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# An Analysis on Multiplier Effects for the Digital Contents Industry of Korea

Trever Jones\*, Shin Pyo Kim\*\*, Kyoo Sung Noh\*\*\*, Jae Wan Cho\*\*\*\*

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## Abstract

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Key goal of the study is to analyze the economical ripple effect by the digital contents industry. In this study, the results of analysis of multiplier effects of digital contents industry can be summaries as follows: (1) Output multiplier for the manufacturing sector was the highest with value of 3.0509 while that of digital contents industry is the lowest at 1.6511. (2) Employment multiplier is the lowest for the manufacturing sector with value of 4.2895, while that of digital contents industry is the lowest with value of 1.0238. (3) Income multiplier is the lowest for the manufacturing sector with value of 5.3331, while that of digital contents industry is the lowest with value of 1.0081. Therefore, digital contents industry is clearly a new-growth power industry in the future rather than in the present.

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\* Trever Jones(Duquesne University, USA)

\*\* Shin Pyo Kim(Korea IT Rental Industrial Association, Korea)

\*\*\* Kyoo Sung Noh(Sun Moon University, Korea)

\*\*\*\* Jae Wan Cho(Kyung Dong University, Korea)

# I . Introduction

Competitiveness of a nation in the era of digitalized economy hangs on whether all the economic units effectively utilize information and knowledge through application of IT technology and reform of the works involved, thereby achieving reduction in the cost and creating new business areas.

The trend in the world's digital contents market shows that it will achieve turnover of US\$ 61.39 billion, 75.08 billion, 94.78 billion, 122.06 billion and 165.49 billion in the years 2001, 2002, 2003, 2004 and 2005 respectively, with average annual growth rate of 28.0%[1].

It is expected that the domestic digital contents market will grow at an average annual rate of 37.7%[2], achieving turnover of ₩1.9767 trillion, ₩2.3916 trillion, and ₩3.6932 trillion in the years 2000, 2001 and 2002, respectively. Input-Output Tables 2000 that the Bank of Korea have announced shows that the domestic total output was ₩1.3929278 trillion and the gross domestic products (GDP) based on the value added was ₩599.6451 trillion[3]. It was assessed that although the domestic digital contents market capacity in 2003 that corresponds to the total output was ₩5.4226 trillion, domestic products of digital contents industry that corresponds to the concept of gross domestic products

was ₩3.7714[2].

Korean government, on August 22, 2003 initiated "report session on next generation new-growth power industry projects" and provisionally decided on (1) digital TV/broadcasting, (2) display, (3) intelligent robot, (4) future concept automobile, (5) next generation semiconductor, (6) next-generation mobile communication, (7) intelligent home network, (8) digital contents/SW solution, (9) next-generation battery, (10) bio drugs/organs as the 10 new-growth power industry projects which included digital contents project. Since the 10 new-growth power industry projects have been selected with focus on the most appropriate areas in which Koreans excel and has outstanding aptitude for, it is forecasted that the generation of added value, employment and income ripple effect of the digital contents industry in the future is to be expected.

In spite of this, study on the economical ripple effect that is imparted by the 10 new-growth power industry industries on the national economy has not been carried out due to reasons such as insufficiency of statistical data necessary for the analysis. Therefore, I have come to realize the necessity to attempt analysis of ripple effect that digital contents industry has on the overall economy of Korea along with publishing of "Report on the domestic digital contents industry market research in 2003".

Key goals of the study on Analysis on Multiplier Effects for the Digital Contents Industry of Korea are as follows:

Firstly, grasp the current situation on turnover, number of employees and income generated by the digital contents industry.

Secondly, estimate the output, employment and income multipliers of digital contents industry.

Thirdly, bestow of economical meaning to the output, employment and income multipliers so estimated.

Analysis shall be approached by utilizing Input-Output Multipliers, which is estimated on the basis of Input-Output Model.

If the goals of the study are achieved, the anticipated expected effects can be summarized as follows:

Firstly, not only the inquiry of the current status on digital contents industry and various statistically related information but also the characteristics of the digital contents market from the point of view of economical ripple effect can also be grasped.

Secondly, it is possible to provide fundamental information that is important in drawing up of policies such as decision making on investment into digital contents industry and establishment of marketing strategies at government level, through grasping of the characteristics of domestic digital contents industry.

Thirdly, it can be utilized as information in research and formulation of strategies by

digital contents related industries, academic fields, research institutions and specialists.

