

# Stages for designing new products

Most entrepreneurs drastically underestimate the cost and time required to develop, scale and manufacture a new electronic hardware product. This is one of the main reasons so many hardware startups ultimately fail.

The transition from prototype to mass manufacturing is a complex process that most people underestimate. Realistically, you can expect it to take about a year to make this transition. Having a finished prototype is a long way from having a mass manufactured product.

There are a series of stages involved in designing a new product based using an incremental cost structure to avoid investing too much time and money into a non-viable product. Each stage is aimed at iteratively formalizing the requirements, understanding the use-case, segmenting the market and designing an optimal product that is not only targeted at a defined market but also tailored to the wants or needs of that market.

The main objective of staging a new product design is to resolve unknowns, eliminate risk and formalize the final design. It is common to see a final design that is significantly different to the original product concept. This is because design concepts typically do not take into account physical constraints or design optimization for volume production.

In order to de-risk a project the initial concept should be tested and developed incrementally starting with a Proof of Concept (PoC). After the PoC is completed, the next step is a rapid prototype where a functional prototype of the product is produced for evaluating the idea.

On successful completion of PoC and Rapid Prototypes the next stage is a pre-production prototype. The pre-production prototype will closely resemble the final product and be able to pass formal certification testing.

The final stage is to convert your pre-production prototype into a manufacturable item and begin volume production.

The following sections explain each of these stages in more detail.

## What is a Proof of Concept (PoC)

A Proof of Concept (POC) is a small exercise to test a design idea or assumption. The main purpose of developing a PoC is to test technical feasibility to verify a product or idea can actually be achieved.

The main reason people opt for a PoC is that the turnaround time is shorter. PoCs can also be used for marketing purposes to try to garner interest from potential buyers or investors.

The disadvantage of a PoC is that they are not optimized for mass production because the unit cost would be too expensive to produce in great quantities.

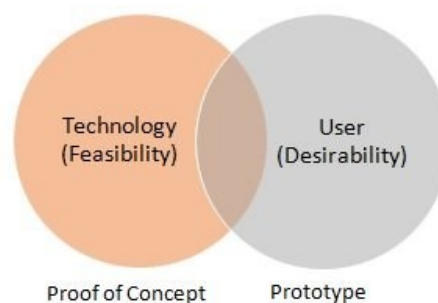
## What is a Rapid Prototype

Rapid Prototyping is a valuable exercise that allows the innovator to visualize how the product will function. It is a working interactive model of the end product that gives an idea of the design, navigation and layout. Rapid prototyping is typically done by hand, step by step, to materialize your vision in a physical form.

While Rapid Prototyping is more expensive per unit than a hard-tooled injection molded parts, it is a shorter and lower cost path to a functional product demonstrator.

## PoC vs. Prototype

While a POC shows that a product or feature can be developed utilising a combination of available components, a rapid prototype demonstrates viability by integrating all of the features specified by the inventor in order to demonstrate the end result as a working model.



**Fig 1- PoC vs. Prototype**

The **PoC** process is typically for internal review and allows sharing internal knowledge among the team, explore emerging technologies, and provide evidence of concept viability. There are

no customers involved at this stage, it is for internal approval and justification for a larger project.

**Rapid Prototyping** is a quick and effective way of bringing a client's ideas to life and serves as a sample for potential users to evaluate, test and share their feedback to make improvements. This is where user feedback provides valuable insights into what the product should or should not do. These types of projects often appear on crowd funding sites to not only raise funds but also gauge interest in this type of product. Crowd funding can often perform your market segmentation saving a significant amount of market research and associated costs.

### **Pre-Production Prototypes (PPP)**

Once the initial stages of PoC and Rapid Prototype are completed, a pre-production prototype should be developed to validate the electronic and mechanical designs. These are prototypes that are made that closely resemble the final product in terms of look, size, and functionality. They are also sent to the labs for pre-certifications (CE, FCC, ROHS, etc). Most importantly, the pre-production prototype will provide the most accurate estimate of the production cost for the final product. However, don't wait till this stage before estimating the unit cost in volume production. The PPP should be a refinement of your existing estimates, not a total surprise.

These prototypes are optimized for mass manufacturing and therefore take longer to make. A PPP is the end result of:

- Industrial design
- Mechanical engineering
- Electronic design (hardware)
- Electronic design (firmware)
- Compliance testing

### **Final design**

Now that we have completely designed the product, tested all of its features and functions and obtained certification, the product is now ready for mass production. As a rule of thumb, to realize the benefits of the low unit cost associated with volume manufacture you need to be producing a 5,000 units per batch. However, for some specialized or high margin products this can be as low as 500 units per batch and still be viable.

## Recommendation

The recommended procedure for developing new products is to conduct the PoC followed by Rapid Prototyping. This will keep your up-front costs down and represents the shortest and lowest cost path to testing product viability.

The PoC followed by Rapid Prototyping in combination with demonstrated demand for your product is often the catalyst for securing funding for your business and the cash flow required for volume manufacture.

<p><b>A PoC is:</b></p> <ul style="list-style-type: none"> <li>• A concept demonstrator</li> <li>• Lowest cost to test a new idea</li> <li>• Hand made, One-off sample</li> <li>• Manually customizable</li> <li>• A mechanism to refine requirements</li> </ul>	<p><b>A PoC is not:</b></p> <ul style="list-style-type: none"> <li>• Ready for customer evaluation</li> <li>• A final product</li> <li>• Optimised for cost per unit</li> <li>• Manufacturable</li> </ul>
<p><b>A Rapid Prototype is:</b></p> <ul style="list-style-type: none"> <li>• Lower cost to create a new product concept</li> <li>• Hand made or manually assembled on a production line</li> <li>• Low volume, e.g. more than one-off</li> <li>• Manually customizable</li> <li>• Beta test phase for limited number of customers</li> </ul>	<p><b>A Rapid Prototype is not:</b></p> <ul style="list-style-type: none"> <li>• Ready or transferrable to volume production</li> <li>• A final product</li> <li>• Optimised for cost per unit</li> <li>• Manufacturable in large quantities</li> </ul>
<p><b>A Pre-Production Prototype is:</b></p> <ul style="list-style-type: none"> <li>• Significant up-front investment</li> <li>• Represents the final product</li> <li>• Optimised for cost per unit</li> <li>• Manufacturable in large quantities</li> </ul>	<p><b>A Pre-Production Prototype is not:</b></p> <ul style="list-style-type: none"> <li>• Low cost</li> <li>• Low volume</li> <li>• Customisable after production</li> </ul>



# About IoTamy

IoTamy specializes in developing new products utilizing leading edge technologies to deliver real world solutions.

IoTamy is your gateway to volume manufacture in Asia through established manufacturing partnerships and prototyping services.

The value we bring includes;

- ensure that you remain competitive through innovation, collaboration and adoption of leading edge technologies to reduce costs and increase market share
- enabling you to stay focused on your business while we manage the end-to-end product development cycle
- future proofing your products for performance, reliability, durability and cost
- access to the worlds most advanced supply chain and lowest cost manufacturing

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