Digital Technologies as Lean Augmentation: A Preliminary Study of Japanese Automotive Manufacturers

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Ⅰ. Abstract

This paper explores how Japanese automotive manufacturers, whose production systems are characterised by the lean principle, address digital transformation. We conducted case studies of seven Japanese carmakers and suppliers to investigate the interplay between lean production and digitalisation. We found that the firms selectively adopted digital technologies to enhance the existing lean production system. We labelled this type of digitalisation 'lean augmentation'. Further, we developed theoretical hypotheses regarding the potential of digitalisation to limit kaizen, the roles of human involvement and organisational coordination in digitalised manufacturing.

Ⅱ. Results & Discussion

All but one of the investigated firms were engaging digitalisation proactively. Remarkably, firms were not engaging digitalisation guided by a vision such as Industry 4.0, but rather deployed digital technologies insularly. Further, digital technologies were typically deployed in ways that support *kaizen* (continuous improvement) activities, i.e. data are often but not exclusively focusing on the production process. Firms typically not aim to collect all process-related data, e.g. data of programmable logic controllers are seldomly utilised. Thus, the characteristic of the Japanese automotive firms studied is that they deploy digital technologies in a way that augments existing practices such as group-based *kaizen* instead of focusing on big data and sophisticated tools such as machine learning. While such technologies are deployed, their deployment is rather to solve specific problems but not to collect all process-related data to establish a digital twin.

Ⅲ. Conclusion

Our case studies of seven Japanese automotive firms find that said firms selectively adopt digital technologies, mainly to achieve paperless shop floors, compress the time needed to grasp the status of operations, and pursue unmanned logistics. This usage of technologies is within the lean principle of existing production systems which seek to compress the time needed to perform or to completely eliminate not directly value-adding tasks. Thus, we label this utlisation type 'lean augmentation'.

Further, studied firms' digitalisation approaches were predominately practically oriented to solve problems of current lean production systems but were not driven by encompassing visions such as Industry 4.0 or the industrial internet of things. Of particular note is that firms seek to employ

technologies in a way that involves human operators in kaizen instead of aiming at autonomously adjusting production processes. Despite this tendency, more research is necessary to investigate how representative these cases are, and especially to investigate if such rather piecemeal digitalisation approaches are competitive against wholistic visions such as Germany's Industry 4.0.

IV. References

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Mokudai, T., Schröder, M., Müller, M., Schaede, C., Jürgens, U., Herrigel, G. and K. Aoki (2021) 'Digital technologies as lean augmentation: a preliminary study of Japanese automotive manufacturers', *Int. J. Automotive Technology and Management* 21, No. 3, pp. 228-249.