## II. Current Market Status of Digital Contents Industry

With the completion of establishment of ultra high-speed information communication network at the end of year 2000, information infrastructure in Korea has been established at the level at par with the advanced countries with the number of subscribers for the ultra high-speed internet services exceeding 10 Million households in October 2002. As such, demand for digital contents has been on the increase and the awareness that digital contents are the motive power of national competitiveness is gradually nestle in.

In particular, digital contents have no regional boundaries and characteristics of being produced, distributed and consumed at global scale. As such, there is even a concern for encroachment of the digital contents market by countries with strong digital contents industry foundation.

〈Table 2-1〉 summarizes the comparison of the current market status of domestic digital contents industry, with aforementioned characteristics, in 2003 with key domestic economic indices.

〈Table 2-1〉 Key Economical Indices for each Industry

Unit: ₩ million, persons, enterprises

Categories	Gross Output	Value Added	Hired Employees	Compensation for Employees	No. of Enterprises
Agriculture, Forestry, Fishery	38,286,604	23,900,251	38,441	3,284,756	2,377
Manufacturing	606,041,032	169,736,043	3,515,036	66,456,751	333,770
Services	743,177,546	402,237,428	10,735,001	194,519,045	2,712,353
Digital Contents	5,422,589	3,771,411	48,126	2,873,810	2,982
All Industries	1,392,927,771	599,645,133	14,336,604	267,134,362	3,051,482

note) Gross output, Value added, wages for employees: refer to the "Input-output Table 2000, 2004" by the Bank of Korea, (price benchmark: current price)  
 Number of workers, No. of enterprises: refer to "Korea Statistical Almanac, 2002" by National Statistical Office.  
 Statistics of digital contents industry: refer to "Report on market research on domestic digital contents industry in 2003" by Korea IT Industry Promotion Agency.

Gross output in the 〈Table 2-1〉 is a concept that includes intermediate transaction volume between the industries for goods and services. Gross market capacity of digital contents industry that has been added up in the year 2003 market research under such concept was ₩5.4226 trillion. This accounts for 0.39% of the Gross output of ₩ 1,392.9278 trillion for all industries.

Value added figure is the concept of summing amount of value added on the goods and services generated in the industry after having excluded intermediate transaction volume between goods and services. Extrapolated amount of value added on to the digital contents industry in 2003 is ₩ 3,7714 trillion and accounts for 0.63% of the volume of value added for all industries at ₩ 599.6451 trillion. Therefore,

digital contents industry in Korea has almost 2-fold weight of amount of value added in relations to the gross output.

Number of workers in all industries is 14.34 million while that in the digital contents industry is 48,126 accounting for 0.34% of all industries. The concept of workers here is the same as the concept of number of employed workers. Employed workers include self-employed, family workers, permanent and temporary workers and casual workers. Number of employees is the number of workers with exclusion of self-employed and family workers. In the case of market research on digital contents industry, number of workers includes self-employed who is also the employer, and permanent and temporary workers who are employees.1)

Compensation for employees in all industries was ₩267.1344 trillion, of which ₩2.8738 trillion is for the digital contents industry, accounting for 1.08% of all the industries.

Total number of enterprises with more than 1 worker, including the self-employed, was 3,051,482 as at the end of 2001. Enterprises in the digital contents industry accounted for 0.10% of this with 2,982 enterprises.

- 1) Limitation in analyzing the weight of workers in the digital contents industry in all industries is that statistical data that is subjected to comparison inevitably has serially correlated differences of approximately 2 years due to differences in the timing of announcement of related statistics.

### III. Analysis on Multiplier Effects for the Digital Contents Industry

Analysis on multiplier effects for the digital contents industry can be grasped through input-output analysis. The input-output table is a quantitatively formalized table by W. W. Leontief in the 1930's from the abstract general equilibrium model of

W. Walras.

Approximately after half a century since the standardization of input-output model by Leontief in 1936, the input-output model today has established itself as an essential and indispensable analysis tool in establishing and drawing up of economic policies through analysis on variety of multiplier effect for each of the industries.

I am going to apply this input-output analysis technique with above theoretical background in analysis on the interrelation between industries included the domestic digital contents industry.

Foremost, in order to induce the input-output multipliers on the basis of input-output table that includes domestic digital contents industry, 4x4 inverse matrix coefficients table that includes the digital contents industry shall be assumed under the following postulation.

Firstly, input-output tables published by the Bank of Korea that will be subjected to the analysis will be that for the year 2000.

Secondly, sector classification of the input-output table has been fixed to 4x4 transaction table from the basis of 404 sectors.

