

## 1. INTRODUCTION

Recently, many companies focus on intellectual property or intangible assets. The total amounts of intangible assets for Korean listed companies are tend to increase continuously. According to holding up this trend, intangible assets such as industrial property rights and R&D investment may affect corporate long and short-term decisions.

This paper tries to provide empirical evidence for the effects of investment in intangible assets on corporate decision making. To analyze these effects, this study examines the association between corporate investment and the impact of intangible assets such as industrial property rights(hereafter, IPR) and annual intangible asset costs(hereafter, AIC).

As developing technologies, the impact of intangible assets on management strategies is strengthened especially in many global companies. For instance, technology-driven companies are tends to invest on industrial property rights, branding, research and development, and other kinds of intangibles. If this investment leads more business performance, these companies will invest resources more in intangibles and this will create a good synergy between accumulating intangibles and investment decisions. Therefore, this paper investigates the relation between intangibles and long and short-term investment of Korean listed companies.

After controlling for firm-specific factors, this study provides empirical results which indicate that R&D expenditures are positively associated with a increase in previously invested  $IPR_{t-1}$ ,  $AIC_{t-1}$ ,  $AIC_{t-3}$ , and a decrease in  $AIC_{t-2}$ . Development costs are only related to the raise of  $AIC_{t-1}$  and negatively related to  $AIC_{t-2}$ . Advertising is tends to be conducted based on a increase in previous  $IPR_{t-2}$ .

The results in this paper enables policy makers and practitioners to understand the impact of corporate intangible assets. Our findings may also help to understand corporate R&D policy, and long and short-term expenditure decisions as it is applied in real business environments.

The rest of this paper is organized into five sections. The next section provides the study background and develops the hypotheses. The third section discusses the research method and data selection procedures. The fourth section presents empirical results, and the last section concludes the study.

## 2. RESEARCH BACKGROUND AND HYPOTHESES

In the competitive business environment, the accumulation of intangible assets for management decisions is considered as the one of key performance factors in many companies. As developing technologies, the impact of intangible assets on management strategies is strengthened especially in many global companies. Generally, technology-driven companies are tends to invest on industrial property rights, branding, research and development, and other kinds of intangibles. If this investment leads more business performance, these companies will invest resources more in intangibles and this will create a good synergy between accumulating intangibles and investment decisions. Therefore, this paper investigates the relation between intangibles and long and short-term investment of Korean listed companies.

### 2.1 Intangible assets

The importance of intangible assets are researched in the previous literature. Cho and Chung (2001) report that investment on R&D is related to subsequent earnings of Korean

manufacturing firms. Wyatt (2005) shows that the strength of the technology, technology cycle, and property rights are associated with managing intangible assets. In spite of the importance of intangibles, Hunter et al. (2012) survey over 600 companies and report that most of companies rarely evaluate the pay-offs from expenditure on intangibles. At this survey, intangibles includes R&D, human resources, information systems, brands, and marketing (Hunter et al. 2012).

## 2.2 Long and short-term decision

The survey results by Hunter et al. (2012) show that most of companies are tends to decide their expenditures on intangibles based on last year's spending and negotiating by senior manager with the CEO. On the other hand, the percentage of deciding based on estimated return ratio is relatively low. Contrary to the expectation, Arrighetti et al. (2015) investigate that investment on intangible assets is conducted discontinuously, and there is no persistent pattern of intangible accumulation.

This tendency may be considered only regional effects by characteristics of research samples in the previous research. To investigate the impact of intangibles in business decisions for Korean listed companies, this paper suggests following hypotheses.

**H1:** Intangible assets such as accumulation of industrial property rights or annually invested intangible assets are not related to future R&D expenditures.

**H2:** Intangible assets such as accumulation of industrial property rights or annually invested intangible assets are not related to future advertising expenditures.

