

PRODUCT DEVELOPMENT CYCLE

Concept -to- Production in Six Steps



Prepared by

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HOPEWELL Companies offers a wide range of engineering and build-to-print manufacturing services, born out of long and successful career in technical services for Aero/Defense and electronics manufacturing. That background of experience makes HOPEWELL Companies a valuable consulting partner for Makers, Start-Ups and OEM's of all sizes. As a result, we are often asked to provide a high-level overview of the Product Development and Product Life Cycles to help our clients better understand where they are in the process, as well as identify any key steps they may have overlooked.

The duration and complexity of each step will vary wildly depending on the product to be designed, and it must be emphasized that the content of this paper does not accurately represent the fullness of the Product Development Cycle as a whole. Rather, it is provided to demonstrate the process and shine a spotlight on some of high-level actions within each of the following milestones of Product Development and New Product Introduction (NPI).



Product Development Cycle: Concept-to-Production in Six Steps



Product Development Cycle: Concept to Production in Six Steps

1. Market Validation

Whereas market research is valuable throughout all stages of the product life cycle, some level of market validation at the front end of NPD provides valuable insights regarding the product concept and benefit to user, market and demographics, legal issues, competition, critical vs high/low value features, key performance characteristics, retail pricing and customer acquisition cost, and other critical information required for a sound business plan.

- ASK: Can I articulate my product design, key features, target market, competitive landscape, product development budget and manufacturing budget?
- TRAP: Switching the order of Product Development and Market Validation/Research, only to discover you have developed a product that you can't afford to bring to market or that doesn't have the critical features and functionality required [leaving someone else to build a better mouse trap than yours].
- DECISION: Go/No-Go to Product Requirements, Incubate idea, or Kill.

2. Product Requirements

Creation of the Requirements Doc (RD) is a crucial step of the Product Development Cycle, as the RD captures (preferably in bullet form) the critical design aspects the product must be designed to comply with. Think of it as a “do not pass go” without list, meaning you can not proceed to nor pass Step 4 (Product Development) without these features. Creating the RD for a product you haven't designed yet is awkward to say the least. However, identifying critical features and establishing budget guardrails early on will be your sanity check six months into development when you are forced to make trade-offs.

- Product Attributes and Critical Features
 - Functional requirements
 - Hardware requirements
 - Software requirements
 - Industrial design requirements
 - Form factors
 - Performance Requirements (include environmental)
 - Quality Requirements and Compliance Standards
 - Manufacturing Preferences (i.e., Made in USA or global sourcing? Green?)
 - Maximum Development Budget
 - Maximum Unit Manufacturing Cost (at a given quantity)
 - Maximum Retail Cost
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- ASK: If forced to make trade-offs, what are the absolute “must haves” my product design needs to minimally satisfy based on market research and competitive landscape?
 - TRAP: Without a clear and well researched Requirements Doc, your product development team may build *the wrong type of mouse trap*, resulting in additional cost and project delays.
 - DECISION: Go/No-Go to Conceptual Design, Incubate idea, or Kill.

