Digital tools in manufacturing environments: a selection guide

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1. Introduction and literature review

Introduction
Factories are increasingly challenged to meet the demands of personalized products. Production engineers must improve lead time and quality while managing costs. Decisions are complex, and limited time and information can reduce operational performance. With limited human and material resources, profitable production becomes critical to business success.

Today, the industrial partner uses many digital tools across multiple manufacturing sites. However, it needs to be more transparent about what tools are used at other locations. Sharing information and insights across the organization is challenging, leading to inefficiencies and missed opportunities. In addition, having multiple solutions also leads to duplication of effort, where different manufacturing sites within the company are working on similar challenges without being aware of each other. This study focuses on different plants' challenges, identifying the tools used, the reasons for their use, and their impact on workflow efficiency. This information can guide the selection of the most appropriate digital tools for maximum success.

Research question
What are the best practices for governing digital tools and their selection within different manufacturing environments?

Literature review
Operational excellence aims to increase productivity for improved competitiveness and future success. With limited resources of skilled operators, machines, and materials, lean manufacturing empowers operators to be more productive by focusing on adding value to products throughout the value chain.

Industry 4.0 and smart manufacturing reduce production costs despite more customized products and support the transition to "lot size one" by improving production flow and flexibility.

Manufacturing decisions are often complex and time-consuming. Digital tools can analyze vast amounts of data and monitor real-time performance. This allows manufacturing managers and operators to improve their decisions for better operational and financial performance. Tools and technologies should match the actual processes.

2. Methodology

What is the framework?
In this study, two sets of in-depth interviews were conducted with experts. All the experts have extensive expertise in manufacturing, while one group was internal to the company, and one group was external from other companies and universities. The interviews uncovered problems and how companies address them. A system for selecting digital tools was created and validated to choose the most appropriate digital tools for different production environments.

