An Empirical Study on the Mediating Effect on Intrinsic Value and Success of Commercialization of R&D Output

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ABSTRACT

It has been widely known that the intrinsic values of R&D output (technology) such as technological characteristics, marketability, and business feasibility are the key influential factors over commercialization of R&D output. Therefore, many studies have been conducted to verify the effects of the intrinsic values of R&D output on the commercialization. However, most of them looked into the limited aspects of the effects of the intrinsic values of R&D output over the commercialization and thus few studies of the success factors of R&D output commercialization have been conducted on the relationship among the intrinsic values of R&D output factors. In this respect, the present study is aimed to analyze the relationship among the intrinsic values of R&D output, which consist of technological characteristics, marketability, and business feasibility. This study found out that technological characteristics and marketability of R&D output partially mediate the business feasibility of R&D output for the success of commercialization of R&D output. In particular, marketability has a greater mediating effect on the business feasibility over the commercial success of R&D output than technological characteristics.

Keywords: Technology Commercialization, Technology Transfer, Commercialization, Technology Valuation, Influential Variables (Factors) of Technology Transfer and Commercialization, R&D output.

1. INTRODUCTION

As science and technology have rapidly developed and so have consumer needs changed, competition has been more heated in a market to take market leadership. Research and development (R&D) investment is playing an important role in securing competitive edge through the differentiation of goods and serves.

South Korea has always stood on top ranks at the ratio of R&D investment of GDP(Bris, 2015). Furthermore, R&D investment has been ever increasing every year to take competitive edge in advance.

Accordingly, R&D success rate has reached considerably high level along increasing R&D expense. However, patent transfer rate (that is an index for actual commercialization for R&D success rate) and research productivity (e.g. royalty) in Korea are quite lower than advanced countries (Bail et. al., 2014).

Therefore, the Korean government and private organizations have tried various promotion policies for technology commercialization to raise the success rate of commercialization of R&D output and established several organizations to support it. In general, technology commercialization means acquiring output through R&D project, producing goods with it, and selling the goods in a market, which is a narrow concept of technology commercialization. However, Jolly, a researcher of International Institute for Management Development (IMD), expanded the concept: he defines the stages of technology commercialization as technology planning, technology acquisition, materialization (goods), mass-production, promotion, and market expansion (Kim & Baik, 2014; Park, 2012). Based on this expanded concept, many studies have been carried out on the success factors of R&D output commercialization for public sectors (Cho, 2015; Lee et. al., 2005; Yang & Choi, 2010; Kim et. al., 2013; Park &Park, 2013) and for industry-specific sector (Kim et. al., 2012; Lee & Yang, 2011; Kwon & Han, 2014). Most of them focus on estimating the success of technology (R&D output) transfer in the process of idea generation, technological development and technology commercialization or technology commercialization in public sectors. Therefore, it is true that few studies have been conducted on the relationship among the influencing factors over the commercialization. In this respect, this research paper is aimed to conduct an empirical analysis on the interaction of intrinsic factors of R&D output that have effect on the commercial success of R&D output.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. Definitions of R&D Output and Technology Commercialization

According to Article 2 (Para. 8) of Act on National R&D Project, Etc Performance Assessment and Management, R&D output is defined as science and technology output (e.g. patent and research paper based on R&D), and other tangible/intangible economic, social, and cultural performance. Brown (1998) divided R&D output into simple outputs and outcomes (Brown & Svenson, 1998). Fahrenkreg (2002) classified R&D output into research output, outcome and impact, and set the scope of research output and outcome: research output to include research paper and patent, which are acquired as result of performing R&D project, and research outcome to include economic outcome and social/cultural ripple effect impact that result from research output (Fahrenkrog et. al., 2002). In this research paper, R&D output is defined as research output that can be commercialized, including research paper, patent, prototype, which are generated through R&D activity. The definitions of commercialization have been drawn in diverse directions in the nation and abroad. Domestically, Act on Technology Transfer and Commercialization Promotion (Para. 3 of Article 2) defines 'commercialization' as developing, producing, or selling a product using technology, or improving technology related to the foregoing process (Choi et. al., 2015). Barr et. al., (2009) defined technology commercialization as introducing high technology developed by university or R&D institute to a market in a form of 'champion product' and making it into 'compelling business case' (Barr et. al., 2009). In addition, Mitchell & Singh (1996) defines 'technology commercialization' as a series of process of supplementing technological resources with various information and knowledge; producing salable goods; actually selling them in a market; and maximizing profit out of *t* it (Mitchell & Singh, 1996). The term 'technology commercialization' can be switched with other synonyms such as popularization, practicability, industrialization, or corporatization according to researcher's preference or the characteristics

of applied sector, but it is commonly interpreted as 'activity of value generation and the process through transferring, spreading and applying R&D output' as shown Table 19.1.

