRW collected by 2014. The film development fund promoted quality improvement in Korean films, and it became a way to spread the excellence of Korean films around the world by holding international film festivals and winning prizes at overseas film festivals. The excellence of Korean films has produced pivotal economic effects for the whole motion picture industry, such as reaching 100 million movie viewers and exceeding 22 million dollars of Korean movie exports. Because of these positive economic effects, the film development fund, which was due to expire in 2014, has been extended to 2021.
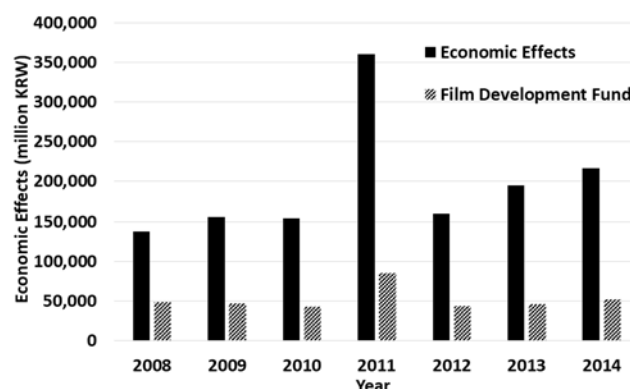

Fig. 5. Economic effects compared to film development fund contribution (million KRW)

<Figure 5> shows that the economic effect has steadily increased since 2008. Particularly in 2011, the effects of the film development fund were higher in than any other year because investment in the motion picture industry increased sharply that year, and the share of the film development fund in total investments increased significantly in the investment value-chain sector. In 2010, the film development fund spent about 16.3 billion KRW, whereas in 2011, it spent 55.3 billion KRW. In other words, increasing the contribution of the film development fund increased its economic effect.

IV. CONCLUSION

The motion picture industry is a meaningful industrial field that can grow together with various related industries. It not only has a huge cultural and economic ripple effect but also plays a leading role in the cultural content industry. To secure the stable growth and development of the motion picture industry, the government has been continuously supporting the film development fund since 2007.

In this study, we developed a quantitative model to analyze the effects of the film development fund by considering the film industry value chain and to quantitatively analyze the economic ripple effect of the fund using an empirical analysis of actual data. For this purpose, we divided the value chain of the film industry into investment and production (supply phase) and distribution and exhibition (demand phase) and developed an economic ripple effect model to reflect the proportion of film development fund support relative to the total cost of each value chain area. In particular, we applied an AHP analysis to expert opinion and analyzed the relative contribution to a performance index by value chain area. The economic effects of the film development fund for the 7 years from 2008 to 2014 were more than 1.3 trillion KRW in sales, which is about 3.7 times the amount invested into the film development fund.

REFERENCES

[1] Vogel, H. L. (2014). Entertainment industry economics: A guide for financial analysis: Cambridge University Press.
[2] Hadida, A. L. (2009). Motion picture performance: A review and research agenda. International Journal of Management Reviews, 11(3), 297-335.
[3] Jie, Z., & Mingjie, R. (2014). Movie Industry from the Perspective of Economist Industrial Economic Research Evolvement of Motion Picture Industry. Journal of Social Science, 11, 005.
[4] Eliashberg, J., Elberse, A., & Leenders, M. A. A. M. (2006). The Motion Picture Industry: Critical Issues in Practice, Current Research, and New Research Directions. Marketing Science, 25(6), 638-661.
[5] Treme, J. (2010). Effects of Celebrity Media Exposure on Box-Office Performance. Journal of Media Economics, 23(1), 5-16.
[6] Treme, J., & Craig, L. A. (2013). Celebrity star power: Do age and gender effects influence box office performance? Applied Economics Letters, 20(5), 440-445.
[7] Litman, B. R., & Kohl, L. S. (1989). Predicting financial success of motion pictures: The '80s experience. Journal of Media Economics, 2(2), 35-50.
[8] Sochay, S. (1994). Predicting the Performance of Motion Pictures. Journal of Media Economics, 7(4), 1-20.
[9] Chang, B. H., & Ki, E. J. (2005). Devising a practical model for predicting theatrical movie success: Focusing on the experience good property. Journal of Media Economics, 18(4), 247-269.
[10] Kim, S. H., Park, N., & Park, S. H. (2013). Exploring the Effects of Online Word of Mouth and Expert Reviews on Theatrical Movies' Box Office Success. Journal of Media Economics, 26(2), 98-114.
[11] Kwon, S. H., & Kim, J. (2013). The cultural industry policies of the Korean government and the Korean Wave. International Journal of Cultural Policy, 1-18.
[12] Kim, M. (2011). The role of the government in cultural industry: Some observations from Korea's experience. Keio communication review, 33, 163-182.
[13] Saaty, T. L. (1980). The Analytic hierarchy process: planning, priority setting, resource allocation / Thomas L. Saaty. New York London: New York London : McGraw-Hill International Book Co