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A STUDY ON THE INFLUENCE OF TECHNOLOGY START-UPS ON BUSINESS PERFORMANCE

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Abstract. *This research is to investigate the impact of business start-ups on business performance. Investigate the success factors for successful business and investigate the effectiveness of the founder competence that is expected to serve as a mediator for business performance and creation. In addition, it examines the influence of success factors on business performance, which is a factor affecting the success of technology start-up companies and presents the results.*

Keywords: Technology-based start-up, Technology-based start-up success variables, Technology-based start-up competence, Technical performance, Technology commercialization ability, Technology marketing capability, Technology innovation capability

1. **Introduction.** This study examines the concepts of start-up success and start-up competency that can improve the business success of technology-based start-ups and analyzes the impacts and identifies the interrelationships between them. However, this study is different from the previous studies (Kim and Kim [1], Kim and Seo [2], Lee [3], Ju [4]) by examining the effects of success factors on competence and business performance by adding factors of success. We used Smart PLS 3.0, a statistical analysis program, to identify the influence of business start-ups motives or entrepreneurship success factors on entrepreneurial capacity and business performance. As a result, the factors affecting the technological performance, which is one of the business performance of the start-up companies, were analyzed by the network capacity, technology capacity and technology innovation capacity of the company. Exit strategy, network competence, and technology competence are factors affecting technical marketing ability, and network competency, technology commercialization ability, and technology competence are factors influencing technology innovation capacity. The factors influencing the technology commercialization capacity were identified as technology commercialization capability and technology capability. The results of this study are important to newly identify the factors affecting the business performance of start-up companies which were not covered in previous studies. This study analyzes the problems and limitations of the previous studies and draws a distinction from the previous studies. As a result, the researchers set up a research model on the effects of success factors on business performance. We set up three high hypotheses as a research model and set up 23 sub-hypotheses to verify the influence and the mediating effect of the entrepreneurial capacity.

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2. **Problem Statement and Preliminaries.** The unemployment rate of the youth in the world is increasing, and the unemployment rate is increasing in Korea because of the decline of the business due to the recession and regulation and the contraction of corporate economic activity. This study examines in detail the concepts of start-ups success and start-ups competence that can enhance the business success potential of technology-based start-up for the activation of technology-based start-ups ecosystem. The specific objectives of the study are as follows. First, we try to identify causality by examining the effects of technology start-up success variables on technological start-up capacity and business outcomes of technology start-up companies. Second, analyze empirically the effects of technological start-up success variables on business performance through mediating effects of technology start-up capability. Third, analyze the effects of technology start-ups capacity on business performance of technology start-up companies. Fourth, analyze the causal relationship and the empirical analysis of the factors affecting the performance of the technology start-up success due to the structural equation model analysis.

2.1. **Successful variables of technology-based start-ups.** The commercialization factor of the technology consists of the completeness of the technology, the subject of the appropriate business, and the feasibility analysis of the business. Therefore, the success factors of technology start-up through technology commercialization can be divided into technical factor, business factor, economic factor and evaluation factor as follows. First, the technical factors are the completeness of technology, the superiority of technology, the ripple effect of technology, the maturity of technology, the useful life of technology, the position in system, the complementary technology. Second, business factors include marketability, business performance, firm size, corporate strategy. Third, economic factors include interest rate, loan market situation, economic fluctuation, regulation. Fourth, evaluation factors include evaluation point, purpose of evaluation, and analytical power. These factors can be summarized as utility and competitiveness on the basis of four components: competitive advantage, solution, core indicators and problem. Competitiveness can be identified as the presence of alternative technologies, competitor impact, technology complexity, differentiation, patent legal rights, strategic position, regional applicability, possibility of technology value decreasing and technology substitutability [5].

2.1.1. *Management capabilities.* The role of entrepreneurs in SMEs is defined as the role of entrepreneurs in terms of human/conceptual competency as the managerial role, the ability to recognize the opportunity, the result-oriented driver, and the technical/functional role as the technical/functional capability and the political capability [6].