Table 19.1
Definitions of Commercialization

Commercialization		Technology or goods is introduced to a market and settled down to a company or as a strategic business unit in a company, becoming a regular business.
Popularization	Broad	A series of activities: R&D and technological development through R&D planning and idea conception; developing a new product or improving existing process and products using developed technology; and thus extending life cycle or new cycle in a market.
	Narrow	To assign technology developed in house or secured from external source to production activity (say, engineering and manufacturing) and making products, delivering, and selling in mass scale.
Practicability		It focuses on the actual use by users regardless of the introduction of technology or goods to a market. It evolves such activities as decision on commercialization, making a prototype, and launching pilot sales.
Corporatization		A similar concept to commercialization. R&D, technology or/and goods is introduced to a market and generates profit by collective entity, forming a series of activities such as technology acceptance, production, marketing activity and market expansion (exploitation) in a long-term strategy.

2.2. Studies on Influential Factors over Commercialization of R&D Output

Most of existing studies on commercialization of R&D output focus on technology (R&D output) transfer and see various external environments as influential factors over the success of commercialization in terms of unique technology of R&D output and demand/supply (Cho, 2015; Lee et. al., 2005; Sung et. al., 2015; Park et. al., 2015; Kim & Jung, 2013). Some studies demonstrated that intrinsic factors, which are evaluated largely by technology, market, and business feasibility, have effect on the success or failure of R&D output commercialization (Yang & Choi, 2010; Kim et. al., 2013; Kim et. al, 2012; Park and Yang, 2010; Yun et. al., 2015), maintained that resource capability (e.g. manpower size and connectivity of technology), business model, strategy, and financial aspect of a company are becoming more important than before commercializing R&D output. Most of existing studies saw commercialization of R&D output (technology) as a series of processes or separated from each other, so they didn't suggest a clear standard for the success of R&D output. In particular, most of studies on influential factors of the commercial success of R&D output have concentrated on what the management has interest in, which limits clear vision to the success factors. In this respect, the this study defined the criteria for successful commercialization of R&D output as profit improvement through new sales generation or cost reduction, and established the intrinsic values of R&D output as influential factor over the commercialization. And this study carried out an empirical analysis to test hypotheses.

3. RESEARCH MODEL AND HYPOTHESIS

3.1. Research Model

With empirical data, Park Sun-chul (2010) analyzed and demonstrated the relationship between technology assessment and technology (or R&D output) commercialization 22. He reported in his study that as

technology assessment plays an important role in providing financial support for technology (R&D output) commercialization, technology assessment institutions have had their own and unique models, approaches, and various assessment systems to measure diverse success of technology (R&D output) commercialization. The system uses strength, market attractiveness and competitive edge of technology as evaluation criteria for success (Jung et. al., 2009). In particular, Korea Technology Finance Corporation uses a technology assessment system that assesses the technological characteristics and marketability of R&D output to measure business feasibility of technology. Examining the interrelationship of the success factors of university technology transfer and technology valuation, Kim Chi-whan (2013) demonstrated that technological characteristics, a right, marketability, and business feasibility are significantly correlated with the items of the government's technology valuation (Kim & Park, 2013). Yang Dong-woo (2005) used the technology assessment index of a venture company, which consists of technological characteristics, marketability, and business feasibility to estimate the profitability of a venture company (Yang, 2005). In this study, literature and theoretical review were taken on the precedent studies related to the influential factors over the success of Technology (R&D output) commercialization in ICT industry and the intrinsic factors that consist of technological characteristics, marketability, and business feasibility were set as independent variable. And the business feasibility of R&D output was set as mediating variable and technological characteristics and marketability were set as its sub-factors in the evaluation model of the business feasibility of this study to analyze the interaction of these variables. In this study, the success of commercialization, which is a dependent variable, is defined as a possibility that goods and service are developed from R&D output, sold in a market, and as a result generate sales or improve profitability as shown Figure 19.1.
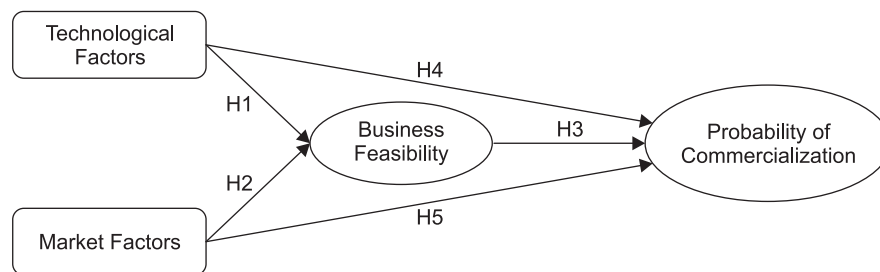

