Case Study of Automation, Workplace Innovation, and Skill Development

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1. Purpose of the Study

A case study was conducted to determine the relationship between automation technology and workplace innovation and skill development in machine parts manufacturing. The results provide policy directions for skill development.
The main theoretical issues regarding the relationship between automation and skills are whether the optimal use of automation technology allows in the expansion and reinforcement of worker's skills. And if so, what are the conditions under which this could occur. With the introduction of automation technology, skill types can be divided largely into operation and setting by task type. The development of these two types of skills is related to their allocation, i.e., the achievement of functional integration that facilitates the assignment of setting tasks to automation technology operators. This was the main question of this case study.

2. Major Findings and Implications

Below are the results of a case study of forging and molding, which are representative processes in the manufacture of machined metal parts.

1) In metal machine forging, automation technology skills are assessed mainly in the following two tasks: the smooth exchange of machine tools and the development of solutions to unpredictable problems. Five years of skill development is required to perform these routine tasks, and approximately 10 years of experience is required to perform automated forging-machine setting, which can be done by a technician. Therefore, workplace innovation in forging should be driven by worker skill development.

Regarding functional integration, tasks were accomplished through the division of labor rather than integration in the forging process under study. The interviewed executives recognized that functional integration was more effective. However, it was difficult to achieve because of the lack of the necessary skills. The interviewed companies did not guarantee appropriate wage levels. Thus, the attraction of young workers and the retention of forging technicians were difficult. The companies lacked the capacity to provide theoretical or practical education through on-the-job training.

2) It is noteworthy that in the molding process, automation has created considerable demand for skilled engineers and technical workers.

   The interviewed Chief Technology Officers (CTOs) or Chief Production Officers (CPOs) predicted that vocational college graduates with the appropriate work experience, education, and training could perform the design work that was currently the province of engineers. It was predicted that skilled workers in assembly production would be required to have competencies such as problem solving and judgment for complex situations. Thus, in addition to theoretical understanding, the practical or intellectual skills gained through work and problem-solving experience have become more important. Therefore, theoretical learning in vocational education in schools should be further strengthened.

   The significant role of skill development in workplace innovation was common to both cases. In one case, workplace innovation was coterminous with organizational learning. However, despite the increasing importance of communication and the design–production relationship, the jobs in these two areas were managed separately in hiring or human resource management. This also restricted skill development.

3) A case study of a business that uses collaborative robots (cobots) for parts manufacturing confirmed that, first, the cobots introduced for small repetitive tasks would likely replace production jobs (e.g., palletizing, inspection, sorting, and conveying). However, if the goal of using cobots was specifically to supplement manual labor to increase productivity and to respond to flexibility, the possibility of substitution was not high. This occurred when a cobot was used as a tool in handmade shoe manufacturing.

Second, the cobots were taking over some of tasks that workers used to do. However, the acquisition of professional expertise or special skills seemed difficult. The cobots were taking the place of co-workers' jobs. Most of the workers indicated that they were able to perform their jobs with only half a day of on-the-job training.

Third, it was thought that the use of cobots could transform the work experience only when their purpose, the design of the work organization, and the social relationships at the work site were fully considered. Furthermore, technicians and engineers who understand and experience the overall work process are needed. When introducing cobots, robot suppliers and System Integrators (SI) experts should be careful not to focus on cost and human resource reductions.