WHITEPAPER

KEY CONSIDERATIONS FOR SUCCESSFUL NEW PRODUCT DEVELOPMENT

DFMPro®

Author

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Abstract

Product design and development life cycle have been gradually compressed. This, in turn, has increased schedule pressures on the development team. Organizations should look for continuous process improvement to increase overall team efficiency and productivity.

Every new product design and development (NPD Process) starts with basic propositions to understand the purpose of the product, which will lead to the creation of competitive differences in the market and drive an organization to develop capabilities internally or through partners. Continuous process improvement is also important in the product development workflow to reduce the development lead time.

Companies should develop communication channels within cross-functional teams to transform their needs and requirements into best practices, rules or standards. This will help minimize rework efforts and emphasize adherence to reduce internal indirect failures leading to unplanned rework in new product design and development.

Organizations must increase personnel cost-effectiveness with help of the latest available automation tools. Transformation of technology can change the entire development approach and provide opportunities to increase efficiency and business profit margin.

For the implementation of a closed loop system, all cross-functional teams should communicate with each other exchanging feedbacks and challenges. For this implementation, organizational teams should understand each other's functional objectives.

Points To Be Thought Of Before Starting An NPD Process

A team should understand the minimum and maximum functional requirements for product and associated manufacturing requirements. This can be achieved by having succinct answers to the questions listed below-

- How complex is the product design and manufacturing and what is the impact of its associative costs?
- How strong is the product and for how long will it last?
- How reliable is the product going to be?
- What will the product manufacturing costs be, and does this allow room for profit without a price tag that will put buyers off?
- Is the product single-use or reusable?
- What are the materials needed for production? This point may require further research

Answering these questions in correlation to organizational capabilities will help us understand the extent of outsourcing requirement as well as feasibility for a given product.

Typical Product Development Workflow and Challenges

An NPD process analysis may help only in checking the present capability of the organization. Many organizations still follow traditional development processes - however, in the recent times, the trend has changed. This is the right time to implement latest technologies to upgrade the development team, otherwise, it may slow down the pace of work.

Traditional development process enforces decision makers to use old documents and methods to resolve issues because a significant part of the process is manual. Every product manufacturing has its own unique set of challenges with an associated indirect cost. One must try to find solutions for bottlenecks inside product manufacturing processes so as to minimize cost in every area right up to the product warranty stage. (Figure 1)

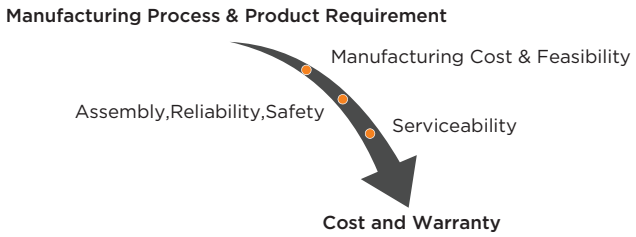

Figure 1

Many organizations fail to achieve desired levels of business success due to a dearth of attention to challenges and requirements of other departments during the development phase. Collaboration with other departments is minimal – even if it exists, there are many iterations. Based on organizational culture, design engineers may or may not spend time with vendors/suppliers to genuinely understand feedbacks. Because of this, indirect expenses get accounted in the company overheads.

As the design moves across departments of the organization and through suppliers, each one applies their expertise and knowledge to bring the product to fruition. As a result, some non-standard practices may be applied to deliver the product, the information about which is not transferred through the workflow and will not be captured in the knowledge base of the organization. As engineers and managers, we tend to err in thinking that we have considered, planned, and designed as per all requirements and that everyone did exactly what was documented in the process specs. However, the failure analysis reports which get reviewed do not even come close to the actual reality on the 'shop floor'.

Need For Communication Development

Cross-functional team collaboration can create a holistic framework to standardize and automate the review feedback process under a centralized data administration system. At the same time, this will help the team to streamline the process and minimize internal failure costs. (Figure 2)