2.1.2. *Technical competence.* It is assumed that there is a need to transform the organizational dimension from the perspective of the entrepreneur, and this study assumes that the technological competence of the entrepreneur will have a positive effect on the management performance [7].

2.1.3. *Network capabilities.* Network competencies in manufacturing firms have shown that vertical collaboration (customers, suppliers, and intermediaries) has a greater impact on innovation than horizontal cooperation (government or institution, university, survey company) [8].

2.1.4. *Technology commercialization abilities.* It is defined to include the act of procuring the technology assets developed in the process of searching for promising items in the market and evaluating the feasibility of the business by transferring, establishing, investing, investing necessary funds or financing [9].

2.1.5. *Exit strategy.* It is necessary to decide how to withdraw the funds that have been withdrawn since the company entered the normal course. It is called EXIT strategy that a venture or investor withdraws investment funds [10]. In addition, IPOs, mergers and acquisitions (including Kang [9]) are also used. However, in general, the method of withdrawal through IPO issuance and merger and acquisition are often used [4].

2.2. **Technology-based startup competence.** The three sub-factors of Technology-based start-up competence, which were examined in previous research, are as follows.

2.2.1. *Technology commercialization capability.*

1) Commercialization ability: Song and Parry proposed the integration of technological capabilities and interdepartmental integration of resources as well as marketing competence as a source of competitiveness that determines the success of new product development [11]. It emphasized the importance of product development by classifying the firm's ability into product development, marketing, competitive response, and product trust group through factor analysis [12].

2) Production capacity: Westphal et al. defined the ability of a company to operate and maintain production facilities in response to changing conditions, and to adopt and improve existing production technologies within the original design range [13].

3) Marketing ability: Dutta et al. emphasized the importance of marketing functions as well as research and development capabilities, which are essential for maximizing performance in cutting-edge markets [14].

2.2.2. *Technology innovation capability.* It has been argued that firms' technological innovation capacity and resources are a useful factor in developing new products, focusing on technological innovation, and influencing firm performance through aggressive strategies [15].

2.2.3. *Technology marketing capability.* Many researches on technology commercialization have focused on the concept of technology marketing, high technology product marketing, and general marketing. It has been found that it is used as a comprehensive sub-tool according to the characteristics of the industrial sector [16].

2.3. **Technical performance.** Technical performance has a relatively large impact on technological and technical management capacity production support, marketing capability research and development capability, and new product development capability, and they have a great influence on business performance as well as market information [4].

2.4. **Setting up a research model.** As a result of previous research and analysis, it can be seen that the sub-factors of corporate success factors are independent variables of the technological performance of enterprise. Dependencies of corporate success factors are the five sub-factors: technology competency, network competency, technology commercialization competency, exit strategy, and management competency. As a parameter, the sub-factors of entrepreneurial competency were set as three sub-factors: technical commercialization ability, technical marketing ability and technological innovation capacity. The research model is shown in Figure 1.

2.5. **Setting up a research hypothesis.** [Hypothesis H1] Successful start-up factors will have a positive impact on technology start-up capability. [Hypothesis H2] Entrepreneurial competence will have a positive impact on technical performance. [Hypothesis H3] Successful start-up factors will have a positive impact on technical performance.