## 3. DATA SELECTION AND RESEARCH METHOD

### 3.1 Research model

In this study, we expect that corporate intangible assets will influence expenditure decisions. The following model, equation (1), is used to test hypotheses, and definition of variables is in below.

$$RnD_{it} \text{ (or } DC_{it} \text{ or } AD_{it}) = \beta_0 + \beta_1 IPR_{it-1} + \beta_2 IPR_{it-2} + \beta_3 IPR_{it-3} + \beta_4 AIC_{it-1} + \beta_5 AIC_{it-2} + \beta_6 AIC_{it-3} + age_{it} + roa_{it} + cfo_{it} + previous_{it} + YR / IND_{it} + \varepsilon_{it} \dots \dots (1)$$

where,

*RnD* = total R&D expenditures scaled by assets in year t for firm i;

*DC* = development costs scaled by assets in year t;

*AD* = advertising expenditures scaled by assets in year t;

*IPR* = industrial property rights scaled by assets in year t-1, t-2, and t-3;

*AIC* = annual intangible asset costs scaled by assets in year t-1, t-2, and t-3;

*age* = the log value of firm j's age in year t;

*roa* = the return on assets in year t;

*cfo* = cash flows on assets in year t;

*previous* = previous value such as *RnD*, *DC*, or *AD* in year t-1 for firm i;

*YR/IND* = year and industry dummies.

Based on prior research, we also include several control variables. This study expects that firms with lower age, more returns, more cash flows, and previously more investments are likely to have more tendency of investing intangible assets. Therefore, age may reflect the life cycle of firms (Dickinson 2011), roa and cfo capture the investment environment of each firm, and previous values of dependent variables will control the individual characteristics of each firm's decision environment (Curtis et al. 2015; Hunter et al. 2012).

### 3.2 Data selection

Samples from 2014 to 2017 were included in this study. Firms in financial service industries, those with insufficient financial data, those without a third consecutive periodic IPR and AIC data, or those with 99th percentile data excluded from the analysis.

Distributions in each year and industry indicate that clustering is not a serious concern. Financial data were extracted from the KIS-VALUE by the NICE Information Service in Korea. The KIS-VALUE database in Korea provides both financial and stock market data for firms listed on the Korea Stock Exchange and KOSDAQ markets, which are equivalent to the COMPUSTAT and the CRSP in the U.S.

**Table 1. Descriptive Statistics**

Variables (N=2,410)	Mean	STD	Min	Q1	Q2	Q3	Max
<i>RnD<sub>t</sub></i>	0.0029	0.0058	0	0	0	0.0024	0.0331
<i>AD<sub>t</sub></i>	0.0023	0.0049	0	0	0.0003	0.0019	0.0302
<i>DC<sub>t</sub></i>	0.0008	0.0029	0	0	0	0	0.0229
<i>IPR<sub>t-1</sub></i>	0.0002	0.0004	0	0	0	0.0001	0.0039
<i>IPR<sub>t-2</sub></i>	0.0002	0.0004	0	0	0	0.0001	0.0032
<i>IPR<sub>t-3</sub></i>	0.0001	0.0006	0	0	0	0	0.0197
<i>AIC<sub>t-1</sub></i>	0.0004	0.0007	0	0	0.0001	0.0006	0.0048
<i>AIC<sub>t-2</sub></i>	0.0004	0.0006	0	0	0.0001	0.0005	0.0042
<i>AIC<sub>t-3</sub></i>	0.0003	0.0006	0	0	0	0.0003	0.0034
<i>age<sub>t</sub></i>	3.5601	0.6243	1.0986	3.4012	3.7377	3.9703	4.625
<i>roa<sub>t</sub></i>	0.0065	0.0975	-1.5149	0.0014	0.0215	0.0455	0.1245
<i>cfo<sub>t</sub></i>	0.0347	0.0645	-0.7527	0.0083	0.0381	0.0716	0.1683
<i>RnD<sub>t-1</sub></i>	0.0028	0.0056	0	0	0	0.0023	0.0318
<i>AD<sub>t-1</sub></i>	0.0023	0.0049	0	0	0.0003	0.0019	0.031
<i>DC<sub>t-1</sub></i>	0.0008	0.0028	0	0	0	0	0.0229

*RnD* = total R&D expenditures scaled by assets in year *t* for firm *i*;

*DC* = development costs scaled by assets in year *t*;

*AD* = advertising expenditures scaled by assets in year *t*;

*IPR* = industrial property rights scaled by assets in year *t-1*, *t-2*, and *t-3*;