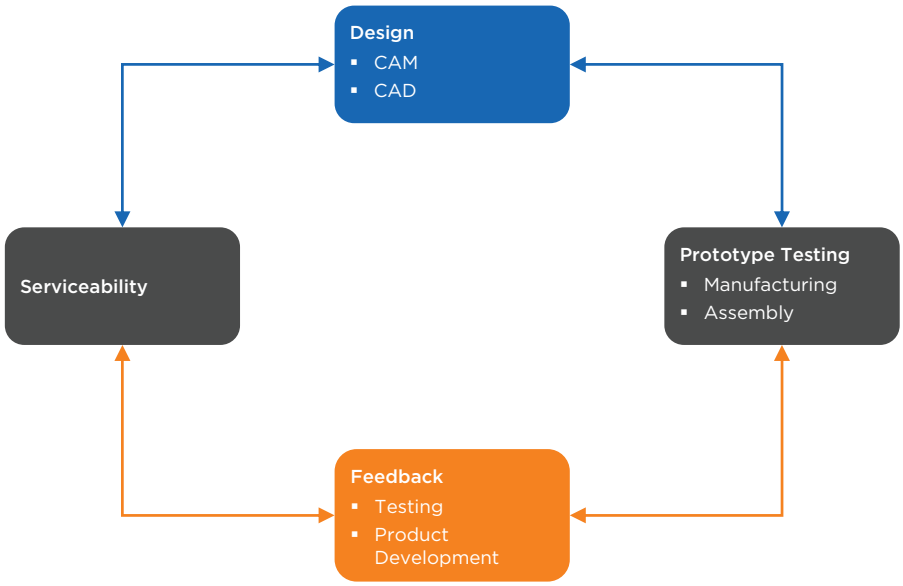

Figure 2

Most organizational standards/guidelines are developed by responsible engineers or subject matter experts based on the learnings from past errors/failures. However, they should also directly or indirectly involve all representatives/ experts from the respective departments or all affected areas. These contextual learnings are transformed into guidelines of DFM&A (Design for Manufacturing and Assembly). (Figure 3)

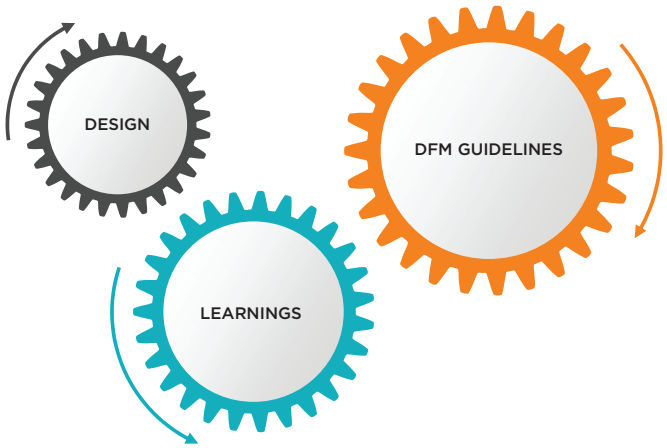

Figure 3

Some developed DFM&A rules are specific to the industry and some are generic. Customization is based on needs of the industry and the responsible team will provide inputs for development, with the help of cross-functional teams.

DFM&A rules development is not a simple task; it requires a lot of effort and experience to conclude. Now CAD Plugin tools (such as DFMPro) are available for multiple CAD platforms covering most of the standard commodities such as machined, sheet metal, plastics, 3D printing, etc. Various types of rules and guidelines are bundled in an automated software tool which highlights design areas which could cause potential failures during manufacture, assembly, or operation, for example:

- Necessary drafts for molding
- Undercuts
- Thin/Thick walls
- Holes to bend distance
- Minimum bend radius
- Tolerance variation
- Tool accessibility
- Hole alignments
- Sharp Corners

Avoiding Internal Indirect Failures

DFM&A guidelines help reduce internal failure costs and rework efforts - these defects can influence both direct and indirect costs. Still, many of these are harder to quantify and these are more productivity-focused. “Good Quality” achievement is possible when you eliminate these failures.

Following are some of the areas where organizations benefit and reduce internal failures by adopting DFM&A guidelines during design

1. **Management time:** Costs of management efforts to resolve quality issues
2. **Redesigning products:** Cost of redesigning to remove the cause of defects, Cost of changes to the product after root cause identification
3. **Redesigning quality processes:** Cost of improving corrective and preventive actions or FMEA process to identify root causes
4. **Rework:** Costs of correcting quality issues on existing product
5. **Rework inspection:** Cost of inspecting a product after rework
6. **Variability in product quality:** Cost of product give-away
7. **Retesting processes:** Costs of testing processes after making changes
8. **Unplanned downtime:** Cost of unused production time due to quality failures

9. **Schedule disruption:** Cost of rescheduling operational activities of development/Manufacturing
10. **Additional material procurement:** Cost to replace defective or missing material
11. **Materials shortages/Unusual requirements:** Costs of changing production plans or missing delivery dates due to quality issues
12. **Supplier rework:** Costs attributed to supplier defects
13. **Downgrading:** Cost of lower the price point of the product with quality issue
14. **Production scrap:** Cost of product that cannot be reworked or reused
15. **Scrap disposal:** Cost of getting rid of a product that cannot be reworked or reused

All of these contribute to internal failure costs and associated effort.