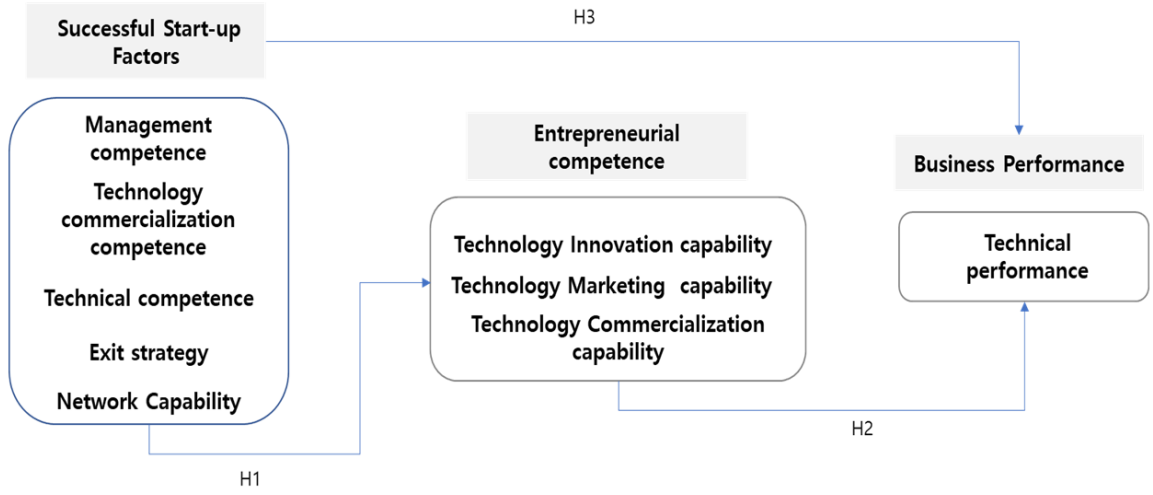

FIGURE 1. Research model

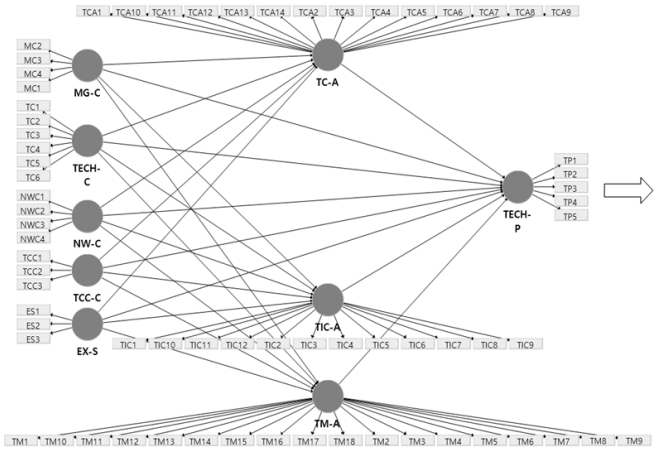

FIGURE 2. Initial structural model

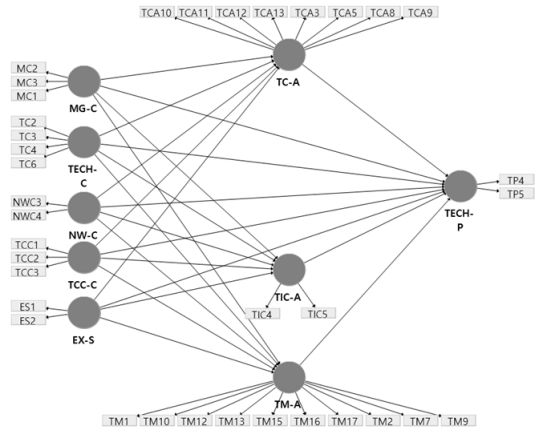

FIGURE 3. Final research structural model

3. Main Results.

3.1. Research method and results.

3.1.1. *Data acquisition.* This research data was collected through on-line surveys and the scope of the surveyors was CEOs of start-up companies. The number of questionnaires requested was 330, the number of questionnaires was 205 and the recovery rate was 62.1%.

3.1.2. *Demographic analysis.* The collected data was analyzed by SPSS 22. The analysis items consist of 8 types such as company type, manufacturing method, sex, industry type, years of establishment, number of employees, age and sales scale.

3.2. Results.

Design of research structure model. The results of this study are as follows. First, the initial research model as shown in Figure 2 was established by using the measurement variables of the five success factors, the independent variables, the measurement variables of the three sub-factors of the entrepreneurial competence and the measurement variables of the technical performance as the dependent variables.