*AIC* = annual intangible asset costs scaled by assets in year *t-1*, *t-2*, and *t-3*;

*age* = the log value of firm *j*'s age in year *t*;

*roa* = the return on assets in year *t*;

*cfo* = cash flows on assets in year *t*;

*previous* = previous value such as *RnD*, *DC*, or *AD* in year *t-1* for firm *i*;

## 4. Empirical Results

### 4.1 Descriptive statistics

<Table 1> lists descriptive statistics of all variables used in the regression analyses. The mean values for total R&D expenditures (*RnD*), advertising expenditures (*AD*), development costs (*DC*), industrial property rights (*IPR*), annual intangible asset costs (*AIC*), *roa*, and *cfo* were about 0.0, and the median values were not far from the mean values.

<Table 2> presents the correlation matrix among the variables used in these empirical analyses. The highest correlation between continuous variables was 0.88 between *AIC*<sub>*t-1*</sub> and *AIC*<sub>*t-2*</sub>, this does not change the tenor of the results. The highest VIF value in main regression analyses was below 10, and the condition index was lesser than 30, indicating that multicollinearity is not a serious concern. Heteroskedasticity and endogeneity issues were also considered.

**Table 2. Pearson Correlation Matrix**

Variables (N=2,410)	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>1. <i>RnD</i><sub><i>t</i></sub></b>	0.16 ***	0.08 ***	0.19 ***	0.19 ***	0.11 ***	0.1 ***	0.09 ***	0.08 ***	-0.08 ***	0.02 ***	0.04 **	0.9 ***	0.13 ***	0.09 ***
<b>2. <i>AD</i><sub><i>t</i></sub></b>		1 ***	-0.01 ***	0.25 ***	0.24 ***	0.12 ***	0.21 ***	0.21 ***	0.18 ***	-0.08 ***	0.04 **	0.04 *	0.12 ***	0.91 ***
<b>3. <i>DC</i><sub><i>t</i></sub></b>			1 ***	0.11 ***	0.1 ***	0.05 ***	0.15 ***	0.09 ***	0.06 ***	-0.03 ***	-0.02 ***	0 ***	0.09 ***	0 ***
<b>4. <i>IPR</i><sub><i>t-1</i></sub></b>				1 ***	0.87 ***	0.43 ***	0.17 ***	0.16 ***	0.12 ***	0.04 *	0.02 ***	0.02 ***	0.19 ***	0.24 ***
<b>5. <i>IPR</i><sub><i>t-2</i></sub></b>					1 ***	0.54 ***	0.18 ***	0.19 ***	0.16 ***	0.04 **	0.01 ***	0.03 ***	0.2 ***	0.23 ***
<b>6. <i>IPR</i><sub><i>t-3</i></sub></b>						1 ***	0.11 ***	0.13 ***	0.19 ***	0.02 ***	0.02 ***	0.01 ***	0.11 ***	0.11 ***
<b>7. <i>AIC</i><sub><i>t-1</i></sub></b>							1 ***	0.88 ***	0.65 ***	-0.02 ***	-0.06 ***	0.01 ***	0.09 ***	0.2 ***
<b>8. <i>AIC</i><sub><i>t-2</i></sub></b>								1 ***	0.76 ***	-0.01 **	-0.04 **	0 ***	0.1 ***	0.2 ***
<b>9. <i>AIC</i><sub><i>t-3</i></sub></b>									1 ***	0.02 ***	-0.02 ***	-0.01 ***	0.07 ***	0.16 ***
<b>10. <i>age</i><sub><i>t</i></sub></b>										1 ***	-0.02 ***	0.01 ***	-0.09 ***	-0.08 ***
<b>11. <i>roa</i><sub><i>t</i></sub></b>											1 ***	0.36 ***	0.01 ***	0.01 *
<b>12. <i>cfo</i><sub><i>t</i></sub></b>												1 **	0.05 **	0.03 **
<b>13. <i>RnD</i><sub><i>t-1</i></sub></b>													1 ***	0.12 ***
<b>14. <i>AD</i><sub><i>t-1</i></sub></b>														1 ***
<b>15. <i>DC</i><sub><i>t-1</i></sub></b>														

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01; The definition of variables is in Table 1.