Figure 19.1: Research Model for Mediating Effect of Intrinsic Values of R&D output on their Commercialization

3.2. Hypothesis

This research hypothesized in advance that the intrinsic values of R&D output has effect on their commercial success and set the following sub-hypotheses as below to verify the main hypothesis in the ICT industry.

H1: The technology value of R&D Output will have a positive (+) effect on business feasibility of R&D output in the ICT industry.

1. The completeness of R&D output will have a positive effect (+) on its business feasibility.

2. The originality of R&D output will have a positive effect (+) on its business feasibility.

3. The scalability of R&D output will have a positive effect (+) on its business feasibility.

According to Morone & Ivins (1982), the complexity, reliability, and originality of technology have effect on the output from technology transferred from a government to a private firm (Morone & Ivins,

1982). And Sung Wung-hyun (2015) and Kim Chi-whan (2013) suggested that availability and scalability of technology are success factors of technology transfer transferred from public research institute and university (Sung et. al., 2015; Kim & Park, 2013).

H2: The market value of R&D Output will have a positive (+) effect on business feasibility of R&D output in the ICT Industry.

1. The market size of R&D output will have a positive effect (+) on its business feasibility.

2. The market potential of R&D output will have a positive effect (+) on its business feasibility.

3. The competition intensity of R&D output will have a positive effect (+) on its business feasibility.

According to Carr (1992), market environment such as size and demand of technology has effect on the output from technology transfer (Carr, 1992). In their study of transfer of government-supporting R&D output, Berry et. al., (1991) verified that market characteristics such as the number of companies (market competition intensity) and market dominance are the success factors of technology commercialization (Berry et. al., 1991). In addition, Yoon Yo-han (2015) and Jongtaik Lee (2015) conducted a tracking study for technology transfer and commercialization and demonstrated that market size has a positive effect on the commercialization of transferred technology (Yun et. al., 2015; Lee et. al., 2015).

H3: The business feasibility of R&D output will have a positive effect (+) on success of commercialization of R&D output in the ICT industry.

1. The ease of commercializing R&D output will have a positive effect (+) on success of its commercialization.

2. Possibility of generating new sales from R&D output will have a positive effect (+) on success of its commercialization.

3. Competitiveness of R&D output will have a positive effect (+) on success of its commercialization.

Sung Wung-hyun (2015) and Park Hyun-woo (2012) proved that new market generation or existing market expandability, technology competitiveness, low barrier to market, profitability and the like have effect on the commercial success of R&D output (Sung, 2015; Park et. al., 2012). In his empirical study of the relationship between technology evaluation index and success of commercialization of technology, Park Sun-chul (2010) proved that the commercial viability of technology has a positive effect on the success of commercialization of technology (Kim et. al., 2012). In addition, Carr (1992) reported that the competitiveness of a technology-based product and R&D information expansion system influence the transferability of technology (Carr, 1992).

H4: The business feasibility of R&D output will mediate the relationship between technological characteristics of R&D output and the success of commercialization of R&D output in the ICT Industry.

