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Field Readiness and Operation Scheduling

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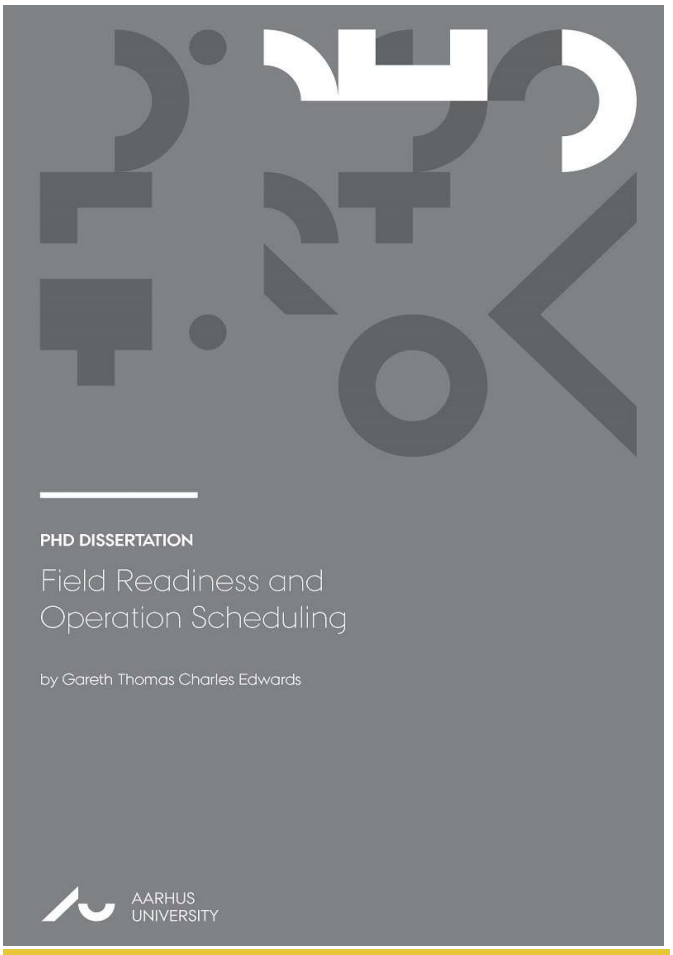
Modern farmers face the problem of increasing their overall productivity to meet the demands of a growing global population, while also being limited by the amount of available resources, e.g. land area, fuel, chemicals, etc. Data technology will pay a pivotal role in helping farmers reach this goal; by correlating and analysing vast amounts of data, operations can be planned and executed based on knowledge that is incomprehensible within current farming practices.

Field readiness is a measure of a field's fitness for purpose for an operation to be executed, and is a conjunction of a field's trafficability and its workability. It is important to consider the readiness of a field when planning operations to ensure operations produce positive results while they also do not cause excessive damage. In the past readiness evaluations have relied upon an experienced farmer's visual assessment, often coupled with a "gut feeling" of how the conditions will change. In order to optimise the planning of operations more scientific methods of evaluation are needed.

The main aim of the thesis was to develop a method of creating optimised machine work plans in accordance with a field's readiness, to assist farm managers execute field operations in an efficient and non-damaging manner. This was constrained by the condition that the field readiness would need to be determined remotely avoiding the need to physically visit potentially dispersed locations.

Farm managers were included in the early stages of development to capture their knowledge and practical experience of problems associated with operations management with respect to field readiness. This was used as the basis of a developed tool to estimate field readiness and produce optimised machine work plans. Methods of determining soil trafficability and the workability of different operations were used to estimate the field readiness of remote locations, negating the necessity for the locations to be physically visited.

The field readiness was utilised as a parameter within a novel scheduling algorithm to create individual work plans for multiple machines executing consecutive operations at multiple locations. Novel optimisation algorithms were also developed and used alongside the scheduling algorithm to find the near optimal allocations of resources. It is also possible to parameterise the optimisation algorithms to offer varying degrees of near-optimality at the expense of the computational time required. This is essential for utilisation of the algorithm at different planning stages involved in operations management.



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