

Can Digital Technology Enhance Performance of Company?

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Digital transformation Policy in Korea

- South Korea (Korea hereafter) has been proactive in adopting new technologies.
 - The institutional arrangement in Korea could be called a ‘state-influenced market economy’. Three characteristics are noteworthy in the Korean model of economy.
 - ✓ the national government has played a central role in developing the economy.
 - ✓ the Korean economy has a significant portion of manufacturing.
 - Manufacturing still accounts for 27.5% of the Gross Domestic Product as of 2022, a level higher than other high-income countries such as the United States (10.9%) and Germany (19.1%).
 - The heavy reliance on advanced manufacturing technology shapes how the government prioritises policy support for AI technology.
- For instance, the Korean government provides substantial subsidies to small and medium enterprises (SMEs) in the manufacturing sector so that they can adopt AI-based production technologies.

- In building an information-based economy, the Korean government has provided substantial support and guidance to industry, being a major 'investor' of itself in technology development.

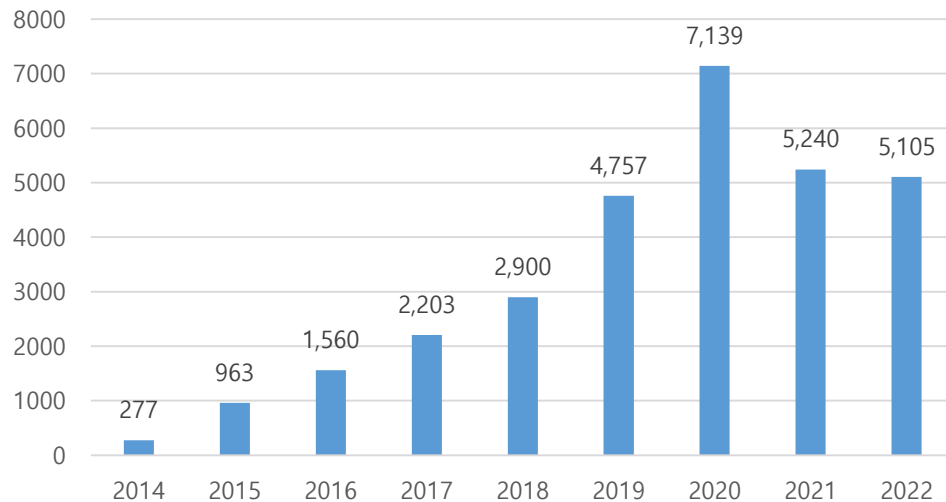
- Beyond IT Powerhouse Toward an AI Powerhouse
 - ✓ the Korean government made explicit investment in developing human capital on new digital technologies.
 - The goal of this scheme is to produce 1820 AI specialists by 2025.

 - ✓ the Korean government has paid special attention to developing technological capability of the manufacturing sector.
 - A challenge for the Korean manufacturing sector, especially for resource-constrained SMEs is to maintain a competitive edge against rising Chinese technology manufacturers.
 - Korean government introduced the 'smart factory' scheme that intends to assist SMEs in adopting advanced digital technologies such as AI and machine learning.

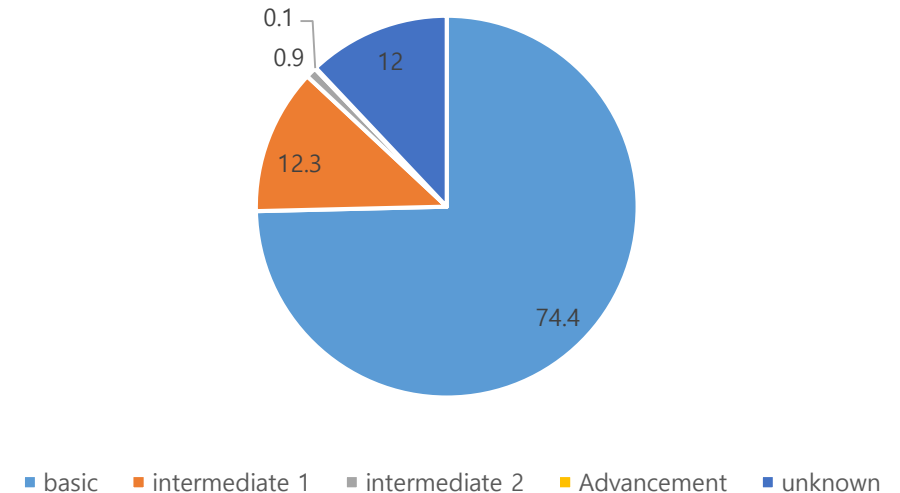
Smart Factory Policy

- Since 2014, the Korean government provided grants to over 30,144 SMEs in the manufacturing sector.
- ✓ Recipients could use the grants to digitize all stages of business operation from market prediction to the shipping of finished goods.
- ✓ there has been a recent shift in this goal, in 2022, the government has set qualitative enhancement of smart factories as a policy objective and is promoting the digitization of small and medium-sized enterprises (SMEs).

