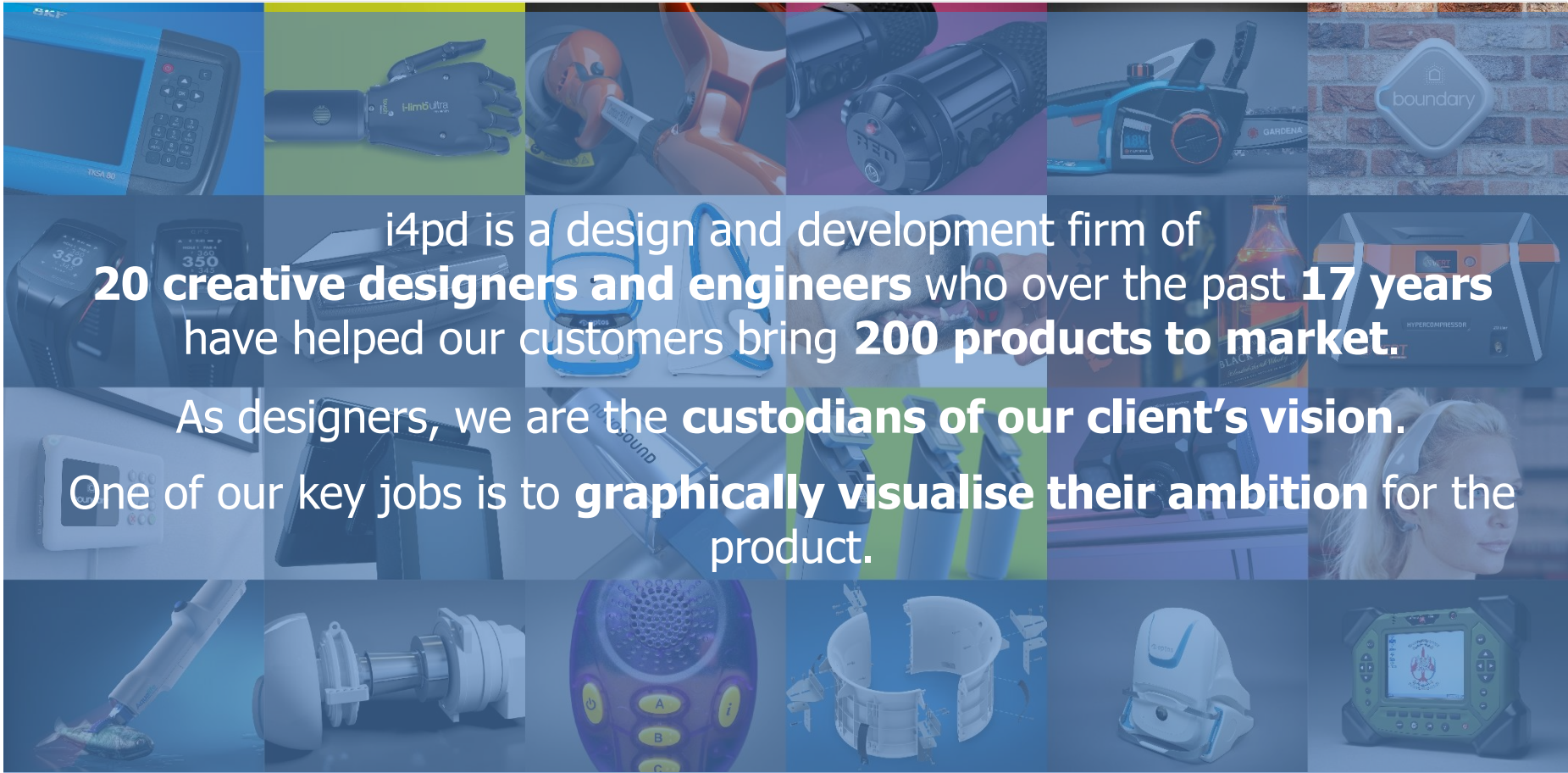




 product design





i4pd is a design and development firm of **20 creative designers and engineers** who over the past **17 years** have helped our customers bring **200 products to market.**

As designers, we are the **custodians of our client's vision.**
One of our key jobs is to **graphically visualise their ambition** for the product.

Example Company's Vision: To build the world's best multi-use spaceships.


To illustrate at a very high level how important the job of a designer is in the success of a product I've used this following hypothetical vision for a space company.

They've set themselves the challenge to build the world's best multi-use spaceships and let their designers (who typically design cars - not rockets) run free.

Visionary? **YES**

Practical? **NO**






Purely conceptual designs can be misleading for entrepreneurs and investors who aren't familiar with the practicalities of design & development.