H5: The business feasibility of R&D output will mediate the relationship between marketability and the success of commercialization of R&D output in the ICT Industry.

The above-mentioned researchers have examined that technological characteristics, marketability, and business feasibility are the intrinsic values of R&D output and that these have direct impact on the

success or failure of the commercialization of R&D output. In this research, business feasibility of R&D output is set as mediating variable; technological characteristics and marketability of R&D output as independent variable; and the success of commercialization of R&D output as dependent variable, and a technology value assessment technique, which takes technology value and market value as main evaluation criterion(Seol,2000), is used to verify the mediating effect of business feasibility of R&D output on the relationship between marketability and the success of commercialization of R&D output.

4. RESEARCH METHOD

4.1. Operational Definition of Variables

To verify the research model and find out the effect of influential factors over the success of commercialization, this study divided each of 3 independent variables into 3 observed variables on the basis of the set hypotheses. The questions to measure each sub-variable were selected from the precedent studies and revised, and measured with 7-point Likert scale (1: least agree, ~ 7: most agree).

First, technological characteristics are divided into 3 variables (completeness, originality, and scalability). Technological scalability of R&D Output means the extent to which technology can be applied (expanded) in diverse directions. Second, marketability consists of 3 sub-variables (size, potential, and competition intensity). Market competition intensity is defined as the presence/non-presence of similar or substitute goods in a market. More similar or substitute goods means higher competition intensity and thus lower score. Third, business feasibility is divided into 3 sub-variables (ease of commercializing R&D output, new sales generation, and business competitiveness). Table 19.2 summarizes the influential variables over the commercial success of R&D output and the operational definition of the variables as shown Table 19.2 below.

Table 19.2
Influencing Factors over the Success of Commercialization of
R&D Output and Operational Definition

Classification	*Key Influencing Factors*		*Reference*	*Measuring Variables*
Independent Variable	Technological Characteristics	Completeness	Bear et. al., (1976), Yoon Yo-han et. al., (2014), Morone and lvins (1982)	Seven-point scale (1: Least Agree)
		Originality	Park ji-won et. al., (2015), Yoon Yo-han et. al., (2014), Morone and lvins (1982)	~ 7: Most Agree)
		Scalability	Yoon Yo-han et. al., (2014), Kim Chan-ho (2012), Park Sun-chul (2010)	
	Marketability	Size Potential	Carr (1992), Berry et. al., (1991), Yoon Yo-han et. al., (2014), Kim Chan-ho (2012), Park Sun-chul (2010)	
		Competition Intensity	Yoon Yo-han et. al., (2014), Kim Chan-ho (2012), Park Sun-chul (2010)	
	Business Feasibility	Easy to Commercialize	Yoon Yo-han et. al., (2014), Kim Chan-ho (2012), Park Sun-chul (2010), Sul Sung-su (2000), Yang Dong-woo (2005), Park Hyun-woo (2012)	

Classification	Key Influencing Factors	Reference	Measuring Variables
	Possibility of Generating New Sales	Park Sun-chul (2010), Park Hyun-woo (2012)	
	Business Competitiveness	Park Sun-chul (2010), Kim Chan-ho (2012), Sul Sung-su (2000), Park Hyun-woo (2012)	
Dependent Variable	Success of Commercialization		

4.2. Data Collection and Sampling

To collect the necessary data to test the research model, this study carried out a survey with questionnaires on the researchers who are currently conducting an R&D project, in one of domestic largest companies in ICT industry. And considering the fact that he survey was conducted on R&D projects in operation, this study distributed questionnaires evenly among the researchers to cover the entire scope of R&D projects and avoid bias to certain projects.

Online survey method was adopted for a total of 507 respondents and 208 responded, which records about 42% response rate. For data analysis, 206 were used after excluding 2 cases due to insincere response as shown Table 19.3.

Table 19.3
The Demographic Characteristics of the Samples

	Classification	Frequency (Number of Person)	Percentage (%)
Age	20s	27	13.0%
	30s	73	35.1%
	40s	95	45.7%
	50s	13	6.3%
Gender	Male	164	78.8%
	Female	44	21.2%
Service Year	Less Than 5 Years	81	38.9%
	6~10 Years	40	19.2%
	11~15 Years	26	12.5%
	16~20 Years	22	10.6%
	More Than 21 Years	39	18.8%

Additionally, 208 respondents are mostly in their 30s to 40s (80%), but their service year profile showed that 39% of them have service year of 'less than 5 years', which can let doubted for their experience with works related to technology commercialization. Therefore, it was checked to the personnel department and we were informed that most of 'less than 5 years' researchers had precious experience in that field before this company.