Actual Cost of "Good Quality" = Cost of "Poor Quality" + Cost of "Good Quality"

A Closed Feedback Loop Culture Helps Avoid Failure Costs

Many organizations fail to meet the product development lead times due to a lack of or inefficient cross-functional team communication. Improper visibility and lack of review feedbacks create gaps, thus, creating an open loop. Cross-functional team feedback needs to reach the design phase and be adopted therein to make this a closed loop system. Practices such as personal notifications, escalating issues rather than finding solutions, or lack of a properly defined authority to approve corrective or preventive actions, will lead to non-conformances at an enterprise level. (Figure 4)

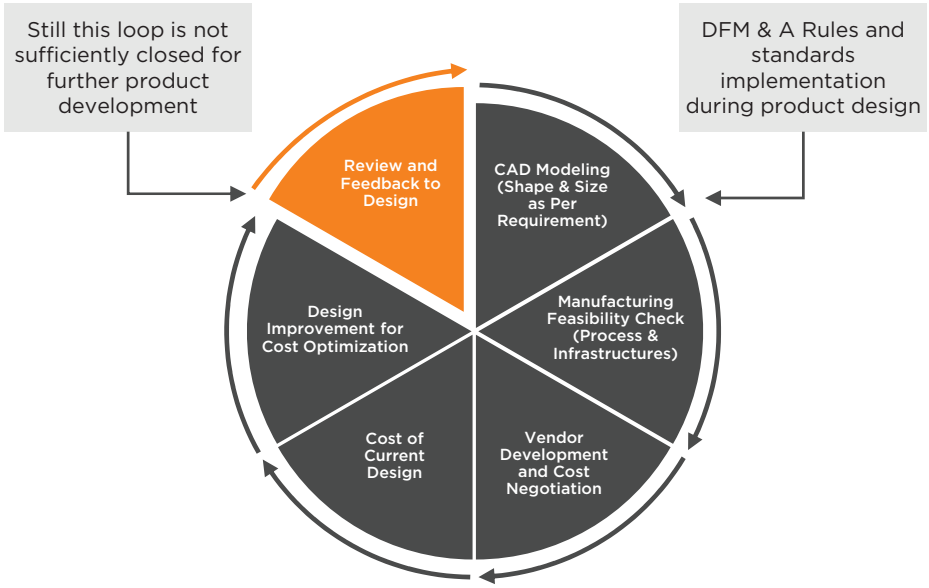

Figure 4

Collaborative Feedback From Functional Teams

CAD & CAM Software can help reveal potential issues before design freeze and resolve any problems in prototype manufacturing.

There might be some further decisions to be made related to Prototype Testing, Manufacturing & Assembly - such as materials, batch numbers, and the manufacturer. Think about what keeps costs low while maintaining the required quality, so that profits can be maximized. In the assembly stage, there will be many opportunities, such as tool accessibility and onsite installation/service related problems.

There are many ways to collect testing & product development related feedbacks in shop floor during product assembly. Take note of all feedback, which are useful for further product development or address any unforeseen issues.

Conclusion

These circumstances may occur when collaboration is fractured and the eminence of feedback is downplayed. It is a challenge to pinpoint specific areas for improvement, but all the above explanations may help industries to overcome the challenges.

The essential intent is to include DFM&A guidelines adoption as a part of the design process with a certain degree of automation to reduce internal failure costs and increase working efficiency of overall design and development team by considering learning feedback, which helps cross-functional teams to minimize product development lead time.

About Author

Ashok is a Mechanical engineer with over 18 years of experience in Design, Manufacturing, Production engineering, and Planning, Project management, Engineering function (PPAP)

He has worked and managed various projects that cater to Design and Manufacturing, tooling, NPD in shop floor, Process planning, CNC programming, Machining and Process selection cutting tool selection and trials, jigs & fixtures design development, Press tools and mold development, VAVE and Should costing.

Ashok has worked in various manufacturing industries of Automotive, Electrical, Material handling equipment's, Special purpose machines (SPM's), HVAC, IT engineering service and Contract manufacturing services industry (PCBA).

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