A Holistic Approach of Reconfigurable Manufacturing System (RMS) Lifecycle

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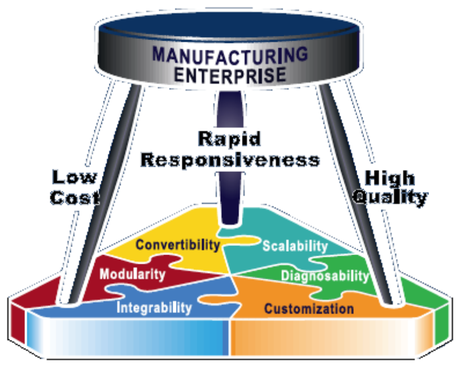
Background

Enterprises could introduce new products and design alterations more frequently. The fluctuation on **varieties**, **batch sizes** and **delivery time** challenges the manufacturers' responsiveness.
As the next evolution step of conventional manufacturing methods, dedicated manufacturing lines (DML) and flexible manufacturing systems (FMS), reconfigurable manufacturing systems (**RMS**) is introduced as a cost-effective paradigm with rapid responsiveness and high quality.



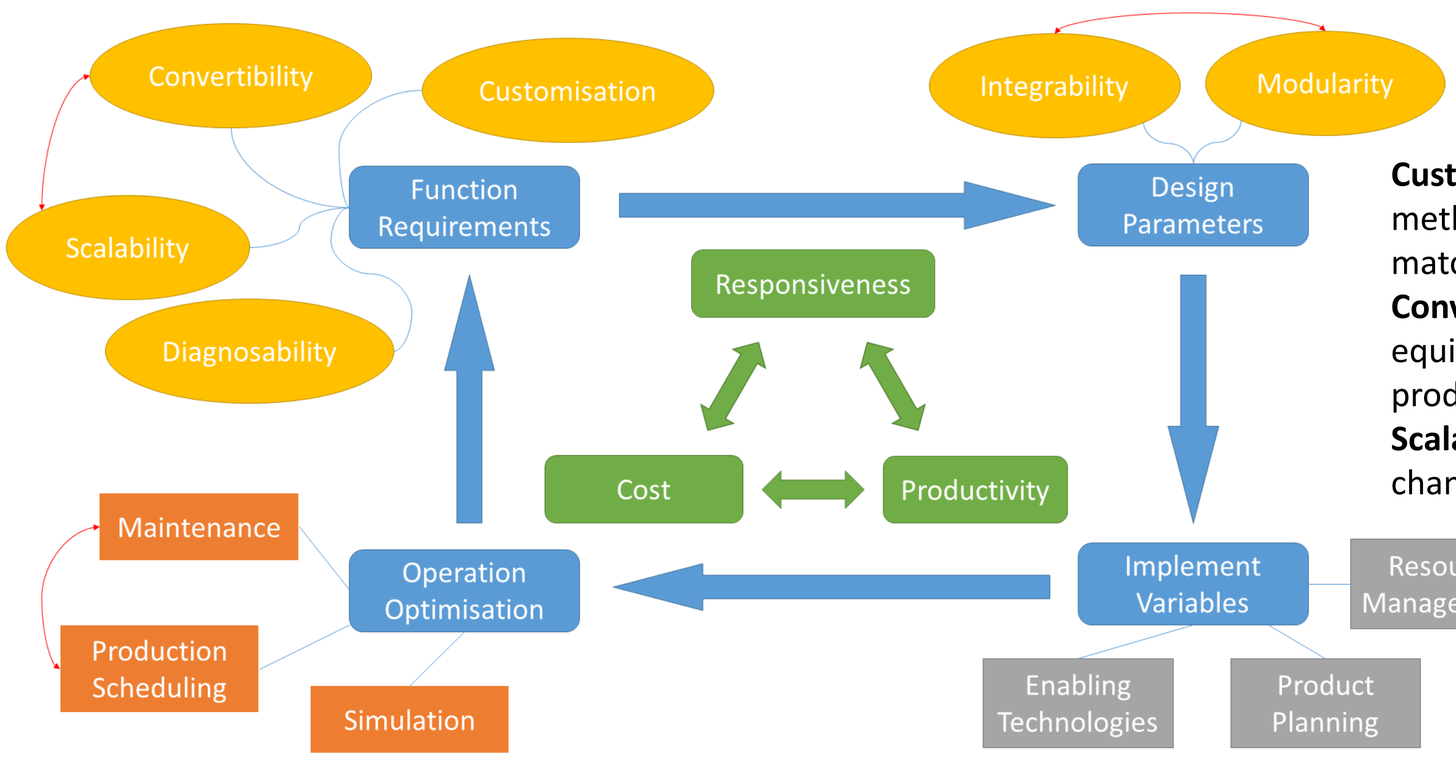
AIMS AND OBJECTIVES

Investigate the following aspects:

- Current state in industry,
- The lifecycle of RMS design, implement and operation,
- and the ***Six Core Characteristics***: Modularity, Integrability, Customisation, Convertibility, and Diagnosability

Methodology

Visualise the relations using the axiomatic design principles.
Analyse the structure
Find out the gaps
Point out the research
List the suitable research tools



Function Requirements

RMS is not limited to modular machines. It requires 4 major features.

Customisation distinguishes the RMS from other manufacturing methods. It reveals the capacity and flexibility were designed to match the production needs of a product family.
Convertibility is a limited ability of RMS which focuses on the equipment can be easily transformed to respond to changes in production requirements.
Scalability requires the throughput can be changed to respond to changes in demand in a relatively short time,

Diagnosability askes the RMS can automatically detect defective products, trace root causes and reset its parameters to restore the initial situation.

Design Parameters

By decomposing the function requirements, there are two major characteristics need more concern.
Modularity focuses on whether the major equipment and the material handling system in the manufacturing system can be easily added to, or removed from the shop floor.
Integrability focuses on whether the system can integrate equipment rapidly and precisely by a set of mechanical, informational and control interfaces in the production system.

Implement Variables

A newly-build RMS could only work successfully if the system operators gain adequate support. Three basic variables should be focused. **Resource management** keeps the system run smoothly. **Product planning** helps understand the vital market changes and boots up the transforming speed. The knowledge of the advanced **enabling technologies** prevent unexpected errors caused by human.

Operation Optimisation

After implement, two essential elements keep the factory generating profit. A dynamic **production scheduling** system and a proper **maintenance** strategy. To handle the complexity of market demands, a well-designed **simulation** forecast system should be run constantly and give suggestive adjustment with least delay according to the changing requirements.

Conclusion and Future Steps

The "Plug and Produce" feature of RMS brings endless system lifecycle. When new demands come in, it requires quickly changes and effectively modification. These enables the operation of simulation techniques and simultaneous tools. Researchers may develop **a real-time scheduling tool** based on simulation techniques to investigate the vital roles in the evolution of manufacturing systems.

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