5. RESULTS

The purpose of this study is to find out the effect of (i) technological characteristics of R&D output, (ii) marketability, and (iii) business feasibility upon the success in commercialization of R&D output, and

examine if business feasibility mediates the effect of technological characteristics and marketability on the commercialization of R&D output. To achieve the purpose, hierarchical multiple regression analysis was conducted according to the procedure that Baron and Kenny (1986) suggested (Baron & Kenny, 1986). Data were processed and analyzed by SPSS Statistics 22 program. The validity of the research model was verified and the verified measurement model was used to test the hypotheses with hierarchical multiple regression analysis.

5.1. Reliability and Validity Test on Measurement Model

Factor analysis was used to test convergent validity and discriminated validity of measuring instruments (construct model). Exploratory factor analysis showed that all the variables converged in 3 factors. And the factor loading of possibility of generating new sales (BF2) of business feasibility was lower than 0.597 but that of other sub-variables was greater than 0.7, which verifies the convergent validity of constructs as shown Table 19.4.

Table 19.4
The Results of Exploratory Factor Analysis (Rotated Component Matrix)

Classification	Component		
	1	*2*	*3*
TF1	.765	.179	.227
TF2	.944	.093	.126
TF3	.844	.114	.090
MF1	.383	.190	.738
MF2	.369	.192	.776
MF3	-.071	-.028	.781
BF1	.109	.865	.019
BF2	.434	.597	.220
BF3	.058	.922	.105

Correlation matrix of the factor analysis demonstrated that those constructs are properly discriminated as shown Table 19.5.

Table 19.5
The Results of Exploratory Factor Analysis (Correlation matrix)

Classification	TF1	TF2	TF3	MF1	MF2	MF3	BF1	BF2	BF3
TF1	1.000	.751	.493	.422	.421	.195	.251	.449	.244
TF2	.751	1.000	.778	.428	.437	.095	.209	.485	.153
TF3	.493	.778	1.000	.420	.375	.074	.215	.380	.204
MF1	.422	.428	.420	1.000	.788	.311	.272	.331	.244
MF2	.421	.437	.375	.788	1.000	.352	.211	.426	.259
MF3	.195	.095	.074	.311	.352	1.000	-.003	.165	.088
BF1	.251	.209	.215	.272	.211	-.003	1.000	.373	.691
BF2	.449	.485	.380	.331	.426	.165	.373	1.000	.563
BF3	.244	.153	.204	.244	.259	.088	.691	.563	1.000

As seen in Table 19.6 below, reliability analysis shows that Cronbach's α of business competitiveness (BF3) of business feasibility of R&D output is 0.641, which is rather low, but all of the rest have Cronbach's α greater than 0.7 as shown Table 19.6.

Table 19.6
Reliability Analysis

Classification	Component (pattern matrix)			Cronbach's a if items are deleted	Cronbach's a
	1	2	3		
TF1	.757	.056	.107	.865	0.863
TF2	.980	−.055	−.018	.660	
TF3	.873	−.015	−.042	.855	
MF1	.263	.091	.700	.512	0.781
MF2	.242	.093	.742	.469	
MF3	.330	.548	.115	.781	
BF1	−.035	.894	−.070	.717	0.783
BF2	.330	.548	.115	.757	
BF3	−.113	.957	.024	.641	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy					.693
Bartlett's Identity Matrix Test				Approximate Chi-square	969.498
				df	36
				Level of Significance	.000

5.2. Mediating Effect

To examine the mediating effect of business feasibility on the relationship where technological characteristics and marketability of R&D output have effect on the commercialization of R&D output, hierarchical multiple regression analysis was carried out according to the stages that Baron and Kenny (1986) suggested 33.

First, analysis of variance was conducted to examine the impact of technological characteristics, marketability, and business feasibility of R&D output on the commercialization of R&D output and the results confirmed that the impacts were all within the significant level (p < 0.01) as shown Table 19.7.