### 4.2 Regression results

<Table 3> provides empirical results of regression analyses to test the first hypothesis. The *RnD* model shows the relation between R&D expenditures and previously invested intangible assets such as *IPR* and *AIC*. If the survey of Hunter et al. (2012) applies in these Korean listed companies, *IPR* and *AIC* may not related to the future R&D expenditures. According to explanation by Hunter et al. (2012), previously invested R&D is mostly affected on the future R&D expenditures. Also, R&D expenditures are positively associated with a increase in previously invested *IPR<sub>t-1</sub>*, *AIC<sub>t-1</sub>*, *AIC<sub>t-3</sub>*, and a decrease in *AIC<sub>t-2</sub>*. This implies that Korean listed companies with more *IPR* and *AIC* are significantly associated with the future R&D expenditures. Moreover, discontinuous accumulation of intangibles as in Arrighetti et al. (2015) is able to confirm by the opposite effect of *AIC<sub>t-1</sub>* and *AIC<sub>t-3</sub>*.

In <table 4>, accumulation of development costs are only related to the raise of *AIC<sub>t-1</sub>* and negatively related to *AIC<sub>t-2</sub>*. As mentioned (Hunter et al. 2012; Arrighetti et al. 2015), previously accumulated development costs is mostly affected on the future development costs, and discontinuity effects of intangibles are also investigated by *AIC*.

**Table 3. R&D Expenditures Results (*RnD<sub>t</sub>*)**

Variables (N=2,410)	Coeff.	Std. Error	t Value	Pr> t
<i>intercept</i>	0.0003	0.0004	0.70	0.4847
<i>IPR<sub>t-1</sub></i>	0.4643	0.1924	2.41 **	0.0159
<i>IPR<sub>t-2</sub></i>	-0.4045	0.2501	-1.62	0.1060
<i>IPR<sub>t-3</sub></i>	0.0919	0.1039	0.88	0.3766
<i>AIC<sub>t-1</sub></i>	0.4743	0.2204	2.15 **	0.0315
<i>AIC<sub>t-2</sub></i>	-0.7217	0.2569	-2.81 ***	0.0050
<i>AIC<sub>t-3</sub></i>	0.4008	0.1707	2.35 **	0.0190
<i>age<sub>t</sub></i>	0.0000	0.0001	-0.03	0.9782
<i>roa<sub>t</sub></i>	0.0010	0.0021	0.48	0.6332
<i>cfo<sub>t</sub></i>	-0.0014	0.0012	-1.23	0.2195
<i>RnD<sub>t-1</sub></i>	0.9098	0.0261	34.86 ***	<.0001
<i>YR/IND</i>	included			
<i>Adj R-Sq</i>	0.8111			
<i>F-Value</i>	471.15***			

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01; The definition of variables is in Table 1.

<Table 5> shows that advertising is tends to be conducted based on a increase in previous *IPR<sub>t-2</sub>*.

In summary, Korean listed companies are likely to decide future expenses based on *IPR*, *AIC*, and the last year's expenses. As in the previous literature, discontinuous effects of accumulation intangibles are investigated.

**Table 4. Development Costs Results(*DC<sub>t</sub>*)**

Variables	Coeff.	Std. Error	t Value	Pr> t
-----------	--------	------------	---------	-------

(N=2,410)				
<i>intercept</i>	0.0002	0.0002	0.67	0.5003
<i>IPR<sub>t-1</sub></i>	0.0970	0.1521	0.64	0.5235
<i>IPR<sub>t-2</sub></i>	0.1896	0.1692	1.12	0.2626
<i>IPR<sub>t-3</sub></i>	-0.0581	0.0672	-0.87	0.3871
<i>AIC<sub>t-1</sub></i>	0.2672	0.1527	1.75 *	0.0803
<i>AIC<sub>t-2</sub></i>	-0.3328	0.1674	-1.99 **	0.0469
<i>AIC<sub>t-3</sub></i>	0.0147	0.0831	0.18	0.8593
<i>age<sub>t</sub></i>	0.0000	0.0001	-0.57	0.5710
<i>roa<sub>t</sub></i>	0.0003	0.0003	1.39	0.1649
<i>cfo<sub>t</sub></i>	-0.0003	0.0005	-0.60	0.5491
<i>RnD<sub>t-1</sub></i>	0.9063	0.0468	19.36 ***	<.0001
<i>YR/IND</i>	included			
<i>Adj R-Sq</i>	0.7696			
<i>F-Value</i>	366.82 ***			

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01; The definition of variables is in Table 1.