4. Control Design.

4.1. Factor analysis.

As a result of the factor analysis by dimension reduction, exogenous variables and endogenous variables were adjusted to change from the initial structural model in Figure 2 to the final structural model in Figure 3.

4.2. Evaluation of measurement model.

4.2.1. *Internal consistency reliability evaluation.* Cronbach's Alpha showed good reliability with a critical value of 0.7 or higher. Therefore, the internal consistency of all research variables is ensured. rho_A is 0.7 or more, which is the critical value. Composite reliability is shown to be a desirable reliability with a critical value of 0.7 or higher. In addition, the AVE value was 0.5 or more, which is the threshold value, and the convergent validity was confirmed. The results are shown in Table 1.

Table 1. Internal consistency reliability evaluation

	Cronbach's α	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)
EX-S	0.889	0.892	0.947	0.900
MG-C	0.830	0.852	0.899	0.748
NW-C	0.893	0.894	0.949	0.903
TC-A	0.945	0.946	0.954	0.722
TCC-C	0.819	0.841	0.891	0.732
TECH-C	0.911	0.911	0.937	0.789
TECH-P	0.886	0.887	0.946	0.898
TIC-A	0.902	0.981	0.952	0.908
TM-A	0.950	0.952	0.957	0.692

4.2.2. *Convergent validity evaluation.* Outer loadings were all 0.7 or more, and the convergent validity of individual measured variables was obtained. The results are shown in Table 2.

4.3. Structural model evaluation.

4.3.1. *Collinearity statistics.* Inner VIF Values are all less than 5, so there is no collinearity among the research parameters of the structural model. The results are shown in Table 3.

4.3.2. *Evaluation of R square.* TC-A & TM-A showed a strong explanatory power of .781 & .707 and TECH-P showed a high explanatory power of .574, and TIC-A had .331 as an explanatory power of adjusted-R squares. It is confirmed that the explanatory power is moderate. The results are shown in Table 4.

4.3.3. *Evaluation of effect size (f^2).* Effect size (f^2) is a measure of the extent to which exogenous research variables contribute to R Square in endogenous studies, with TCC-C having the largest effect of .486 contributing to TC-A. Next, f^2, which NW-C contributes to TM-A, has a moderate effect of .144. The effect of TECH-C on TM-A and TECH-P was found to be somewhat lower than that of medium, with f^2 being .139 and .137. The results are shown in Table 5.

4.4. Hypothesis tests result.

4.4.1. *Influence relationship between factors.* The results obtained from the results of running Smart PLS 3.0 are shown in Figure 4.

TABLE 2. Outer loadings

	EX-S	MG-C	NW-C	TC-A	TCC-C	TECH-C	TECH-P	TIC-A	TM-A
ES1	0.945								
ES2	0.952								
MC2		0.901							
MC3		0.780							
NWC3			0.948						
NWC4			0.953						
TC2						0.881			
TC3						0.899			
TC4						0.908			
TC6						0.865			
TCA10				0.861					
TCA11				0.875					
TCA12				0.844					
TCA13				0.810					
TCA3				0.820					
TCA5				0.888					
TCA8				0.848					
TCA9				0.851					
TCC1					0.880				
TCC2					0.879				
TCC3					0.806				
TIC4								0.937	
TIC5								0.969	
TM1									0.777
TM10									0.844
TM12									0.857
TM13									0.857
TM15									0.785
TM16									0.826
TM17									0.858
TM2									0.838
TM7									0.845
TM9									0.823
TP4							0.947		
TP5							0.949		
MC1		0.907							

4.4.2. *Path coefficients analysis result.* The results of hypothesis tests on the results of the estimation of path coefficients (mean, STDEV, T-value, P-value) show that EX-S→TM-A, NW-C→TECH-P, NW-C→TIC-A, NW-C→TM-A, TCC-C→TC-A, TCC-C→TIC-A, TECH-C→TC-A, TECH-C→TECH-P, TECH-C→TIC-A, TECH-C→TM-A, TIC-A→TECH-P hypotheses were adopted to meet the significance and conformity criteria. The results are shown in Table 6.

