

Factor Analysis on the Effect of Win-win Smart Factory Education on Job Satisfaction of Medium and Small-sized Enterprises

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Abstract

Developed countries that have experienced decline in productivity due to the economic crisis in the past have come to recognize the smart factory as an important means to strengthen the competitiveness of the manufacturing industry due to the increase in labor costs, the avoidance of the manufacturing industry, and the resolution of the shortage of skilled manpower. The necessity of nurturing manpower for self-maintenance was felt through identifying factors for successful smart factory introduction by companies and providing smart factory education. Therefore, the effects of educational satisfaction and operational competency on self-efficacy as a parameter and self-efficacy as a parameter were analyzed using research models and hypotheses to determine whether there was an effect between job satisfaction as a dependent variable. As a result of the analysis, it was found that the mediating effect of self-efficacy and self-efficacy on job satisfaction was found to have significant effects on operational competency and self-efficacy as parameters, as well as educational satisfaction and operational competency. The implication of this study is that continuous education and innovation activities are important in order to increase the business performance of companies, and through this, the manufacturing competitiveness of SMEs can be improved.

Keywords : 4th industrial revolution, Training satisfaction, Self-efficacy, Job satisfaction

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Smart Factory [7].

2010

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[11].

[15].

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(2017) , Smart Factory 1)[16]
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 [9].
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[14]. 가 Smart Factory AMOS
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2.

2.1 Smart Factory

Kim[4] 가
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2 (MES/ERP)
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3 (Lee, 2017)[12].
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20
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Compbell(1970)

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[10]. Locke (1976)

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(self - efficacy)

Albert Bandura(1986)가

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(Bandura,

1986), 가

. Jeong[5]

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Lee[12]

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(1992)
5가
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(, 2012,) [17].

2.6

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(1992)
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<Table 1> Survey Configuration

division	The details	Metrics	source
independent variable	Training Satisfaction	5	Tae - Geun Yoo (2005)
	Operation Capability	5	Cheong - seop Cheon (2005)
dependent variable	Job Satisfaction	6	Jeong - taek Kim (2008)
parameter	Self - Efficacy	5	Soon - woo Lee (2014)
control variable	sex, age, educational background, job, years of service, position		

Smart
Factory
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6가
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3.

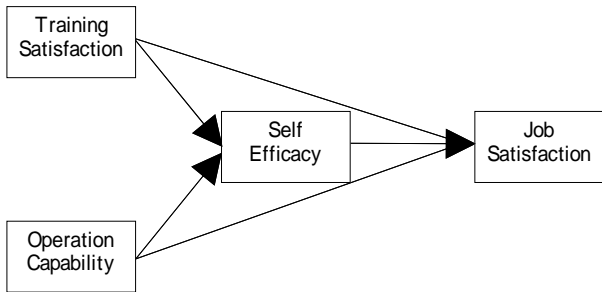
3.1

3.2

<Table 1>
4가 27
Smart
Factory
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[Figure 1]
가



[Figure 1] Research Model

- 가 1 : Smart Factory (+) 가
- 가 2 : Smart Factory (+)
- 가 3 : Smart Factory (+) 가
- 가 4 : Smart Factory (+)
- 가 5 : Smart Factory (+) 가

3.3

2020

. 2020 3 19

135

. 135 94.8%

5.2% , 26~35 가 54.8%,
44.4%, ()가 63.4% 가
10~20 33.3% ,
25.2%, 21.5%

<Table 2>

<Table 2> Survey Contents

Factors	Survey contents
Training Satisfaction	Classrooms and training rooms were suitable for education
	The instructor showed vitality and enthusiasm for teaching.
	The instructor motivates the students to actively participate
	The pace of the instructor's training was appropriate.
Operation Capability	I think the contents of education and training are valuable to our company
	I believe that the contents of education and training can be used for decision -making
	If you use the contents of education and training, your job performance will be improved
	The content I received is directly related to my work
	When a problem arises in the contents of education and training, it can be resolved
Self Efficacy	I think I am qualified for my work
	I can do all my assigned tasks with my own abilities.
	I am confident that I can put what I have learned in education to good use in difficult situations.
	I believe in my ability to use new directives in my work.
Job Satisfaction	My job is something that gives me a sense of accomplishment
	I am interested in my job
	I am satisfied with my job
	I feel like our company's problems are mine
	Our company means a lot to me

4.

4.1

Smart Factory

SPSS

<Table

Cronbach

3>

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(0.7)

0.5
 <Table 3> KMO 0.871 0.6
 Bartlett 0.000
 P < 0.01
 4 69.250%

<Table 3> Reliability and factor analysis results

Factors	Measurement items	factor loading	Cronbach's Alpha
Training Satisfaction	Training facility	0.577	0.81
	Enthusiasm	0.801	
	Motivation	0.854	
	Understanding	0.755	
Operation Capability	Value	0.668	0.879
	Deision	0.780	
	Work ability	0.604	
	Relevance	0.772	
	Solving ability	0.828	
Self Efficacy	Performance	0.657	0.850
	Ability	0.807	
	Confidence	0.714	
	Ability to use	0.635	
Job Satisfaction	Achievement	0.787	0.843
	Interest	0.735	
	Job satisfaction	0.761	
	Loyalty	0.644	
	Company satisfaction	0.791	
KMO(Kaiser Meyer - Olkin)			0.871
Bartlett's Sphericity Test	Chi - Square	1509.92	
	df(P)	153	
	P - value	0.000	
Rotation Sums of Squared Loadings(%)			69.250

