

Workstream 7: Cost of Complexity



Accommodating market and customer needs remains a core principle among most companies in the manufacturing industry. However, working with integrated product structures in a stream of ever-changing wishes and demands is bound to take its toll:

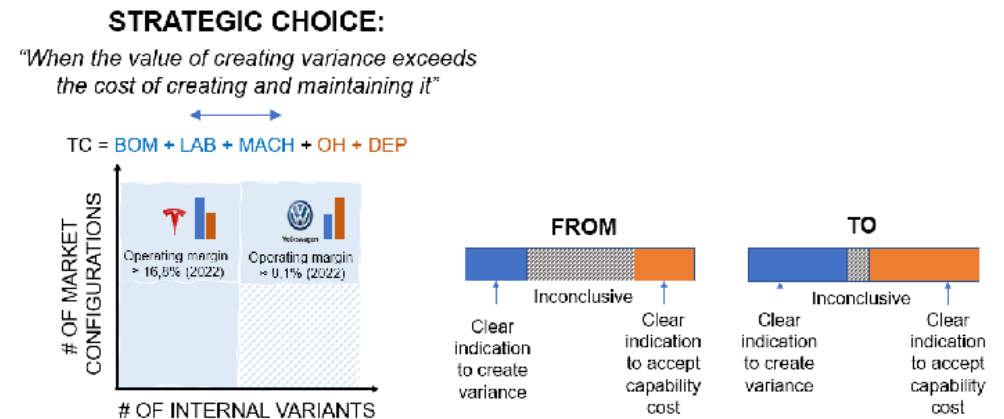
As complexity in products and value chains increases, so do costs. But what is the cost of complexity, and what can companies do to reduce it?

Complexity impacts both external variance (the product, with all its functions and features, that is delivered to the market) and internal variance (the total number of parts and modules involved in generating the product and in the processes connected to it), and its costs play an important role in the profit and loss of variant generation. Therefore, examining the costs associated with increased complexity can be an eye-opening experience and a great incentive to explore alternatives to traditional integrated design.

Beyond the immediate effects on factors like direct material and labor costs, there is often untapped potential for cost and revenue improvements stemming from streamlining and simplifying processes in the value chain. This specific potential and how to grasp it what Workstream 7 is centered around.

With a particular interest in examining how costs change when the level of complexity is altered and how introducing modular product structures or creating new product variants impacts costs, representatives from five NEM member companies joined forces in Workstream 7 to explore the topic 'cost of complexity'. Together, they defined the workstream's main objective:

To develop a widely applicable model that aids companies in calculating complexity costs and enhances transparency when choosing product variants, introducing modular product structures, and making decisions about product structure alternatives.



The complexity cost calculation model created in Workstream 7

UNDERSTANDING THE COST OF COMPLEXITY

When companies consider variance generation and modularization, a common question arises: How does it improve our profitability? While profitability is strongly associated with increased revenues and reduced direct product costs, companies frequently overlook or fail to fully comprehend that complexity and its associated costs also play a significant role in the quest for increased profitability.

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To better understand the ways in which complexity impacts costs – and how modular approaches can help combat disproportionate complexity – the participants in Workstream 7 have collaborated in examining the relationship between complexity management, modularization, and profitability.

A key finding in Workstream 7 is that a cornerstone for comprehending complexity costs lies in value stream mapping. The value stream is the specific sequence of steps (i.e., activities and processes) required to deliver a product or service to a customer. The process of mapping it entails identifying the cost drivers and their susceptibility to complexity or changes in complexity within each of these steps.

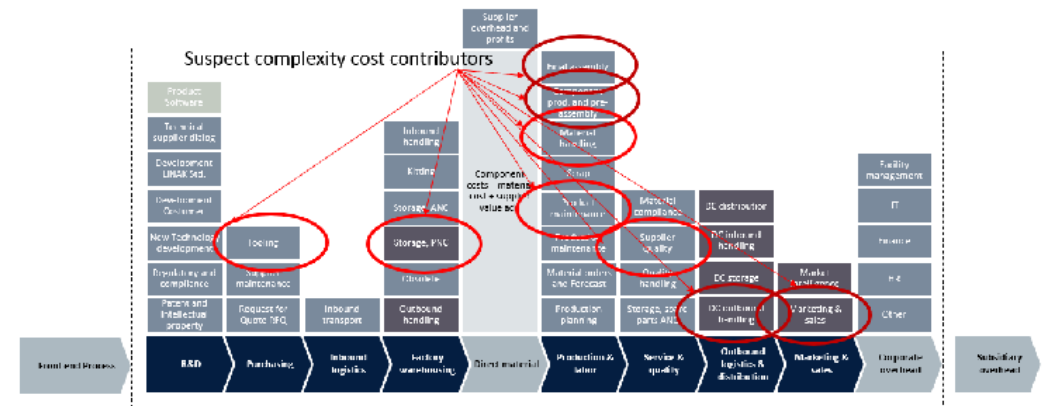
The specific number of steps to consider and the departments involved may vary from one company to another. However, in general, value stream mapping enables companies to pinpoint specific sub-processes that exhibit heightened sensitivity to complexity, indicating target areas to focus on in the process.

