

## Popular Scientific Abstract

“You take the blue pill, the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill, you stay in wonderland, and I show you how deep the rabbit hole goes.” As the famous quote by Morpheus goes from the movie, *The Matrix*. This abstract serves to increase your appetite for the red pill to look deeper into Matrix Production – a new type of manufacturing system – and how to design and control these.

Fortunately, this rabbit hole does not lead to a dystopic reality with intelligent, evil-minded machines controlling humanity through a simulated reality – but we might get close to some aspects. The first stop on this trip down the rabbit hole is at the mirror. We, as consumers, have in recent years grown used to customized products, but we still expect the price to be low. This has put a lot of pressure on the manufacturing companies to still sufficiently supply products, while making profits. Some of these companies have started looking into manufacturing systems that can account for this, such as Matrix Production. This manufacturing system consists of independent production cells that depending on the tools it receives, can perform various tasks. Between multiple of these production cells, self-navigating robots are transporting products around.

The second stop down the rabbit hole is at the current literature on Matrix Production. Briefly summarized, the current literature does not cover how to design, control, and eventually operationalize this type of manufacturing system. This is the background and reasoning for performing this study. Quickly moving further down the rabbit hole, through laboratory and company case studies, two approaches for designing products and work cells are developed, as well as a control system. This control system uses artificial intelligence to make the manufacturing system perform better based on computer simulation of the real manufacturing system. No humans have (yet) been harmed in this development.

Reaching the end destination of this trip down the rabbit hole, Matrix Production is discussed in relation to supply chains and how it impacts those. On top of this, the sustainability impact of Matrix Production is discussed. While implementing this manufacturing system does not guarantee to save the world, it shows aspects that make the future less dystopic in some cases. Finally, new business opportunities are also discussed and how Matrix Production can help local communities.

The final stop on the trip down the rabbit hole is yet another quote from Morpheus in *The Matrix* from 1999. This quote serves as the last motivation for taking the red pill and reading the full PhD thesis, *Matrix-Structured Manufacturing Systems: From Design to Operations* by Christian Petersson Nielsen.

“Neo, sooner or later you’re going to realize just as I did that there’s a difference between knowing the path and walking the path” – Morpheus (*The Matrix*)