4.2

SPSS
 Smart Factory

<Table 4>
 Pearson 가 0.488 0.691

P < 0.01

<Table 4> Results of Correlation Matrix

Factors		TS	OC	SE	JS
TS	Pearson CC	1	.530..	.531..	.488..
	P - Value		.000	.000	.000
	N	135	135	135	135
OC	Pearson CC	.530..	1	.687..	.546..
	P - Value	.000		.000	.000
	N	135	135	135	135
SE	Pearson CC	.531..	.687..	1	.691..
	P - Value	.000	.000		.000
	N	135	135	135	135
JS	Pearson CC	.488..	.546..	.691..	1
	P - Value	.000	.000	.000	
	N	135	135	135	135

* TR : Training Satisfaction, OC : Operation Capability, SE : Self Efficacy, JS : Job Satisfaction

AMOS

<Table 5>

. CMIN/DF 2 , 3
 2.121 가
 1.823 3
 가 , RMR
 0.05 0.04
 0.038 가 . GFI,
 AGFI 0.9 0.9
 가 .

<Table 5> Structural equation model analysis result

Factors	Fitness Index	
	Before	After
CMIN(²)	273.637	228.500
CMIN/DF	2.121	1.823
RMR	0.040	0.038
GFI	0.825	0.848
AGFI	0.768	0.792
NFI	0.828	0.856
IFI	0.796	0.929
CFI	0.899	0.928
RMSEA	0.843	0.079

RMSEA 0.08

0.843 0.079 가
 , NFI, IFI, CFI 0.9

IFI, CFI
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<Table 6>

<Table 6> Result of hypothesis testing of structural model

Division			Estimate	S.E	C.R	P - Value
H1	TR	SE	0.248	0.148	1.675	0.094
H2	OC	SE	0.552	0.097	5.714	***
H3	TR	JS	0.171	0.165	1.037	0.300
H4	OC	JS	0.092	0.13	0.706	0.480
H5	SE	JS	0.677	0.157	4.306	***

* $p < 0.001$, TR : Training Satisfaction, OC : Operation Capability, SE : Self Efficacy, JS : Job Satisfaction

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6. References

- [1] A. Bandura(1986), Social foundations of thought & action: A social cognitive theory. Englewood Cliffs, NJ: Prentice - Hall, pp. 44 - 99.
- [2] B. H. Lee(2019), "To improve the efficiency of smart factory promotion small and medium business education improvement strategy." Technology Management Economics Society, 12 - 1790049 - 000002 - 01:32 - 33.
- [3] B. J. Jung(2017), "A study on the effect of smart factory on corporate performance and job satisfaction."

- Master's thesis, Kyung Hee University Graduate School of Education.
- [4] E. H. Kim(2020), "A study on application of Fraunhofer industry 4.0 layer model for Korean SMEs' smart factory training." Korean Association of Business Education, 35(3):91 - 112.
- [5] H. R. Jeong(2011), "A study on the effects of airline organizational culture on job satisfaction and customer orientation: Focusing on the ground workers of domestic and foreign airlines." Master's thesis, Dong - A University.
- [6] H. H. Lee, C. S. Leem(2018), "SWOT analysis for small and medium enterprise in smart factory introduction." Journal of the Korea Convergence Society, 9(3):1 - 14.
- [7] J. H. Sim, M. S. Yoon, J. B. Ahn, B. D. Yu, I. K. Hwang(2017), "A study on smart factory construction in small and medium manufacturers." Journal of the Korean Institute of Plant Engineering, 22(1):87 - 97.
- [8] J. H. Kim(2019), "Analysis of factors affecting company performance by smart factory." Journal of the Society of Korea Industrial and Systems Engineering, 42(4):76 - 83.
- [9] J. S. Park, K. S. Kang(2017), "Strategies of smart factory building and Application of small & medium-sized manufacturing enterprises." Journal of the Korea Safety Management & Science, 19(1):227 - 236.
- [10] J. Compbell(1970), "On the nature of organizational effectiveness." New Perspectives on Organizational Effectiveness, 13:55.
- [11] J. H. Kwon, S. B. Lee(2016), "A case study of german small and medium enterprises' introduction of 'Industry 4.0' and it's implication to Korea." Koreanisch Deutsche Gesellschaft fur Wirtschaftswissenschaften, 34(3):37 - 55.
- [12] J. H. Lee(2017), "The effects of education and training satisfaction on learning transfer and job satisfaction." Master's thesis, Korea University of Tchnology & Education.
- [13] J. W. Kim(2017), "Current status and development plan for smart factory education." The Korea Contents Society, 15(2):25 - 29.
- [14] Korea Policy Briefing(2020), Smart factory, smart industrial complex. <https://www.korea.kr/special/policyCurationView.do?newsId=148866604> (Search date: 2020.03.18.)
- [15] Ministry of SMEs and Startups(2021), Achieved 20,000 smart factories supply. <https://www.korea.kr/news/ressReleaseView.do?newsId=156431980>(Search date: 2021.09.13.)
- [16] News Channel J(2019), Smart factory business briefing session. <http://www.newsch.co.kr/news/articleView.html?idxno=10221> (Search date: 2019.10.15.)
- [17] O. Jang(2012), "Effect of education and training of Korean companies entering China on job satisfaction and job performance improvement." Master's thesis, Kangwon National University.



: Smart Factory, 4



: SCM/APS, MES, Smart Factory, Blockchain