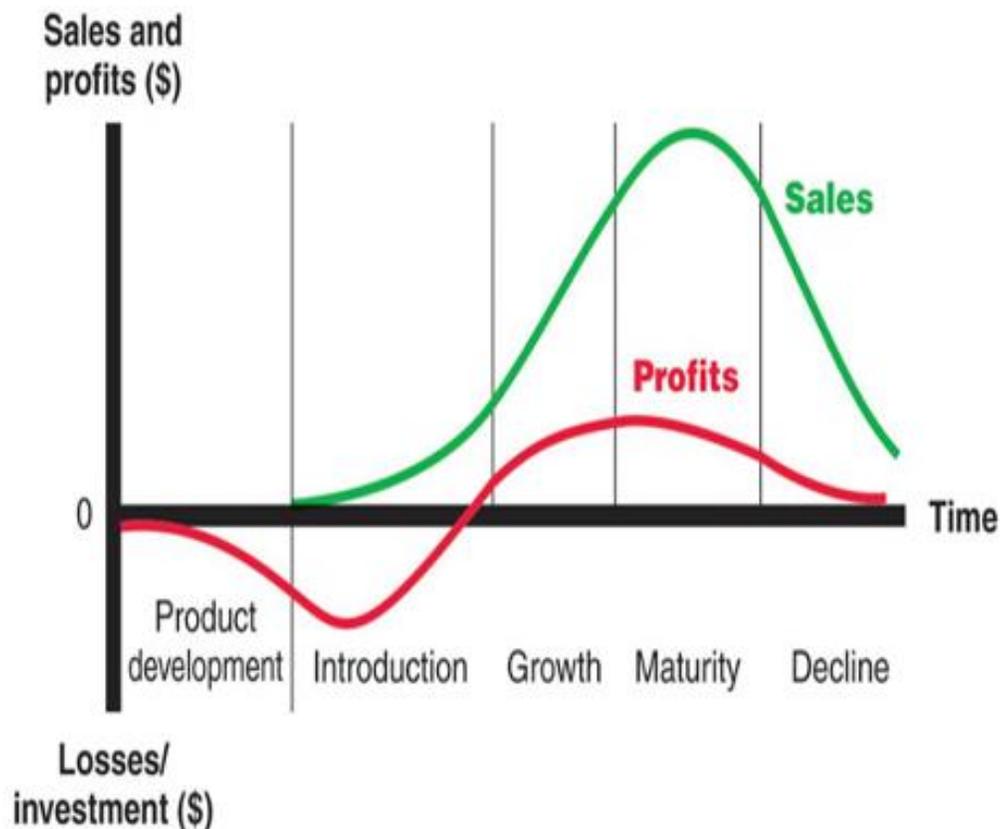
3. Conceptual Design

In the early stages of product development, the primary design objective is proof of concept or to develop a Minimally Viable Product (MVP) idea stated in meaningful consumer terms. Depending on the complexity of the product (i.e. mousetrap) this might be done in renderings or low-cost prototypes that demonstrate form and fit with minimal functionality. These renderings or low-cost prototypes may be used for crowd funding, marketing and product demos. For more complex products (i.e. ventilator), the lines between Concept Design and Product Development are often blurred.

MVP's or early functional prototypes may require significant investments for custom parts and prototypes. Employ ongoing market research to eliminate features that don't hold value with your target customer.

- ASK: Is there a significant body of evidence proving that the risk of moving forward is low?
- TRAP: Rushing into design phases without completing a thorough business and financial assessment to determine viability of further development and investment.
- DECISION: Go/No-Go to Develop, Incubate idea, or Kill.

Product Life Cycle (profitability chart)