<Figure 1> The performance in establishing smart factories



<Figure 2> The Level of Smart Factory



- Whether the smart factory scheme achieved its intended goals is debatable.
- ✓ a survey conducted by the Korea Federation of SMEs in 2022 indicates that the digital maturity of SMEs is around 40 out of 100 points. This presents that the level of digitalization among small and medium-sized enterprises is relatively low.
- ✓ Heo and colleagues (2021), even among companies that have implemented smart factories, only about half are effectively utilizing the technology.
- ✓ Bang and Nho (2018) surveyed machinery companies that participated in the smart factory program and found no evidence of improvement in revenue or employment levels.
- ✓ Lee (2021) suggests that companies with smart factory projects experienced an increase in revenue and expanded employment, although the author could not rule out the possibility that companies pursuing digitization were already experiencing revenue growth and expanding employment.
- ✓ Other studies note that smart factory projects are likely to produce intended outcomes only when employees are actively involved in the process, ensuring the newly adopted technologies are properly deployed in workplace (No & No, 2022; No, No, & Kim, 2019).

Participatory Work Organization and Digital Technology

- The Task-Technology Fit Theory suggests that technology aids individual task performance. The impact on performance varies depending on the characteristics of tasks performed by individuals, as well as how well individuals accept and effectively utilize the new technology.
- Cagliano et al. (2019) propose that companies have two scenarios to choose from when introducing smart technologies.
- ✓ One scenario is digital Taylorism, where operators perform limited roles in processes using automated technology. They have no discretion, do not engage in problem-solving, and execute standardized and repetitive tasks. A few experts handle tasks such as technology control and issue resolution.
- ✓ Another scenario involves operators having full control over the automation system, enabling them to gather information and intervene extensively for better control. In this scenario, workers require high technological skills.
- ✓ The authors distinguish smart factories into levels and analyze the task organization characteristics at each level. As a result, in smart factories (the highest level with multiple smart technology integrations and interconnections), they observe a need for task discretion (control over production processes and problem-solving), diverse tasks (production, control of machinery/equipment), cognitive abilities (ability to make decisions and control through information collection and analysis), teamwork, and other organizational features.

Labor Policy for Participatory Work Organization design

➤ Workplace Innovation

- ✓ Through the establishment of collaborative labor-management relations, a focus on worker participation, and a shift towards a continuously and organizationally working approach, innovation activities aim to simultaneously enhance the quality of life for workers and productivity.
 - ✓ Workplace innovation, stemming from the logic that the same technology does not yield identical technological effects and exhibits varied outcomes based on the characteristics of work organization, signifies not so much technological innovation involving the development of new technologies or products but rather social innovation aimed at fostering changes in work organization and human resource management.
 - ✓ Since 2004, a government policy has been implemented to provide consulting services directly to small and medium-sized enterprises (SMEs) for the establishment of participatory work organizations.
 - ✓ crucial initiative within the consulting projects of the Ministry of Employment and Labor, representing the largest budget allocation since its inception
- Approximately 280 billion won

Labor Policy for Participatory Work Organization design

- The reason to consider Workplace Innovation in Smart factory
- ✓ Firstly, combining workplace innovation with the introduction of smart factories is not only necessary for addressing the issues inherent in smart factories but also requires intentional direction setting.
- ✓ Secondly, fostering an atmosphere of embracing change through workplace innovation is essential for the successful adoption of smart factories.
- ✓ Thirdly, creating a conducive environment for accepting change through workplace innovation is necessary for the successful adoption of smart factories.
- ✓ Fourthly, the simultaneous introduction of smart factories and workplace innovation is essential to address the human resource issues faced by small and medium-sized enterprises through the creation of high-quality jobs.

<table 1> The Employment Effects of Workplace Innovation in Smart Factory Support Programs

Variables	(1)	(2)	(3)	(4)
Workplace innovation	76.72*** (22.24)	66.53*** (22.31)	57.95*** (22.32)	47.35** (19.83)
industry 1		-30.76** (13.56)	-31.07** (13.75)	-30.17* (15.68)
industry 2		-59.20*** (16.41)	-59.32*** (16.42)	-56.28*** (19.17)
industry 3		-44.60** (19.69)	-44.38** (19.74)	-31.04** (12.32)
constants	83.81*** (1.660)	-81.29 (109.3)	-82.44 (109.4)	-47.76 (109.9)
observations	47,782	47,782	47,782	41,284
coefficient of determination	0.707	0.711	0.711	0.773
*** p<0.01, ** p<0.05, * p<0.1				

- ✓ At a significance level of 5%, an increase in employment of approximately 47 individuals was observed.
- ✓ combination of smart factory and workplace innovation, as seen in the earlier pathway of job creation, led to an enhancement in the competitiveness of the manufacturing sector. As a result, with increased revenue and profits, the size of companies grew, leading to a greater demand for labor.

Digitalization Based on the Enhancement and Utilization of Workers' Competencies

- The production process involves the combination of technology and human labor, making technological advancements necessitate changes in the relationship between technology and human labor.
- When approaching workplace innovation and smart factories in an integrated manner, leveraging the innovative capabilities of workers can ensure the effective operation of smart factories.
- The introduction of smart technologies can assign new tasks to workers.
- ✓ Employees can interpret data coming from the factory, identify and solve problems, thereby improving the company's productivity and simultaneously gaining job satisfaction, leading to improvements in working conditions.

Thank you.

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