Qualitative research design

3. Results and discussion

Problems and challenges manufacturing sites face
Several problems have been identified in various manufacturing environments. The most critical issues are the limited capacity of machines, operators, and equipment, as well as quality issues with purchased parts. Challenges other companies face include increased flexibility, operator training, and methods for implementing digital tools.
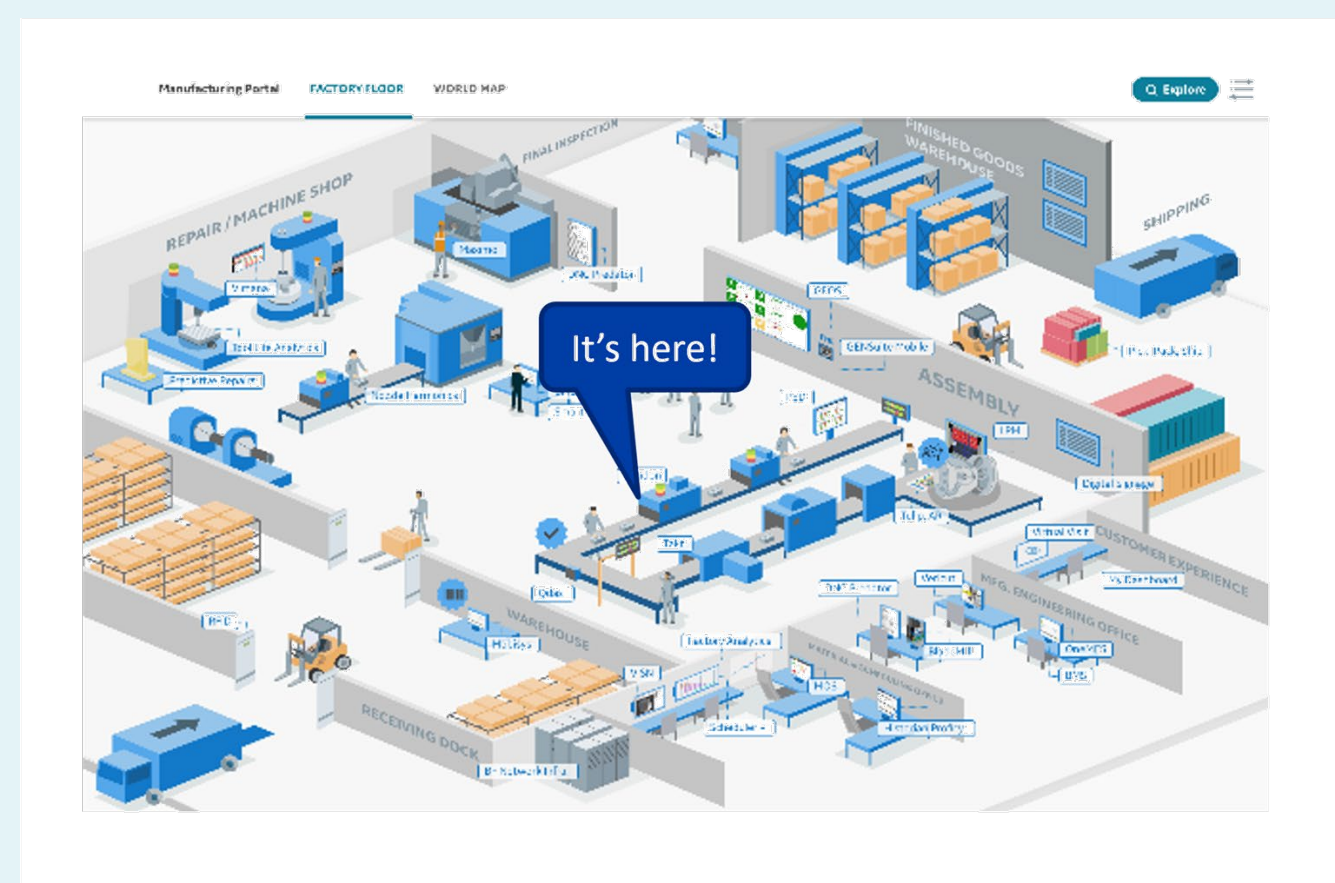
Integration of lean methods – The interviews confirmed the importance of lean manufacturing in several ways. Process centricity and prevention of future problems are already integrated into the company. Digital tools can support the implementation of lean tools.
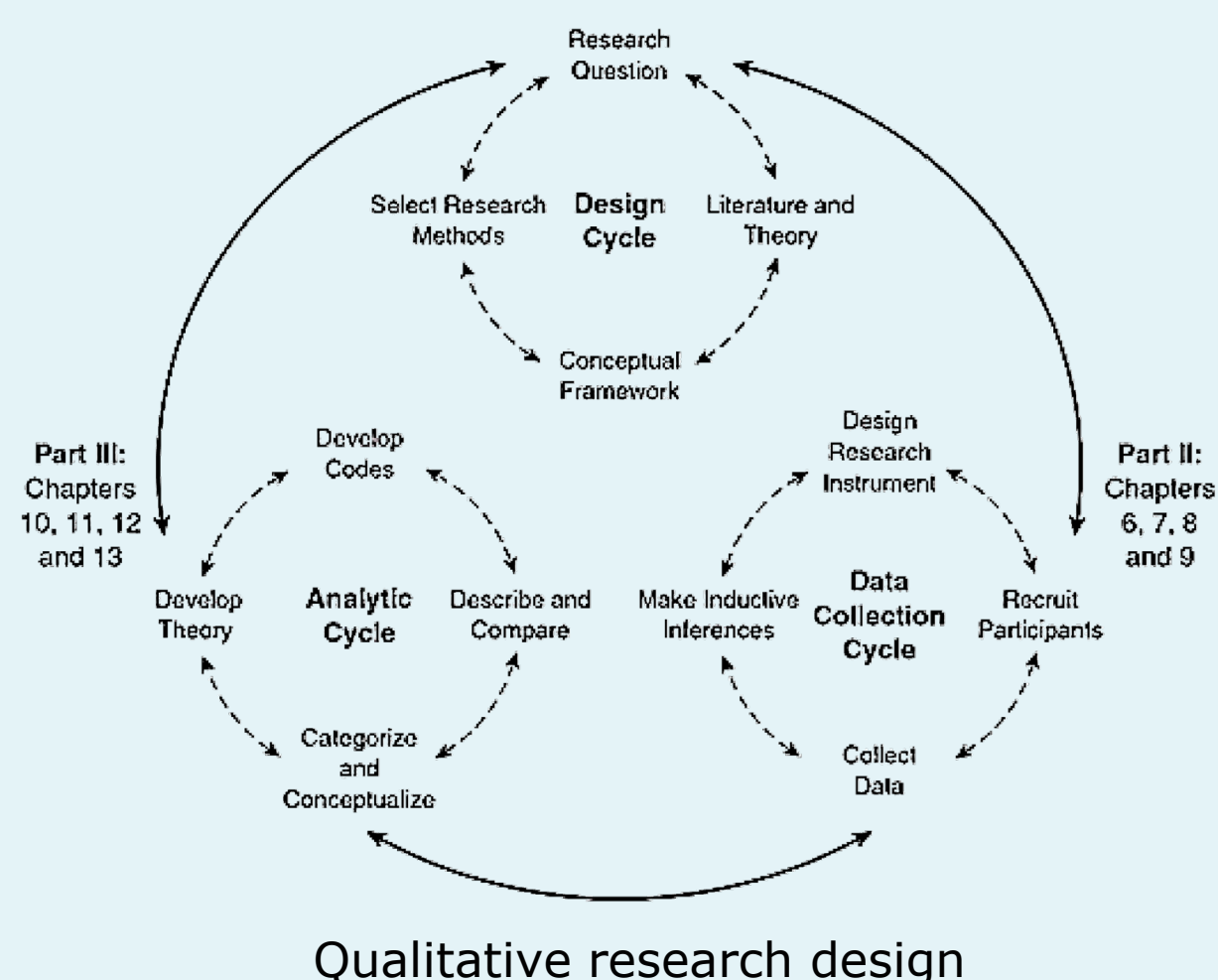
Digital tool selection is a complex and iterative process – Successful selection of digital tools for any production environment requires a holistic view of production and each process step. Due to environmental changes and ongoing technology improvements, technology adoption is not viewed as a completed event but rather as a continuous improvement process.

Sharing lessons between sites – Bringing together different actors with similar challenges is an opportunity to learn from each other. Processes and requirements are best known by themselves. Due to the high complexity and changes in the environment, an adaptive solution such as an "experience-sharing platform" has a high value. In addition, lessons learned from pilot projects can be easily shared and scaled.

4. Conclusions and recommendations

Conclusions
Technology can help solve problems when used in the right way. Making decisions in manufacturing is complex, and sharing experiences is an effective way to address unique challenges. A holistic view of the value stream across the enterprise is important because many problems may be solved more efficiently in another department or at another level. Although a "lean first, digital second" approach prevents digital waste, improving processes while transitioning to digital technologies creates even more opportunities.

Recommendations
Further research is suggested to identify and validate implementation methods for digital tools in a structured way.

References

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