**Table 5. Advertisement Expenditures Results(*AD<sub>t</sub>*)**

Variables (N=2,410)	Coeff.	Std. Error	t Value	Pr> t
<i>intercept</i>	0.0006	0.0003	1.87 *	0.0611
<i>IPR<sub>t-1</sub></i>	0.0443	0.1598	0.28	0.7814
<i>IPR<sub>t-2</sub></i>	0.3179	0.1739	1.83 *	0.0676
<i>IPR<sub>t-3</sub></i>	-0.0063	0.0466	-0.14	0.8920
<i>AIC<sub>t-1</sub></i>	0.0643	0.1597	0.40	0.6874
<i>AIC<sub>t-2</sub></i>	0.0379	0.2562	0.15	0.8826
<i>AIC<sub>t-3</sub></i>	0.1308	0.2012	0.65	0.5157
<i>age<sub>t</sub></i>	-0.0001	0.0001	-1.22	0.2231
<i>roa<sub>t</sub></i>	0.0019	0.0009	2.19 **	0.0283
<i>cfo<sub>t</sub></i>	-0.0006	0.0010	-0.62	0.5380
<i>RnD<sub>t-1</sub></i>	0.8907	0.0281	31.72 ***	<.0001
<i>YR/IND</i>	included			
<i>Adj R-Sq</i>	0.8295			
<i>F-Value</i>	533.76 ***			

\*: p<0.1, \*\*: p<0.05, \*\*\*: p<0.01; The definition of variables is in Table 1.

## 5. Conclusion

This study examines how corporate long and short-term decision is related to the level of intangible assets. To provide empirical evidence for the effects of investment in intangible assets on corporate decision making, this paper investigates the association between corporate investment or expenses and the impact of intangible assets such as *IPR* and *AIC*.

The empirical results indicate that R&D expenditures are positively associated with a increase in previously *IPR<sub>t-1</sub>*, *AIC<sub>t-1</sub>*, *AIC<sub>t-3</sub>*, and a decrease in *AIC<sub>t-2</sub>*. Development costs are

only related to the raise of  $AIC_{t-1}$  and negatively related to  $AIC_{t-2}$ . Advertising is tends to be conducted based on a increase in previous  $IPR_{t-2}$ . Korean listed companies are likely to decide future expenses based on  $IPR$ ,  $AIC$ , and the last year's expenses. As in the previous research, decision making tendency based on last year's spending and discontinuous effects of accumulation intangibles are also investigated.

The results in this paper enables policy makers and practitioners to understand the impact of corporate intangible assets. Our findings may also help to understand corporate R&D policy, and long and short-term expenditure decisions as it is applied in real business environments.

## REFERENCES

- [1] Arrighetti, A., F. Landini and A. Lasagni (2015), "Intangible asset dynamics and firm behaviour", *Industry and Innovation*, 22(5), 402-422.
- [2] Cho, S.P. and J.Y. Chung (2001), "The Effect of R & D Expenditures on Subsequent Earnings", *Korean Management Review*, 30(1), 289-313.
- [3] Curtis, A., M.F. Lewis-Western and S. Toynbee (2015), "Historical cost measurement and the use of DuPont analysis by market participants", *Review of Accounting Studies*, 20(3), 1210–1245.
- [4] Dickinson, V. (2011), "Cash Flow Patterns as a Proxy for Firm Life Cycle", *The Accounting Review*, 86(6), 1969–1994.
- [5] Hunter, L., E. Webster and A. Wyatt (2012), "Accounting for Expenditure on Intangibles", *A journal of accounting, finance and business studies*, 48(1), 104-145.
- [6] Wyatt, A. (2005), "Accounting Recognition of Intangible Assets: Theory and Evidence on Economic Determinants", *The Accounting Review*, 80(3), 967-1003.