Feasibility and Effectiveness Analysis of ICT for Reverse Supply Chain Management

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[Abstract]

Key Words: ICT and AI Technology, Information Linkage, Supply-demand matching, Preventive maintenance

The objectives of this research project are to explore the potential uses of information and communication technology in the reverse supply chain, to investigate the feasibility of their implementations, and to clarify their effectiveness through empirical studies.

In sub-theme 1, we proposed an integrated waste management system towards the realization of interactions between the waste generators and disposers by using IoT (internet of thing)/AI (Artificial Intelligence) techniques and evaluated the effectiveness of their implementations. In particular, we proposed an optimized collection system of industrial plastic waste by using machine learning approach and optimization algorithm, a button-type collection request system instead of the telephone-based one, a traceability system based on the WCM (work chain management) system, and an information-sharing platform for medical waste with the cooperation of multiple collection and transportation companies. Moreover, we developed an AI-based image diagnosis system for reuse parts of ELV (end-of-life vehicles) based on the investigated feasibility and evaluated the prototype of it. To implement such system, one of the challenges is establishing an accurate data-collecting method (supervisory data). The system is expected to be upgraded under the assumption that AI will perform the image diagnosis.

In sub-theme 2, we designed a waste-incineration sourced steam-supply system in which it matched the demands well by utilizing information technology, and evaluated its cost-effectiveness. We also made efforts to establish a research system for commercialization.

In sub-theme 3, an effective monitoring system has been constructed with a series of functions e.g., measuring, processing, recording, and remotely transmitting data on blower vibration acceleration and fabric filter differential pressure. Non-linear regression analysis was applied to determine the degree of anomaly based on the monitoring data. Besides that, its effectiveness and the cost-effectiveness of maintenance management by applying this monitoring system for extending the life-span of equipment were verified.

In sub-theme 4, we developed an intelligent system that could input the information from paper manifests automatically by using AI-OCR (Optical Character Reader) and RPA (Robotic Process Automation) techniques. The essential conditions for cost saving in this system were detected. Moreover, the analysis result demonstrated that the risk of heat stroke and the physical load (labor intensity) of workers could be grasped by using smart wearing, and the system could enhance the safety management of workers.

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