Engineering Change Management in the Automotive Industry – When are you Finally Market Ready?

Abstract

The automotive industry is one of the largest manufacturing industries in terms of scale, revenue as well as processes and is also considered to be one of the largest drivers of economic growth across the globe. This is an industry that has its fulcrum not just on the strength of its manufacturing processes and engineering capabilities, but also on the strength of its parts procurement, assembly lines, supplier and distribution networks, quality testing, etc. to name just a few. Before a vehicle is ready for the market, it goes through various stages and investments that are to the tune of millions of dollars even for the prototype. While all automotive industry manufacturers aim to make their end product the perfect one, both in terms of safety as well as efficiency across parameters, the road to perfection does involve many changes. It could be either in the design, the performance criteria, the aesthetics, or the manufacturing methods and could sometimes be as simple as the design of the seats or as big as the efficacy of the ABS. These changes would in turn have an impact on the life cycle of the product, its competitive advantage, as well as its market readiness.

This paper explores the effect that change can have on the automotive industry and analyses how the ECM process could make or break the success of the automobile and its manufacturer.

1. Anti-lock Braking Systems
2. Engineering Change Management
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Introduction

The automotive industry was predicted to cross US$1.7 trillion by the year 2015, an increase of 39.6% from the year 2010. The automotive manufacturing industry includes the production of trucks, commercial vehicles, and passenger vehicles, out of which cars alone account for as much as 61.5% of the industry’s total value. (MarketResearch.com, 2011). While the total cost of manufacturing a car can be demarcated as 47% for components and raw materials, 21% for labor, 6% for R&D, 6% for depreciation, 10% for administration, 3% for logistics and the remaining 7% for all the other parameters including marketing, (Kailstrom, 2015) one big hidden cost that all OEMs have to incur are the costs associated with engineering changes. (Chuck Stuart, 2006). Inadequate handling of the engineering change process can spin the product lifecycle out of control and stay out of control every time there is a model change requirement as well. While change is inevitable whether it is in design, manufacturing, material requirement, packaging or QA standards, getting the costs under control and managing the product lifecycle depends completely on how effectively the OEMs have driven the change enterprise wide.

Automotive Engineering Change: Key Implications

The cars of today are engineering complexities, with many thousands of components, thousands of hours of research, processing, designing, testing, etc. The sheer number of components that go into making a car, along with the latest designing systems, infotainment systems, chassis, vehicle body, suspension, control systems, safety systems, make sure that a car is one of the most sophisticated engineering products available in the market. The competition in the market, the pressure to perform and the market readiness of the car are already pressure points in themselves. Added to this is the pressure of the frequent change, which is inevitable. Automotive OEMs feel that approximately 40% of their challenge is due to the frequent engineering changes which causes disruption in their original plan as well as the product lifecycle, not to mention the additional burden on their manpower and budget. (Automotive engineering change: The key to cost reduction for competitive advantage, 2013)

In the automotive industry, vehicle development can take as much as eight years. The product lifecycle is already vast enough, even without changes coming in the form of dimension, durability, safety, quality, ergonomics, performance, standards, etc. In order for the change to be absorbed faster into the lifecycle, enterprise wide communication and collaboration between the OEMs, the suppliers and the workforce becomes imperative. (Chuck Stuart, 2006).
Communicating the Change – PLM Shows the Way

The automotive industry has the fiercest competition within and only the best in the industry can survive the race to the finish line. While Toyota is known for its JIT and Lean management principles, all OEMs have to necessarily allocate the time and the resources required to manage the changes.

Another big player in automotive sector who is known for its commercial and utility vehicles but forayed into the cars segment a few years ago has also modelled its automotive manufacturing processes using PLM. Being new to the car segment, the manufacturer had already anticipated the challenges that they would face both in terms of processes, experienced workforce as well as the engineering changes that were imminent. They also had the added pressure of being in the same vicinity of the more experienced car manufacturers, which brought on the pressure to innovate as well. Being new to the segment, there was also the challenge of QA and automobile recall systems. Some of the redundancies that they needed to address were:

- Their processes worked on the PDM concept. They needed to infuse PLM, which was an extension of PM into their planning as well as manufacturing processes. This would assist them in managing the entire lifecycle including the data management, management of techniques, processes, material procurement and handling, reengineering, coordination of all the above, as well as DM which would help them in imitation analysis and prototyping in the virtual environment. The latter would ensure that any changes that were required could be tried and tested in the virtual environment, without having to put a burden on all their resources (Digital manufacturing and China automotive industry, 2008)

- They needed to expedite their manufacturing processes, streamline their planning and production and reduce duplication in design and at the same time increase their average output.