Visionary? **YES**

Practical? **YES**

A futuristic spacecraft with a sleek, aerodynamic design is shown in space, orbiting Earth. The spacecraft is white with blue accents and has a long, thin tail section. It is positioned in the upper left quadrant of the frame. The Earth's surface is visible below, showing clouds and the horizon. The background is a dark blue gradient representing space.

A more achievable concept (assuming you have a similar budget to SpaceX!) for this vision might look more like Starcraft which is still inspiring.

As an integrated design and engineering firm, it is our responsibility to both creatively visualise and then realise a product concept. That we means we have to employ some degree of **'creative pragmatism'**.

Three questions to set yourself on the path towards DfM:

1. What is the development **budget** and target unit cost?
2. What is the experience & **capabilities** of the assembled team to design for manufacture (according to relevant processes)?
3. Who will ultimately be **responsible** for what in the journey?



- What will be the cost of the design and engineering effort for each phase.
- What are the prototyping, tooling, 3rd party test house costs and manufacturing set-up costs.
- When considered all together, the budget ramps up towards the tail-end of a project due to higher fidelity prototypes and investment in tooling/testing.

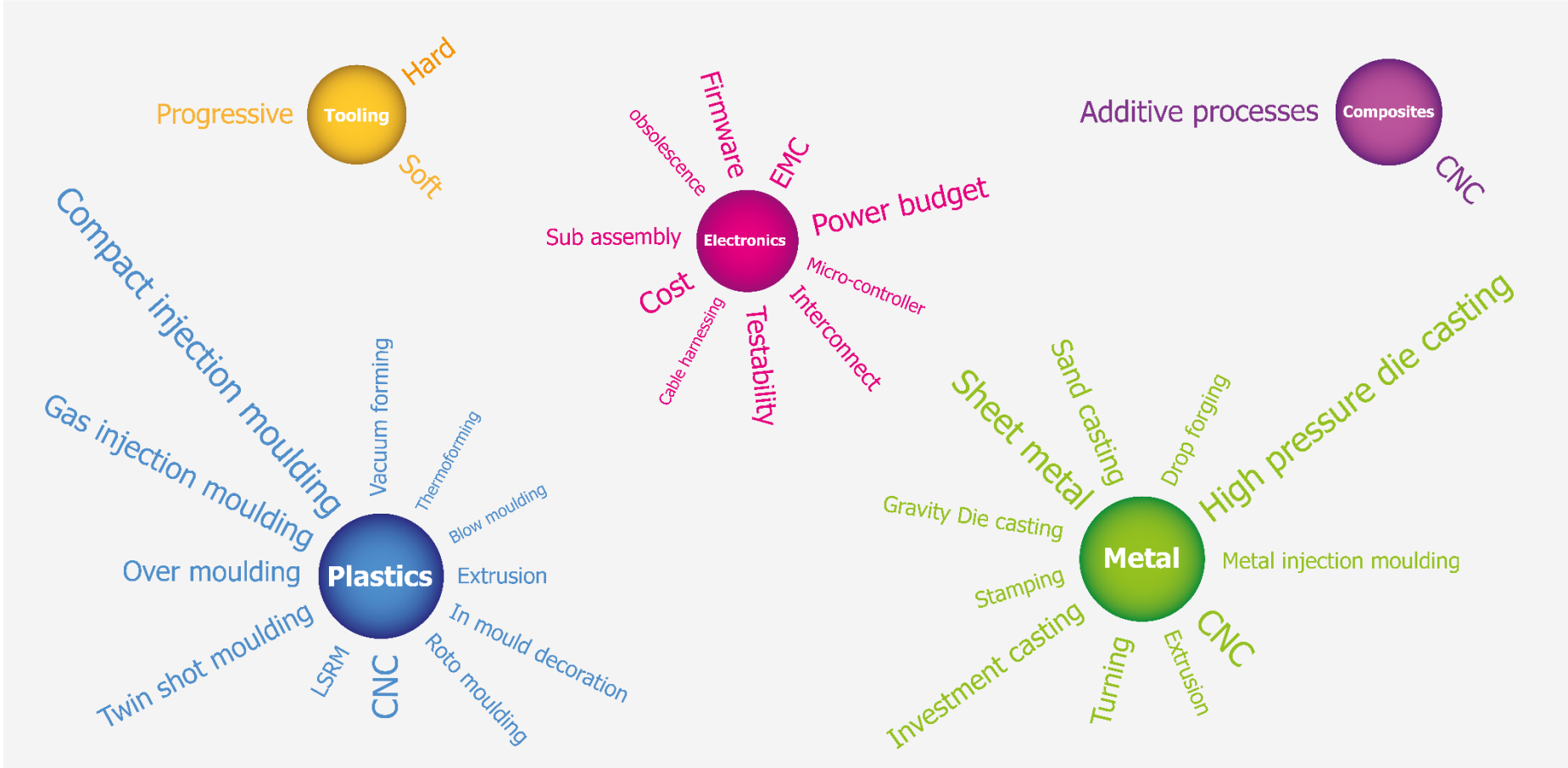


It is crucial to be honest with yourself as to the true cost of development and budget accordingly or you risk “**zombifying**” your project. If quotes are being sought from external development partners, make sure they have provided an all inclusive budget.

