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«Infrastructure and Construction Project Management»

Postgraduate Diploma Thesis

Productivity and Consumption of Construction Machinery in the Context of Industry 4.0

Student Name:	*Theodora Sorkou*
Supervisor:	*Konstantinos Kirytopoulos, Professor, NTUA*
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Abstract

The study examines how Industry 4.0 implementation impacts the operational output of construction equipment and its fuel usage patterns. The research combines both qualitative and quantitative approaches to establish connections between human insights and statistical information. The research team conducted semi-structured interviews with experienced excavator operators to understand their digital tool perceptions and site work efficiency factors and their views on skill development and training.

The research shows that Industry 4.0 technology adoption rates are lower than what its advocates predicted. The operators find value in systems which help them predict maintenance needs and provide easy-to-use real-time information that enables them to take direct action without needing to navigate through dashboards. The operators believe digital tools should support human capabilities instead of trying to replace them. The collected data supports their statements. The actual fuel efficiency and machine availability improvements depend on equipment usage patterns and the durability of sensors under harsh conditions and user interface designs that follow operational workflows. Small and medium-sized businesses face three main barriers to adoption because of expensive initial costs and long-lasting equipment needs and complex interfaces which lead to operational delays. The research provides three vital recommendations for successful implementation which start with sensor acquisition followed by user interface development and training-based data interpretation and then proceed with phased feature deployment beginning with maintenance and idle-time optimization. The research shows that operator expertise together with economic modeling helps identify smart system benefits for productivity and fuel efficiency while providing cost-effective implementation methods that generate environmental advantages.