Table 19.7
1st Stage Analysis Result_Coefficients
(Dependent variable: success of commercialization of R&D output)

Model		Non-standardized Coefficient		Standardized Coefficient	t	Level of Significance
		B	S.D.	(β)		
Technological Characteristics	(Constant)	4.830	.075		64.234	.000
	Technological Characteristics	.256	.075	.231	3.396	.001
Marketability	(Constant)	4.830	.071		67.717	.000
	Marketability	.426	.072	.385	5.962	.000
Business Feasibility	(Constant)	4.830	.068		70.860	.000
	Business Feasibility	.522	.068	.471	7.635	.000

Next, analysis of variance was conducted to examine the impacts of technological characteristics and marketability of R&D output when business feasibility of R&D output was set as dependent variable on the commercialization of R&D output and the results confirmed that the impacts were both significant ($p < 0.01$) as shown Table 19.8.

Table 19.8
2nd Stage Analysis Result_Coefficients
(Dependent variable: business feasibility of R&D output)

Model		Non-standardized Coefficient		Standardized Coefficient	t	Level of Significance
		B	S.D.	(β)		
Technological Characteristics	(Constant)	3.373	.050			1.000
	Technological characteristics	.192	.051	.204	3.735	.000
Marketability	(Constant)	3.373	.044			1.000
	Marketability	.320	.048	.275	5.209	.000

Last, when technological characteristics of R&D output was set as independent variable; business feasibility of R&D output as mediating variable; and the commercialization of R&D output as dependent variable, hierarchical multiple regression analysis was carried out. The results showed model 1 = 231 > model 2 = 217 when β of the independent variables used in both models (1 and 2) were compared. It demonstrates that business feasibility of R&D output (mediating variable) has a mediating effect on the relationship where technological characteristics of R&D output (independent variable) has effect on the success of commercialization of R&D output (dependent variable) shown Table 19.9.

Table 19.9
3rd Stage Analysis Result_Coefficients
(Business feasibility-mediated regression analysis)

Model		Non-standardized Coefficient		Standardized Coefficient	t	Level of Significance
		B	S.D.	(β)		
1	(Constant)	4.830	.075		.000	1.000
	Technological characteristics	.256	.075	.231	3.396	.001
	(Constant)	4.830	.071		67.717	.000
	Marketability	.426	.072	.385	5.962	.000
2	(Constant)	27.054	.047		.000	1.000
	Technological characteristics	.274	.052	.217	5.285	.000
	Business feasibility	.325	.055	.301	5.904	.000
	(Constant)	23.004	.046		−0.993	.352
	Marketability	.510	.044	.297	2.513	.012
	Business feasibility	2.131	.049	.356	4.551	.000

In addition, when marketability of R&D output was set as independent variable; business feasibility of R&D output as mediating variable; and the commercialization of R&D output as dependent variable, hierarchical multiple regression analysis was carried out. The results showed model 1 = .385 > model 2 = .297

when β of the independent variables used in both models (1 and 2) were compared. It demonstrates that business feasibility of R&D output (mediating variable) has a mediating effect on the relationship where marketability of R&D output (independent variable) has effect on the success of commercialization of R&D output (dependent variable) as shown Figure 19.2.
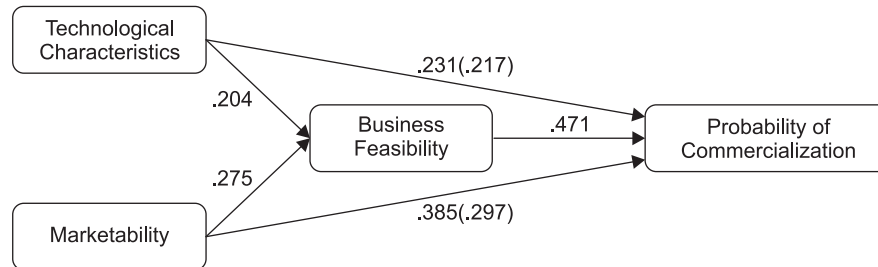

Figure 19.2: Mediating Effect Model of Business Feasibility on Success of Commercialization

5.2.3. *The Results of Hypothesis Test*

The results of this study demonstrated that the independent variables ((i) technological characteristics, (ii) marketability, and (iii) business feasibility) have a positive effect (+) on the dependent variable (the success of commercialization of R&D output). And technological characteristics and marketability also have a positive effect (+) on business feasibility of R&D output.