4.4.3. *Special indirect effect.* In case of special indirect effect, TCC-C→TC-A→TECH-P, TECH-C→TIC-A→TECH-P and NW-C→TIC-A→TECH-P showed the effect of medium. TECH-C→TC-A→TECH-P, EX-S→TIC-A→TECH-P, NW-C→TC-A→TECH-P, MG-C→TC-A→TECH-P showed weak effect. The results are shown in Table 7.

Table 3. Inner VIF values

	EX-S	MG-C	NW-C	TC-A	TCC-C	TECH-C	TECH-P	TIC-A	TM-A
EX-S				2.813			2.998	2.813	2.813
MG-C				3.957			4.079	3.957	3.957
NW-C				2.937			3.518	2.937	2.937
TC-A							4.790		
TCC-C				2.271			3.555	2.271	2.271
TECH-C				2.460			3.143	2.460	2.460
TECH-P									
TIC-A							1.567		
TM-A							3.650		

Table 4. R square

	R square	R square adjusted
TC-A	0.786	0.781
TECH-P	0.591	0.574
TIC-A	0.347	0.331
TM-A	0.714	0.707

Table 5. Effect size (f^2)

	EX-S	MG-C	NW-C	TC-A	TCC-C	TECH-C	TECH-P	TIC-A	TM-A
EX-S				0.000			0.001	0.019	0.054
MG-C				0.014			0.010	0.001	0.017
NW-C				0.044			0.072	0.054	0.144
TC-A							0.006		
TCC-C				0.486			0.005	0.040	0.006
TECH-C				0.112			0.137	0.093	0.139
TECH-P									
TIC-A							0.026		
TM-A							0.000		

5. **Conclusions.** It is confirmed that the network capacity (NW-C) and the technology capability (TECH-C) are the factors that strongly affect the technical achievement (TECH-P). The network capacity (NW-C) and the technology capacity (TECH-C) were found to have a significant influence on the parameters TIC-A and TM-A. It has also been confirmed that the exit strategy (EX-S) and the technology capability (TECH-C) affect technology marketing ability (TM-A). In conclusion, it is important to provide a result that it is necessary to strengthen these two capabilities in order to increase business performance in the future, since network capacity and technology capacity, which are successful start-up factors, directly affect technical performance. It is necessary to carry out further research by expanding the technology field into manufacturing, non-manufacturing, IT, etc., and to carry out further research as a research topic that is deepened after this study.

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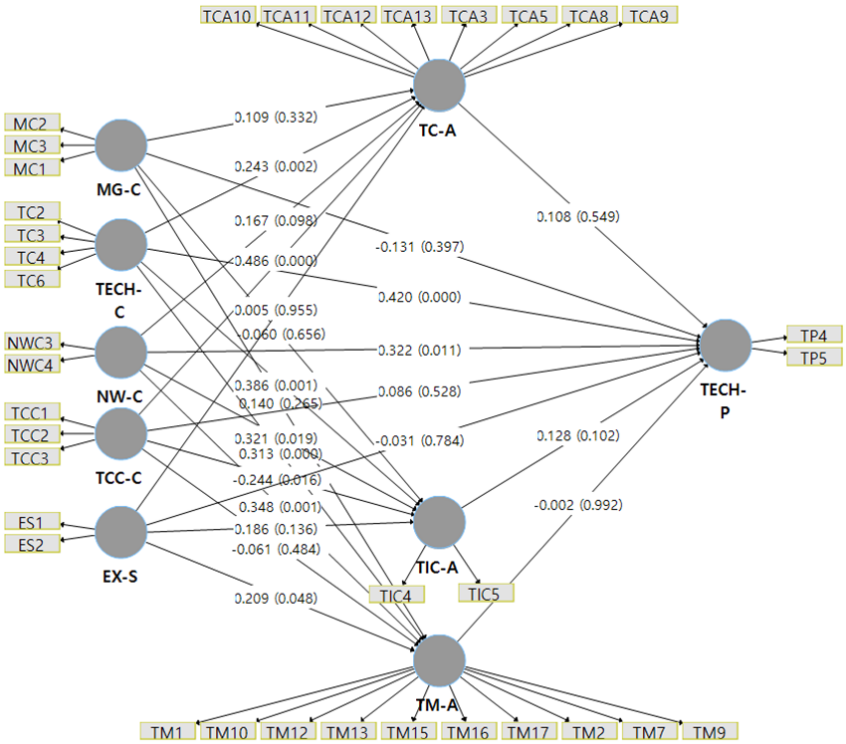

