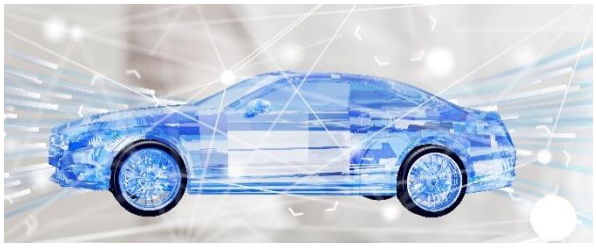
Why it's Getting Harder to Innovate in Automotive

- and what you can do about it

Right now the pressure to innovate in the automotive industry is arguably the strongest it has been in its entire history. Decarbonisation, autonomous vehicles and Brexit are changing regulatory demands, driving up product complexity, and encouraging the industry to invest in digital manufacturing and supply chain integration. In other words, even before the Covid crisis, the next few years looked like a period of significant change.

These complexities are unavoidable and increasing rapidly. The pace of technical and regulatory change is creating particular challenges for a heavily optimised Lean manufacturing sector like automotive, which needs to be able to guarantee the stability of both its resource and knowledge inputs.



Innovation requires creativity, and as any engineer would tell you, coming up with a good new idea means rejecting a lot of bad new ideas along the way. Without stable, scientific and Lean engineering processes, creativity can be extremely costly, especially if defects aren't discovered until a late stage of the development life cycle.

Reducing waste in innovative engineering is about ensuring that problems are detected as early as they possibly can be and preventing sunk costs. The processes and tools associated with 'systems engineering' are emerging as the best way to obtain the benefits of Lean engineering in the automotive industry. Systems Engineering (SE) helps design, integrate, and manage complex systems over their life cycles. Instead of focusing on the individual behaviours of a component, SE focuses on understanding and validating the component as part of the whole.

By having a suite of processes and tools designed to model and anticipate the structure of a system, projects can have assurance from the start that the right thing is being built in the right way, and that the product will interact appropriately with its context. This drives down cost by reducing the risk of mistakes and unanticipated defects, while simultaneously driving up quality by tying engineering activity more closely to precisely defined stakeholder needs.

SE processes and tools give you the ability to test and validate against clear, integrated specifications held in common along the supply chain, as well as to define requirements and produce specifications with this test and integration orientation in mind. And what's more, like Lean manufacturing, SE can also boost customer value by ensuring consistent quality.

SE enables innovation by securing what you already know and streamlining how you go about validating new ideas.

Maximising Customer Value in Innovation

Getting customers to articulate their needs can often be an extremely frustrating process. Half the time – even more if the project requires some research and development – they don't even really know what they want themselves.

No process can pull information out of the void when it doesn't exist, but SE takes a robust and scientific approach to requirements management that cleanly and specifically identifies ambiguities and gaps in stated stakeholder needs. The best way to get a straight answer is to ask a straight question, and the SE process is very good at generating straight questions. Working with vague or incomplete requirements doesn't just lead to a risk of building the wrong product: it can also risk building the right product badly. With expectations of innovation in your requirements, clarity and consistency become vital to prevent

potentially spiralling costs. Problems that arise in this way only multiply over time as knock-on effects are generated and start introducing chaos of their own. The process begins by identifying what the client wants in terms of a problem that they need to solve, or an opportunity that they want to pursue. Without yet looking to specific solutions, the first step is to develop the 'operational concept' - what users want the system to do. The context and environment for the system – its basic inputs and outputs – should be understood as clearly as possible while the system as a whole is still being treated as a black box.

From there, systems engineers continue with a 'top down' approach to requirements and modelling, creating similar ways of understanding the product at different levels of specificity. As requirements get clarified and detailed, the model progresses down equivalent layers of complexity, at each stage fundamentally treating subsystems and individual system elements as black boxes that transform inputs into outputs.

A formal SE model is built entirely out of black boxes, taking inputs from users and the environment and outputting stakeholder needs. The model is not concerned with how individual components work, but rather with the structure of a system as a whole: the inputs, outputs and interactions of subsystems.

In an SE process, only then do you start to formally investigate the sorts of systems which could solve the clients' problem. This should begin by generating as many ideas as possible about what should go in the black box, and at this stage should not progress beyond identifying a preferred class of solutions. It has been a longstanding maxim in organisational psychology that the most efficient way to solve a problem is to discuss it for as long as possible before proposing solutions; systems engineering embraces this as a philosophy for the stakeholder relationship.

As such, the benefits of an SE model are not just confined to presenting a clear, coherent architecture to designers, testers and operators, it also allows the behaviour of the system as a whole to be anticipated prior to engineering the specific details of individual components.

In other words, many innovative ideas can be pre-validated by exploring how they will interact with their context and environment, saving engineering the burden of costly rework when discovering a defect after costs have already been sunk. Clarity in identifying the problem is the most important component of delivering an innovative solution through an efficient, and Lean, SE process.

Changing Process

Continuous improvement provides a model of how to articulate the value and work plan of specific innovative initiatives. We all understand how to plan, do, check and act on an incremental change, making sure those changes are continuous, and sometimes even making sure they are improvements, can be an unexpected challenge.

No matter how mature your Lean management operations are, there will always be people in the organisation who want to do things the old way, even if you can demonstrate with a scientific level of certainty that the new way is better for your organisation, your customers and your employees.

There is a subtle difference between empowering your employees and just letting them get on with it. Empowering your employees is about giving them the tools and the skills they need to take a personal interest in the initiative, and making it feel like it is something they have ownership over.

Continuous improvement is fundamentally a scientific exercise, concerned with hypotheses (plan; "we would be more efficient if we did it this way"), experiments (do; "let's try it out in controlled circumstances"), measurements (check; "were we actually more efficient"), and publishing theories, (act; "this is better and it should be generally accepted and promulgated").

Throughout all this, evidence is king, just like in science, and you can't empower your employees to take a scientific attitude to your process without giving them ownership of and access to the evidence. If you can't measure performance, you can't improve performance, or at the very least it becomes difficult to say if your performance has improved or not. By giving employees real-time access to your continuous improvement metrics, properly documented and measured, you can give them the information they need to make continuous improvement experiments a routine, straightforward and interesting part of their day.

Being able to see weak points in your process through data can stimulate your employees into having ideas for incremental improvements and focus attention on those areas most in need of change. Cross-team transparency can also foster an attitude of collaboration and healthy competition with respect to continuous improvement objectives.

But most of all, robustly and efficiently measured metrics allow a decentralised continuous improvement culture to increase performance without increasing risk. The key to derisking innovation is information: knowing where you are, where you're going, and what's happening along the way. This is as true for your business process as it is for your products.

The key to unlocking this level of transparency is in tools which enable an instantaneous real-time view of your project at every stage of its life cycle, integrating a single source of truth across requirements, design, configuration, workflow management and all aspects of quality, as well as generating repeatable templates that allow you to retain improvements between as well as within projects.

Transparency is ensured by providing access to those features through a dashboard that gives you a real-time view of what's going on at every stage of the life cycle across specialised and fully integrated applications. SE tools are designed with these innovation-enabling objectives in mind.

Tools like IBM® Engineering Lifecycle Management can break down walls between your engineering teams and your engineering data and can help ensure that the continuous improvement journey really is continuous, and bring everyone in to making it a reality.

About SyntheSys

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