Thirdly, input coefficients of digital contents industry utilized that of software development and supply sector.

Therefore, the <Table 3-1> illustrates the summary of technological structure of digital contents industry.

**〈Table 3-1〉 Technological structure of digital contents industry**

Categories	intermediate input	Value added	Total
Input structure	0.3045	0.6955	1.0000

Fourthly, estimate for the final demand for the digital contents industry can be made as in 〈Table 3-2〉 on the basis of the technological structure of digital contents industry in 〈Table 3-1〉.

The economical meaning of the value 0.0009 in 4<sup>th</sup> row, 1<sup>st</sup> column of 〈Table 3-2〉 indicates that direct and indirect output requirements in the digital contents industry that is necessary in order to satisfy

**〈Table 3-2〉 Distribution structure of digital contents industry**

unit: ₩ million

Categories	input structure	Digital contents
intermediate input	0.3045	1,651,178
Value added (Final demand)	0.6955	3,771,411
Total	1.0000	5,422,589

Fifthly, Transaction table is valued at producers' price.

final demand of ₩10,000 in the agriculture, forestry and fisheries industry are ₩9.

Sixthly, 4x4 inverse matrix coefficients table computed is as illustrated in the 〈Table 3-3〉.

Similarly, value of 0.0307 in 4<sup>th</sup> row, 2<sup>nd</sup> column indicates that both direct and indirect output requirements in the digital

**〈Table 3-3〉 4×4 inverse matrix coefficients table computed for digital contents industry**

Categories	Agriculture, Forestry and Fisheries	Manufacturing	Services	Digital Contents
Agriculture, forestry and fisheries	1.0780	0.1032	0.0300	0.0109
Manufacturing	0.6368	2.4598	0.5577	0.2160
Services	0.2694	0.4572	1.4721	0.4235
Digital contents	0.0009	0.0307	0.0018	1.0007

contents industry that is necessary in order to satisfy the final demand of ₩10,000 in the manufacturing sectors are ₩307. In addition, value of 0.0109 in the 1<sup>st</sup> row, 4<sup>th</sup> column indicates that direct and indirect output requirements in the agriculture, forestry and fisheries industry that is necessary in order to satisfy the final demand of ₩10,000 in the digital contents industry are ₩109, and value of 0.2160 in 2<sup>nd</sup> row, 4<sup>th</sup> column indicates that direct and indirect output requirements in the Manufacturing industry that is necessary in order to satisfy the final demand of ₩10,000 in the digital contents industry are ₩2,160.

Therefore, output requirements in all sectors of the economy that is necessary in order to satisfy the final demand of ₩3.7714 trillion for the digital contents industry can be extrapolated as <Table 3-4> on the basis of the information given in the <Table 3-3>.

It can be observed that the economical meaning of the <Table 3-4> is that direct and indirect output requirements in the agriculture, forestry and fisheries industry that is necessary in order to satisfy the estimated final demand of ₩ 3.7741 trillion for the domestic digital contents industry is ₩ 41.1 billion, in the manufacturing sectors ₩ 814.6 billion, in the service industries ₩ 1,597.2 billion, and in the digital contents industry ₩3.7741 trillion.

An output multiplier in the digital contents industry refers to the direct and indirect input requirement from all the industries in order to satisfy change of 1 unit of final demand in the digital contents industry. Types of output multipliers include multi-sector multipliers, Type I and Type II output multipliers, uniform demand expansion multipliers, growth equalized multipliers, non-growth equalized multipliers, consistent production

**<Table 3-4> Economic ripple effect of digital contents industry**

unit: ₩ million

Categories	Output multiplier	ripple effect for each industry
Agriculture, forestry and fisheries industry	0.0109	41,108
Manufacturing sectors	0.2160	814,625
Service industry	0.4235	1,597,192
Digital contents industry	1.0007	3,774,051
Total	1.6511	6,226,976

multipliers. Of these, I am computing the Type I output multipliers. This can be expressed into equation (3-1).

$$Y = \sum_{i=1}^n b_{ij} \quad (3-1)$$

The summary of output multipliers computed on the basis of the equation (3-1) is given in the <Table 3-5>.

unit of final demand in digital contents industry is very low. As a reference, output multiplier of digital contents industry in the <Table 3-5> is the same as the value of the 4<sup>th</sup> row of the <Table 3-4>

An employment multiplier refers to the multiple that indicates the total changes in employment in overall economy that has been invoked from the change of 1 unit of direct employment of a given industry.

