

# SIMULATION AS DECISION-SUPPORT FOR IMPROVED MANUFACTURING PERFORMANCE

BY JOHAN FREDLUND AND JOHAN LORENTZON

**The manufacturing industry has for a long time been trying to squeeze the most out of its resources. Competitors fight to keep their costs low and share the same objective of delivering products to customers. As designing factories and optimising production is becoming increasingly complicated for decision-makers, decision support is more important than ever.**

With tens or hundreds of connected processes, and hundreds or thousands of products and components, making the right decisions is difficult. Both in the short- and long-term, how should customers be satisfied while keeping costs low? What happens if the customers start demanding other products, or if the amounts they demand change completely? The human mind alone is unable to understand the complicity of a dynamic manufacturing system:

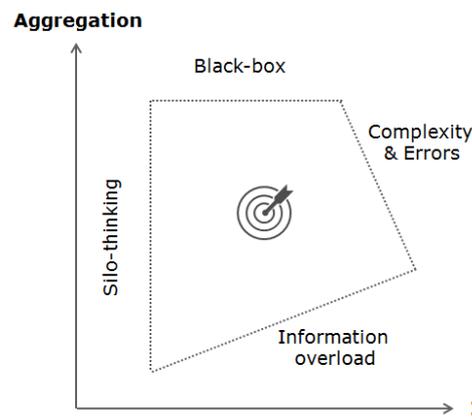
Let's assume it's Monday and you want to throw a garden party on Saturday. Naturally, you only want to invite people if the weather will be *good*. Looking out the window won't tell you anything about the weather in five days, so you decide to check the weather forecast instead. Apparently, it will be sunny. But what if it will be cold or too hot? 23°C, looking good. Wait, the wind is apparently going to be 13 m/s; should you still invite them? Is this *good* weather? You also recall that the weather forecasts tend to have poor accuracy. Can you even trust this information?

This is an analogy of what decision-makers in the manufacturing industry face. They need a tool to support their decision-making, and one such tool is *simulation*. By building a virtual factory model in a computer, the impacts of various actions can be evaluated to make the best decision in the real factory. But a simulation tool has similar problems as a weather forecasts: What is *good* performance? Can it be defined by one single parameter, or do we need to check multiple ones simultaneously? To what extent can the results be trusted?

The definition of good performance depends on the strategic goals, objectives and current situation of the organisation. Likewise, for the garden party, it may be important that the wind is

not too hard, but what if you wanted to go wind surfing instead?

Two concepts related to defining good performance in a simulation are *integration* and *aggregation*. The level of integration describes whether the manufacturing performance is measured in the whole factory, or just in a small part of it. The level of aggregation determines whether you measure the overall performance in the whole factory, or the performance of individual parts. It also describes whether you see the performance over time or on average.



When building a simulation tool and deciding what should be measured, it is important to set the levels of integration and aggregation carefully, because there are trade-offs. When either of the levels become too low or too high, there will be negative effects on the decision support. The levels should be based on the purpose of the decision support. Before initiating a simulation endeavour, decision-makers must ask themselves: What additional knowledge is needed to make informed decisions that support the strategic goals and objectives? Based on the answer and the technical limitations of modelling, a purpose for the decision support can be formulated.

When correctly applied, simulation-based decision support can aid manufacturers to utilise their maximum potential. However, the pitfalls are many. When considerations are not properly taken, the tool can be both costly and potentially damaging to the manufacturing performance.