This is where you have spent all your funds on reaching the engineering phase but your initial investment can't cover the cost of tooling, let alone the first minimum order quantity production batch.



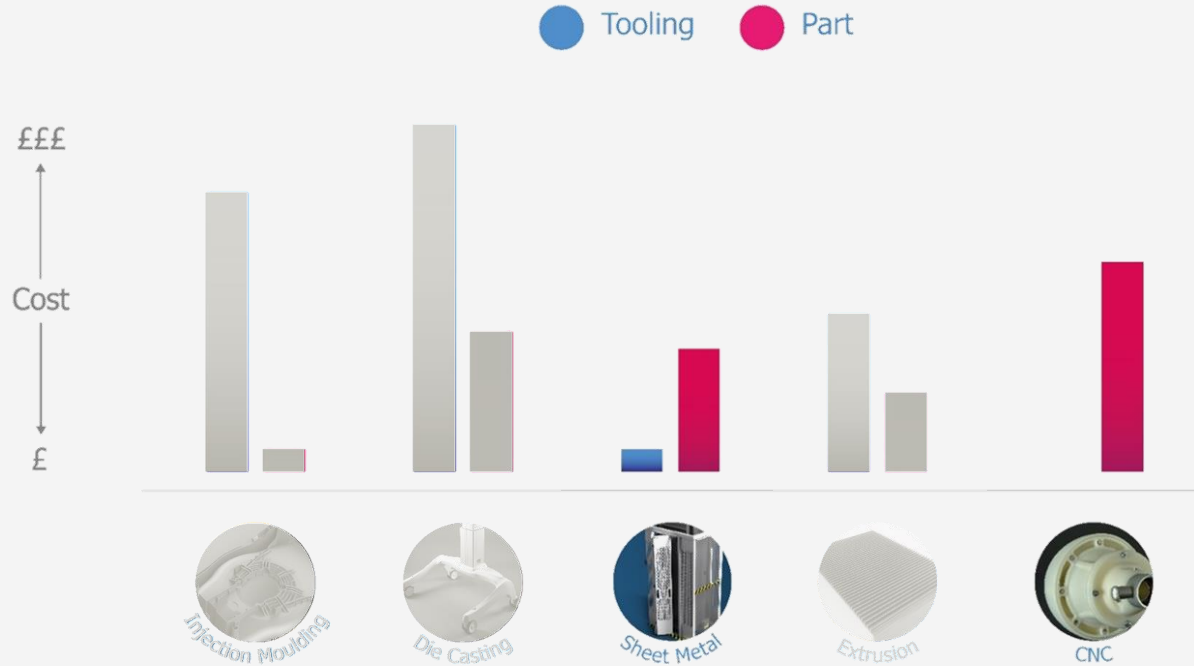
- One of the most important pieces of information a designer can be fed is the target cost for the product (manufactured, assembled and shipped).
- A target allows for practical concepts to be generated around:
 - part count
 - materials
 - processes
 - off-the-shelf vs custom routes.
 - etc.
- Your target unit cost can be worked out roughly by taking what you intend to be the retail price and deducting distribution costs and your desired margin.



It's not uncommon to use several different fabrication processes to produce the parts for one product.

This means to achieve your marketing and technical requirements you should consider the various tooling options/budgets associated with these processes and plan accordingly.

