

Automotive Manufacturing 101: The Multi-Year Process from Idea to Product

Building an Idea



Imagine – A new car begins with an idea at least as five years before it hits the road.



Create – Engineers and designers build and test a prototype three years before it is in production.



Decide – Three years in advance of release, an automaker decides where and how the car will be built.

Prototype Performance Testing



Circling the Globe – Over a period of a year or so prototypes are often driven enough to circle the globe 40 times.



To the Limit – Components are tested by running non-stop for the equivalent of 100,000 miles.



Every Environment – Prototypes are durability tested in the most extreme conditions like the Arctic and Death Valley.



Safety and Regulatory Standards



Compliance – Safety and emissions systems are tested to meet regulatory and company standards.



Simulating the Real-World – Up to 400 virtual tests and computer simulations, over hundreds of thousands of hours, reflecting real-world crash scenarios.



Crash Tests – Cars are crash-tested from the front, side, roof, and rear using test dummies of various shapes and sizes costing between \$130,000-\$1,000,000 each.

Manufacturing



Job One – "Job One" is the very first vehicle of a new or redesigned model and production begins six months before going on sale.



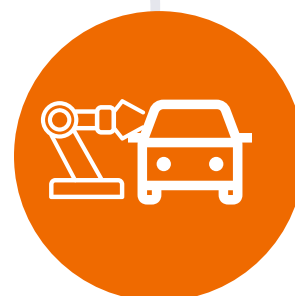
Extensive Support Network – A new production may require 100 U.S. facilities for assembly, stamping, and powertrain.



Expensive Venture – To succeed in the market, a new vehicle has to improve upon the model it's replacing in every way, involving thousands of people, as much as five years, and up to a \$5 billion investment in the product.



Investment – R&D and manufacturing challenges continue to become more complex. Automakers will invest \$250 billion by 2025 to electrify their fleets and install potentially life-saving crash avoidance technologies.



Automotive Manufacturing: Building the Future

Innovation in Electrification and Automation



Latest and Greatest – Electrification and automation require fundamental changes in the material.



Raw Materials – Minerals need to be sourced, refined, and processed. This includes lithium, cobalt, silicon-graphite, and other rare earths and polymer materials.



Components – Supply chain disruptions can lead to shortages that slow vehicle production and availability.



Production Facilities – Electrification and automation require new value and supply chains.

Transition in Production



Develop Supply Chains – Cars have batteries, charging sockets, power inverters and converters. Today, Asia is home to many of these parts which cause delays.



Domestic Supply – To provide supply chain consistency, many automakers are investing in their own domestic production facilities.



Little by Little – Today, six states have new battery factories, and at least 8 more facilities have already been announced.



Managing Future Success



Consumer Preference – Consumers must trust, and understand, automotive innovations, including driver assistance systems.



Economic and Resource Constraints – Manufacturers have significant, but not infinite, finance, technical and manufacturing capabilities.



Government Requirements – New frameworks should be affordable, achievable, and economically sustainable. Infrastructure is important.

Coming Together

It all comes together as part of a complex, rigorous and challenging cycle that results in one groundbreaking innovation after another. And the reward goes to the customers. Customers who have more choices and more products with ever advancing technologies.