**<Table 3-5> Input-output multiplier for each of the key industries**

Categories	Output multiplier	Employment multiplier	Income multiplier
Agriculture, forestry and fisheries industry	1.9851	2.2021	1.3688
Manufacturing sectors	3.0509	4.2895	5.3331
Service industry	2.0616	1.9346	2.6095
Digital contents industry	1.6511	1.0238	1.0081

In the <Table 3-5> the output multiplier for the manufacturing sector was the highest with value of 3.0509 while that of digital contents industry is the lowest at 1.6511. Value of output multiplier for a given industry is the indication of by how much increase in production of other industries sectors has been induced as the result of increase in the production in that particular industry. Therefore, larger value of output multiplier signifies that the ripple effect of it is that much more pronounced. It can therefore be seen that direct and indirect input requirement from all other industries in order to satisfy increase of 1

Types of employment multipliers include Isard-Kunne method, Type I and Type II employment multipliers of Moore-Peterson method, Hansen-Tiebout method and Type III employment multipliers of Miernyk method. In this study, Type I employment multipliers of Moore-Peterson method will be extrapolated. This can be put into equation (3-2).

$$\mu_j^L = \sum_{i=1}^n l_{ni} b_{ij} / l_{nj} \quad (3-2)$$

<Table 3-5> illustrates the summary of employment multipliers for each industry as computed on the basis of the equation (3-



2).

An employment multiplier is the highest for the manufacturing sector with value of 4.2895, while that of digital contents industry is the lowest with value of 1.0238. Therefore, digital contents industry is an industry that imparts very low changes in the total employment of the overall economy as the result of increase in direct employment of 1 person in the digital contents industry.

An income multiplier refers to the changes in the gross income in the overall economy occurred from the result of change of 1 unit of income in a given sector in response to changes in the final demand. Types of income multipliers include Type I and Type II income multipliers of Moore-Peterson, Type III income multipliers of Miernyk, Type IV income multipliers of Madden-Batey, and Type A and B income multipliers of Conway. In this study, Type I income multiplier of Moore-Peterson method will be extrapolated. This can be put into equation (3-3).

$$\mu_j^y = \sum_{i=1}^n V_i b_{ij} / V_j \quad (3-3)$$

〈Table 3-5〉 illustrates the summary of employment multipliers for each industry as computed on the basis of the equation (3-3).

Income multiplier is the highest for the manufacturing sector with value of 5.3331, while that of digital contents industry is the

lowest with value of 1.0081. Therefore, digital contents industry is an industry that imparts the lowest changes in the gross income of the overall economy occurred from the result of increase in 1 unit of income in the digital contents industry in response to changes in the final demand.

## IV. Summary and Conclusion

Korean economy at the moment is under going prolonged and continuing economic recession. As a countermeasure in coping with such, the government has decided on and announced 10 new-growth power industries that include digital contents industry. Key goal of the study is to analyze the economical ripple effect by the digital contents industry.

Input-output multiplier was utilized as the tool of analysis.

In this study, the results of analysis of multiplier effects of digital contents industry can be summaries as follows:

Firstly, gross output by the digital contents industry in the current market situation is ₩5.4226 trillion, while the amount of value added is ₩3.7714, number of employees 48,126, wages for the paid workers ₩2.8738 trillion, and total number of enterprises 2,982.

Secondly, output requirement by the agriculture, forestry and fisheries industry in order to satisfy the final demand of ₩ 3.7741 trillion of digital contents industry is ₩ 44.1 billion, by the manufacturing sectors ₩ 814.6 billion, by the service industry ₩ 1.5972 trillion, and direct output requirement of ₩ 3.7714 trillion and indirect output requirement of ₩ 2.7 billion for total of ₩3.7741 trillion by the digital contents industry.

Thirdly, output multiplier for the manufacturing sector was the highest with value of 3.0509 while that of digital contents industry is the lowest at 1.6511.

Fourthly, employment multiplier is the lowest for the manufacturing sector with value of 4.2895, while that of digital contents industry is the lowest with value of 1.0238.

Fifthly, income multiplier is the lowest for the manufacturing sector with value of 5.3331, while that of digital contents industry is the lowest with value of 1.0081.

Therefore, digital contents industry is clearly a new-growth power industry in the future rather than in the present.

The future task of domestic digital contents industry, as revealed from the survey of 856 enterprises in the industry [2], includes fund support, improvement of laws and systems that are related to the development of digital contents industry, support and fostering that is focusing on the small to medium enterprises rather than the conglomerates, vitalization of economy and market at the national level, in this sequence.

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