FIGURE 4. Final research structural model result

TABLE 6. Path coefficients

	Original sample (O)	Sample mean (M)	STDEV	T value (|O/STDEV|)	P value	Result
EX-S→TC-A	0.005	0.011	0.083	0.057	0.954	Reject
EX-S→TECH-P	−0.031	−0.027	0.109	0.282	0.778	Reject
EX-S→TIC-A	0.186	0.177	0.129	1.440	0.150	Reject
EX-S→TM-A	0.209	0.206	0.106	1.979	0.048	Accept
MG-C→TC-A	0.109	0.111	0.109	0.996	0.319	Reject
MG-C→TECH-P	−0.131	−0.137	0.153	0.855	0.392	Reject
MG-C→TIC-A	−0.060	−0.052	0.137	0.436	0.663	Reject
MG-C→TM-A	0.140	0.133	0.125	1.126	0.260	Reject
NW-C→TC-A	0.167	0.165	0.101	1.659	0.097	Reject
NW-C→TECH-P	0.322	0.328	0.127	2.533	0.011	Accept
NW-C→TIC-A	0.321	0.324	0.138	2.335	0.020	Accept
NW-C→TM-A	0.348	0.351	0.098	3.535	0.000	Accept
TC-A→TECH-P	0.108	0.116	0.176	0.614	0.539	Reject
TCC-C→TC-A	0.486	0.487	0.066	7.326	0.000	Accept
TCC-C→TECH-P	0.086	0.078	0.132	0.651	0.515	Reject
TCC-C→TIC-A	−0.244	−0.246	0.101	2.417	0.016	Accept
TCC-C→TM-A	−0.061	−0.057	0.086	0.709	0.478	Reject
TECH-C→TC-A	0.243	0.237	0.079	3.080	0.002	Accept
TECH-C→TECH-P	0.420	0.412	0.116	3.627	0.000	Accept
TECH-C→TIC-A	0.386	0.386	0.113	3.415	0.001	Accept
TECH-C→TM-A	0.313	0.318	0.085	3.669	0.000	Accept
TIC-A→TECH-P	0.128	0.124	0.079	1.623	0.105	Accept
TM-A→TECH-P	−0.002	0.009	0.151	0.010	0.992	Reject

Table 7. Special indirect effect

	Special indirect effect	Result
EX-S→TC-A→TECH-P	0.001	No effect
MG-C→TC-A→TECH-P	0.012	Slight effect
NW-C→TC-A→TECH-P	0.018	Slight effect
TCC-C→TC-A→TECH-P	0.052	Medium effect
TECH-C→TC-A→TECH-P	0.026	Slight effect
EX-S→TIC-A→TECH-P	0.024	Slight effect
MG-C→TIC-A→TECH-P	−0.008	Reject
NW-C→TIC-A→TECH-P	0.041	Medium effect
TCC-C→TIC-A→TECH-P	−0.031	Reject
TECH-C→TIC-A→TECH-P	0.049	Medium effect
EX-S→TM-A→TECH-P	0.000	Reject
MG-C→TM-A→TECH-P	0.000	Reject
NW-C→TM-A→TECH-P	−0.001	Reject
TCC-C→TM-A→TECH-P	0.000	Reject
TECH-C→TM-A→TECH-P	0.000	Reject

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