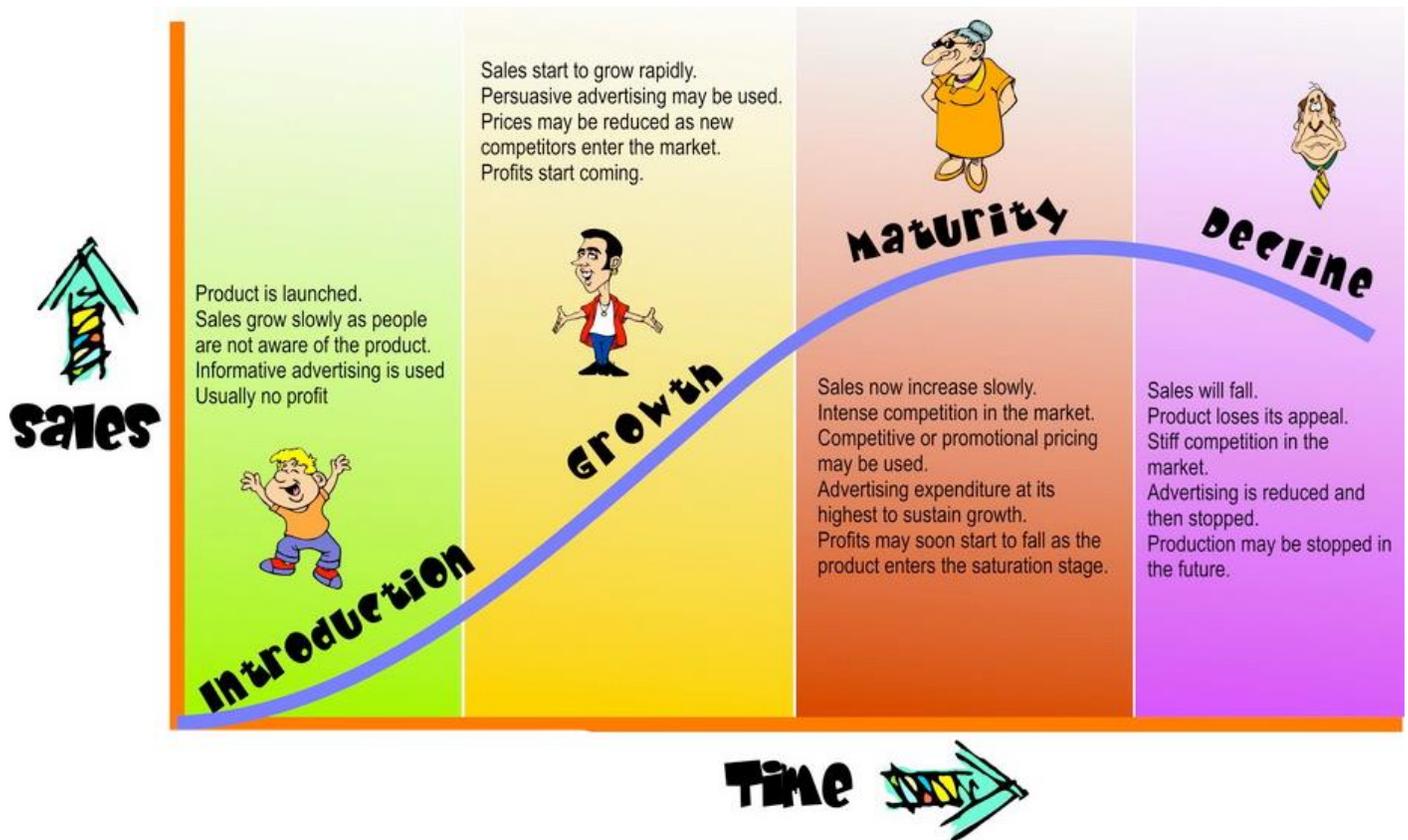


4. Product Development / Detailed Design / Design Verification Testing

Product Development is an extension of Conceptual Design and often (for more complex products) they go hand in hand. Manufacture and performance testing of fully functional prototypes delivers critical insights for product reliability and manufacturability. Redesigns may be (and often are) required to ensure design complies with the criteria called out on the Requirements Doc. Non-Recurring Engineering (NRE) and Tooling charges begin to mount. Supply partners are identified for contract manufacturing, and you would do well to invite them into your design efforts for DfM (Design for Manufacturing) input. Compliance testing may be required for applicable quality standards. Product development and marketing efforts are harmonized, sales and distribution channels are identified.

- ASK: Did I build the right thing? Did I build the thing right?
- TRAP: Don't get hung up on perfection. Adding too many bells and whistles not only adds cost, but it may give a competitor time to launch first and capture market share (even with an inferior product).
- DECISION: Go/No-Go to Pilot Production, Incubate idea, or Kill.

Product Life Cycle (maturity chart)



5. Pilot Production / New Product Introduction

The pilot production is your “dress rehearsal” to full production most often executed via short runs or low volume manufacturing in lot sizes that are frequently a low percentage of estimated annual usage (EAU). Manufacturing costs are typically significantly higher than they will be at full production rates.

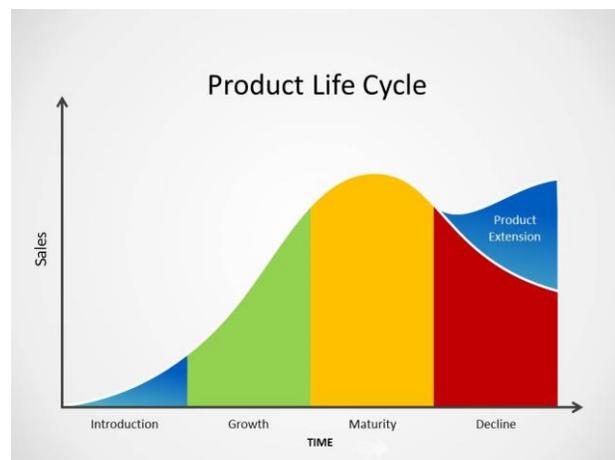
The journey from New Product Introduction (NPI) to full production can be a minefield of disruption and setbacks. User feedback, field failures and a whole host of other variables may necessitate design revisions. There is often a high budget for marketing and promotion, but sales may be slow to mount resulting in lower profits. But lessons learned during low volume manufacturing and NPI will prove invaluable when transitioning to full rate production.

- ASK: Have I worked out all the kinks of product design and manufacture, while proving my product to be viable in the market? Do I have quality systems in place, and a sales/distribution plan?
- TRAP: Rushing into production without an understanding of the cost of customer acquisition and/or manufacturing at a higher production rate (or initial build quantity) than you are confident of being able to sell.
- DECISION: Go/No-Go to Full Production, Incubate idea, or Kill.

6. Full Production

Approaching full production rates, manufacturing costs typically true up and profits increase. Focus on production efficiencies to further reduce cost. Explore different product applications and consider adding new features to protect market share as competitors’ surface. As your product moves through the Product Life Cycle, you will experience many new challenges: market saturation, supplier quality issues, employee retention and obsolescence issues just to name a few.

- TRAP: The journey from design-to-production is not a “one and done” operation, but requires ongoing efforts in market research, design evolution and product improvements, customer care operations, and ultimately an end-of-life strategy.



At HOPEWELL Companies, we work with Makers and Manufacturers of all shapes and sizes, providing on-demand engineering expertise and manufacturing services of value throughout all stages of the product life cycle (product concept -to- end of life) and bringing empowerment to our clients through:

- Consultation and experienced interpretation of complex Scopes of Work to space, avionics, military and commercial regulatory standards;
- Timely identification of Principals able to satisfy client requirements for quality, performance, budget and delivery;
- Expansive network of subject matter experts and consultants;
- Assistance beyond the sale, to include ongoing program oversight.

For additional resources or to schedule a short telecom or videoconference to discuss your next product, project or manufacturing challenge, please visit www.hopewellcompanies.com



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