It was demonstrated that business feasibility of R&D output has a positive mediating effect on the relationship shown Table 19.10 in which technological characteristics and marketability of R&D output have effect on the commercialization (dependent variable). In addition, it was confirmed that the mediating effect of marketability of R&D output is relatively higher than that of technological characteristics of R&D output.

Table 19.10
The Results of Hypothesis Test

Sub-Influencing Factors			Hypothesis	Classification
Technological Characteristics	H1		Technological characteristics of R&D Output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
	Technology Completeness	TF1	Completeness of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted
	Technology Originality	TF2	Originality of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted
	Technology Scalability	TF3	Scalability of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted
Marketability	H2		Marketability of R&D output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
	Market Size	MF1	Market size of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted
	Market Potential	MF2	Market potential of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted
	Competition Intensity	MF3	Competition intensity of R&D output will have a positive effect (+) on business feasibility of R&D output.	Accepted

Sub-Influencing Factors			Hypothesis	Classification
Business Feasibility	H3		Business feasibility of R&D output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
	Easy to Commercialize	BF1	Ease of commercializing R&D output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
	Possibility of Generating New Sales	BF2	Possibility of generating new sales from R&D output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
	Business Competitiveness	BEF3	Competitiveness of R&D output will have a positive effect (+) on success of commercialization of R&D output.	Accepted
Mediating Effect	(Technological Characteristics)		Business feasibility of R&D output will have mediating effect on the relationship where technological characteristics of R&D output have effect on the success of commercialization of R&D output.	Accepted
	H5 (Marketability)		Business feasibility of R&D output will have mediating effect on the relationship where marketability of R&D output has effect on the success of commercialization of R&D output.	Accepted

6. CONCLUSION AND LIMITATIONS

Success or failure of commercialization of R&D output (technology) is quite different from that of development of R&D output. However, most of researches have conducted on success or failure of development of R&D output. Even some studies that focus on success or failure of commercialization of R&D output also tilted to partial effect (direct effect) of the intrinsic values of R&D output upon the commercialization. Therefore, few studies focused on the relationship among intrinsic values of R&D output when they have impact on the success of commercialization of R&D output.

This study classified the intrinsic values of R&D output, which are the influencing factors over the success of commercialization of R&D output (technology), into 3 sub-factors (technological characteristics, marketability, and business feasibility), and analyzed the relationship among those factors. Technological characteristics include technological completeness, originality, and scalability. Marketability consists of market size, market potential, and competition intensity in market. In addition, business feasibility is divided into ease of R&D output commercialization, possibility of generating new sales, and business competitiveness and the relationship among those factors were analyzed.

The results of this study showed that business feasibility of R&D output partially mediates the relationship between technological characteristics and marketability of R&D output has effect on the commercialization of R&D output. In particular, it was confirmed that the mediating effect of marketability of R&D output is relatively higher than that of technological characteristics of R&D output. It is assumed that this result is related to interchangeability of the terms 'market value' and 'business value' in meaning.

This study has a practical implication for which focused on ICT private firms as follows. It is important to improve the intrinsic values of R&D output in order to enhance the success of commercialization of R&D output, but more important to look into the interaction of the intrinsic values of R&D output so that business feasibility of R&D output can have energy effect with technological characteristics and marketability. In particular, this study demonstrated that marketability of R&D output can have better (more positive)

effect on the success of commercialization of R&D output when it works with high business feasibility of R&D output.

Despite the practical implication, this study has some limitations as follows and will suggest a direction in which future study needs to go: (i) sampling is biased to private ICT industry so that it can't represent whole ICT population and (ii) to the internal employees of a large company owning own R&D institute so that their responses could lead to statistical distortion. Therefore, it is necessary to keep collecting and analyzing the data from which significant variables were derived. Furthermore, future study needs to diversify data collection (business type, size and characteristics, etc.) and consider the growth stage and characteristics of a company from which data are collected.

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