What is R & D and why does it take so long?

Research and development (R&D) refers to the investigative activities a business conducts to improve existing products and procedures or to lead to the development of new products and procedures.

R&D plays a critical role in the innovation process. It's essentially an investment in technology and future capabilities which is transformed into new products, processes, and services. R&D involves researching your market and your customer needs and developing new and improved products and services to fit these needs.

The path from discovery through development to a product on the shelf is convoluted and treacherous. A lot of good ideas get nowhere, and fall into a chasm often called the "Valley of Death." The quicker R&D can be assessed and "fail fast" the more efficient the overall process of new product development will be in the long run.

When you are thinking about a new product, each component of that product has to go through the R&D process, that all takes time and money!

There are 3 broad scale process stages:

- Analysis
  At the beginning of the process there needs to be extensive research involving concrete facts and figures. This data then feeds into possible solutions to the problem at hand, and the best way to achieve these solutions.
- Concept
  Once the problem and potential solutions are narrowed, the final solution is identified and conceptualized in detail. This includes working out adherence to standards and how closely the visualized solution meets identified customer needs.
- Synthesis
  At this stage, the solutions are turned into ideas and the best ones are highlighted. These ideas of design turn into prototypes on which actual products will be based.

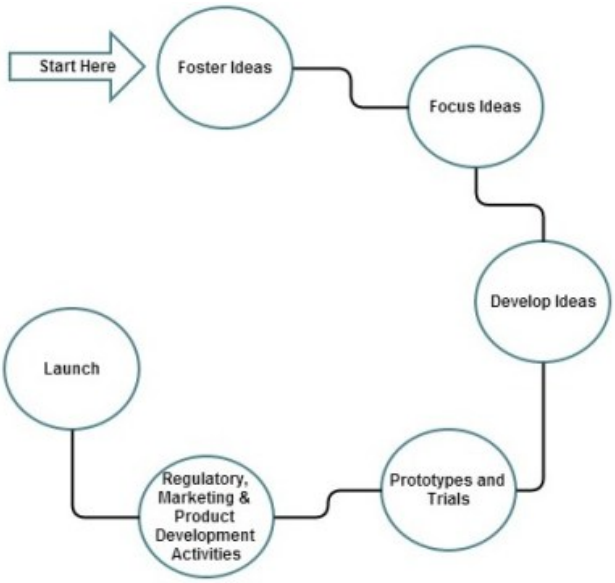
Although traditionally sequential, multiple iterations within these stages can be reduced by **focussing on the following questions**:

- Manufacturing – What facilities are required to manufacture our product?
- Sales – Are we able to produce what the customer wants?
- Purchasing – Do we have required parts readily available or do they need to be ordered?

- Repeatability – Is the process easily repeatable? Can you produce multiples? Will the cost and effort remain consistent?
- Cost – What will the design cost us to make?
- Transport – is the product sized for available transportation methods? Will there be any special transportation needs?

Product design is such a complex process with conflicting needs that also require attention such as:

- Economic Viability
- Price, Appearance, and Value
- Functionality
- Maintenance



Graphic source: https://www.cleverism.com

Using the Me-Moo Motorised Moo as an example for the R&D process let's look at the wheels. Our requirements for wheels were:

- Have as few external parts as possible (no external chains to get bound up or caught on terrain)
- Adaptable to multiple terrains
- Battery driven – without needing excessive huge weighty batteries
- Configurable motor controllers
- Affordable & accessible
- Repeatable for cost/effort/supply
- Low maintenance and durable

It's not as easy as going to the local tyre shop!

Now repeat the considerations again for every component!