Once these target areas have been determined, the next step is to collect and analyze data on aspects like product revenues, costs, margins, fixed and variable costs, and cost drivers. The essential final step is to identify the cost impacts by creating the impact rationals from the cost drivers and the corresponding cost formulas, either by input from subject matter experts or by creating a mathematical model. Together with the feasibility of necessary changes in the process, this will lead to the potential improvements.

Having relevant data at hand grants companies valuable insight into the cost of their complexity, enabling the determination of:

- Complexity costs for individual parts
- Changes in complexity costs with varying product variant quantities
- The influence of complexity costs on alternative product structures
- The shift in complexity costs from integrated to modular product structures
- Variations in complexity costs due to adjustments in the number of parts or products
- The holistic product cost when factoring in complexity

Accordingly, assessing complexity costs aids companies in making informed decisions, and alongside direct product costs, they can have a significant impact on business cases and decisions regarding variant generation. Nevertheless, a successful assessment hinges on data availability and the seamless integration of all functions within the company.



Example of value stream mapping carried out in Workstream 7

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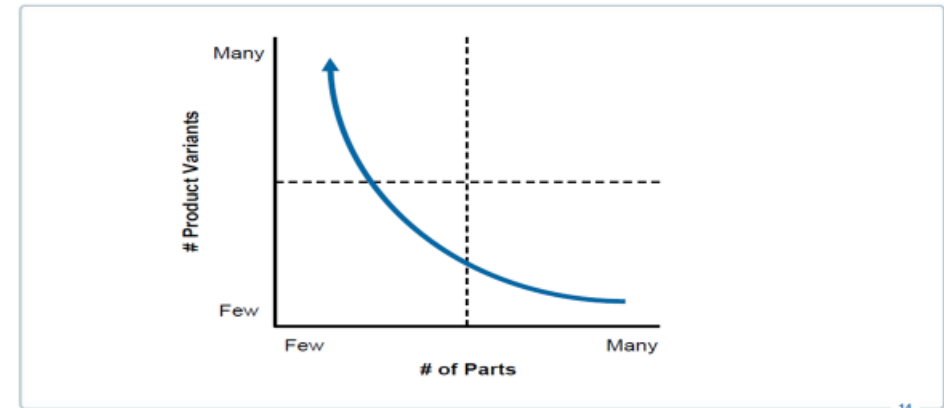
THE CASE FOR MODULARIZATION

Modularization has long been established as a fruitful strategy to manage and reduce complexity and the extent to which complexity can skyrocket costs is a common incentive for companies to explore what modularization can do for the bottom line.

Adopting a modular structure not only significantly reduces complexity costs in variant creation but also opens the door to generating additional variants without cost increases and corresponding revenue increases. Thus, transitioning from an integrated product structure to a modular one facilitates cost advantages throughout the entire value chain.

In modularization, direct material costs depend on the chosen modular structure, and balancing common modules and minimize oversizing can be achieved through economies of scale. Creating new variants can incur minimal or no additional complexity costs compared to integrated structures, allowing for a wider product variety without cost spikes. This potential expansion can boost revenue, volume, and gross margins.

The relationship between complexity costs and modular product structures unveils substantial potential for cost reduction when transitioning from traditional integrated product structures to modular ones. While the magnitude of these cost-saving possibilities varies based on factors like business characteristics, product attributes, and the extent to which a company has implemented modularity in their product architecture, the Workstream 7 participants have generated preliminary estimates that suggest a minimum cost reduction of 2-5% in terms of the cost of goods sold (COGS) on top of traditional modularization savings. These estimates are based on real-world cases.



The relationship between product variants and parts in modularization

AIM FOR A TAILORED APPROACH

As Workstream 7 progressed, the participants had to come to terms with the fact that a generic "one-size-fits-all" model for calculating complexity costs in complex organizations is somewhat of a pipe dream.

What can be considered the best approach depends on the individual company and its characteristics. Consequently, the exact savings that complexity management can facilitate will differ as well; for example, the model would vary significantly in a Make to Stock (MTS) setup compared to an Engineered to Order (ETO) setup.

Subsequently, the participants' conclusion is that a model for calculating complexity costs must entail a degree of flexibility, and their developed methodology can therefore be tailored to different situations and application areas, empowering companies with the knowledge to make sound business decisions regarding variant generation and product structures.

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INITIAL STEPS IN CALCULATING THE COST OF COMPLEXITY

1. Define scope and objectives
2. Map the complete value stream, identify cost drivers and their sensitivity to complexity, and select highly exposed process steps
3. Define (complexity) relevant sub processes and their costs, e.g. through cost center accounts, activity based assessments, and interviews with subject matter experts
4. Identify cost drivers and the impact rational to complexity
5. Calculate the cost impact based on the key cost drivers with a financial model, either derived from a mathematical model and/or by cost formulas developed with subject matter experts

ABOUT WORKSTREAM 7

Workstream 7 kicked off with an in-person workshop in which the participants defined the overall process flow and has since continued as bi-weekly virtual meetups.

The workstream lead is Gert Kjær, Chief Product Architect at Danfoss Power Electronics and Drives. Workstream 7 is set to conclude in the Fall of 2023.

This article was written with assistance from Peter Greiner, Workstream 7 participant, former CFO for Operations in Electrolux, and a key person in NEM's activities in Germany.

WANT TO JOIN?

If you are interested in exploring modularization through teamwork and sharing experiences with companies within NEM, do not hesitate to contact us to receive additional information on how to get started!

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