- They needed to have a proper change detection and resolution procedure in place. Every time there was a change required, production came to a standstill as their engineers had to concentrate on absorbing the changes as well. This was prolonging the product lifecycle. Also each change had to be examined and tested in real time, which again put pressure on their timelines and workforce

- They also had to find a way to shorten trial-production time, duration of their manufacturing processes, reduce commissioning time to assembly line, and optimize their processes in such a way that changes were dealt with quickly and effectively. Lean management and use of technologies such as DFX would help them shorten the lifecycles

- There was a need to strengthen their network between them the OEM and the suppliers of various components, as well as increase the communication and collaboration between them. This would help in fostering an interoperability and Just In Time technology process sharing which would in turn reduce time and cost redundancies and improve their time to market

6. Just In Time technology
7. Product Data Management
8. Digital Management
9. Design Facing Manufacturing/Assembly
The OEM approached the same PLM provider who had streamlined their processes for their other vehicle segments as they had found their solutions were a perfect match for their requirements. Not only did the solution seamlessly integrate with their existing PDM systems, but it also helped them right from R&D to assembly line stage and setting up of the manufacturing plant using all the requisite technologies while helping them overcome all changes including engineering changes along the way. While switching over to PLM and DM for their manufacturing boosted their time to market by reducing costs and process cycles, they were also able to effectively streamline their processes for engineering changes.

- Virtual simulation helped in quicker detection, dynamic analysis and remedial of the changes that were required
- Use of the 3D digital model (CAD) for design helped in easier rectification of the design changes that needed to be included
- Digital development helped in integration of all the individual lifecycles such as design, process planning, maintenance, assembly line, testing, manufacturing, etc and also helped in collaborative working between the various teams involved even cutting across regions and geographies
- It also helped in easy management of data for the production that can be ten times more complex than that of the design data
- Virtual environment also helped in higher rates of reusability of analysis and resolutions
- Engineers were able to make innovative modifications in a virtual environment which were often identified independent of the errors
- They were able to reduce engineering changes by almost 60%
- Streamlined processes helped them optimize several of the processes, which reduced the need for work adjustments
- The software environments could now easily predict the changes and the loopholes before they occurred thereby giving the engineers a chance to improve process efficiency and effectively manage change
- They could reduce the time taken in communication between the various internal and external teams by increasing interoperability and easier data sharing

10. Computer Aided Design
Conclusion

The OEM, having gained prior experience of the havoc that change can cause on their product lifecycle, looked to implement processes that would help them in a “first time right” approach. While the process of changes and modifications is inevitable, they have been able to reduce the modification lead time, thereby reducing not just the costs involved, but also the strain that was put on their various teams, the time of the individual processes as well as the entire product lifecycle right from R&D stage to go-to-market. This also helped them in improving their data sharing and communication as well as the way the intelligence of their processes was tapped. Ultimately, the core competencies of their manufacturing improved and so did their ability to face evolving customer demands and competition.
References


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PROLIM is a leading provider of PLM Software Services to industries like Automotive, Aerospace, Manufacturing Supplier and Life Sciences. Providing these services has helped the clients to enhance efficiency and top-line growth. As one of the fastest growing private companies in America recognized by Inc 500, PROLIM being customer focused rather than product focused, the company envisions harnessing customer requisites by adding more satellite offices over the next few years in major metropolitan centers. PROLIM envisages reaching customers beyond borders to deliver effective services in the west and east coasts of the US, Canada, and Europe and Asia.

US OFFICE – DALLAS
PROLIM Global Corporation
2805 N. Dallas Parkway, Suite 610
Plano, TX 75093
Phone: 214-945-2667

US OFFICE – DETROIT
PROLIM Global Corporation
30445 Northwestern Hwy, Suite 380
Farmington Hills, MI 48334
Phone: 248-522-2575

CANADA OFFICE
PROLIM Canada Inc
4611 Rosebush Road,
Mississauga L5M 5H2,
Canada
Phone: 416-220-2892

INDIA OFFICE
PROLIM Solutions Pvt. Ltd.
World Trade Center
20th Floor, Malleswaram,
Bangalore 560055
Phone: +91 80-41637666