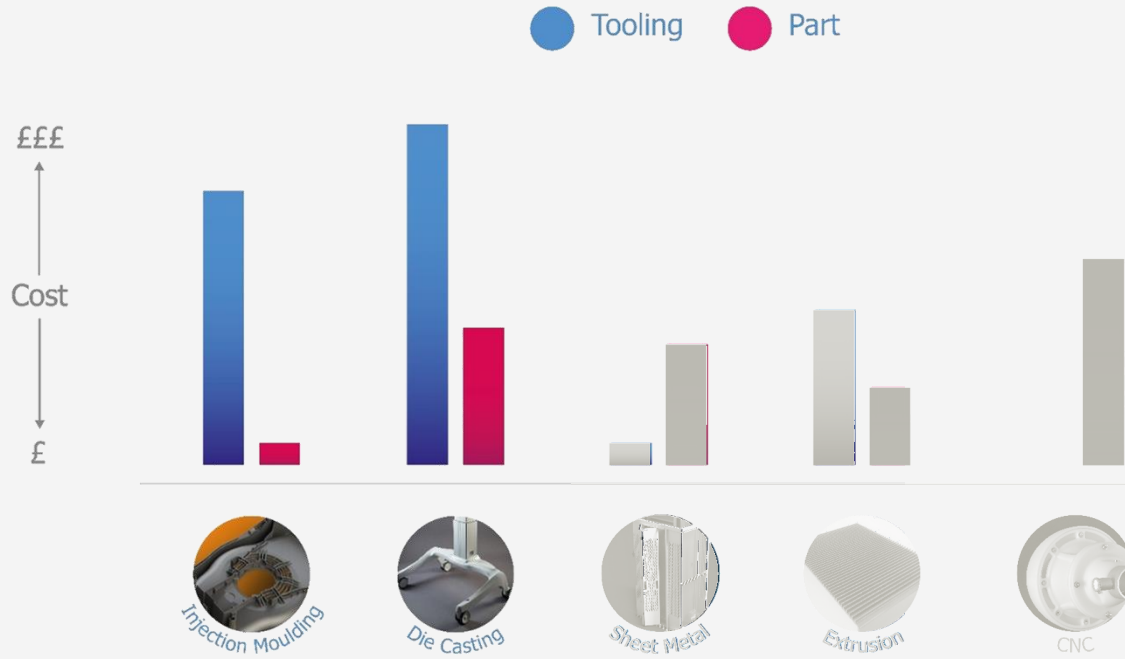
At i4pd we have created a platform for estimating the tooling and unit cost so we can give our customers an early indication of tooling and unit costs for their NRE budget. Throughout the project we refine this estimate as the design evolves and as we have more detailed discussions with contract manufacturers.



It may be that there is no budget available for tooling and all the funds must be diverted into the design and engineering of an Earliest Sellable Product.

This could be a combination of Sheet Metal which needs very little tooling investment and additive or subtractive manufacturing which needs none at all.

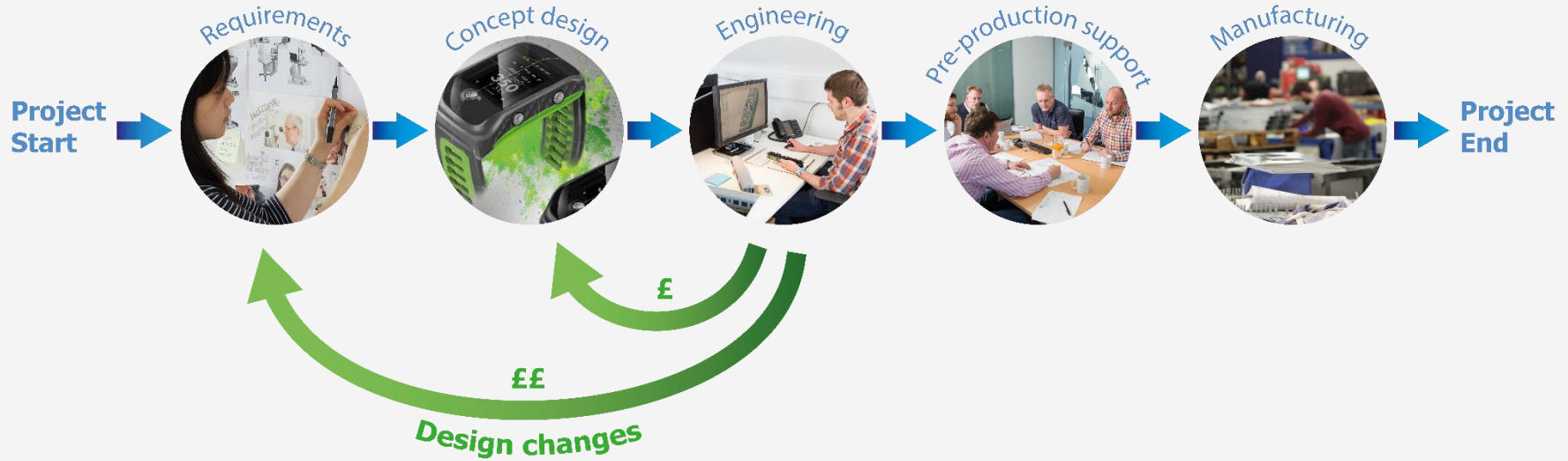
The trade off is that the unit cost for this will be far higher as a result of selecting these slower, low volume manufacturing processes. However, this could be a viable option as a means to an end where you need to prove the concept to investors before progressing to a design that can earn make a decent margin for you.



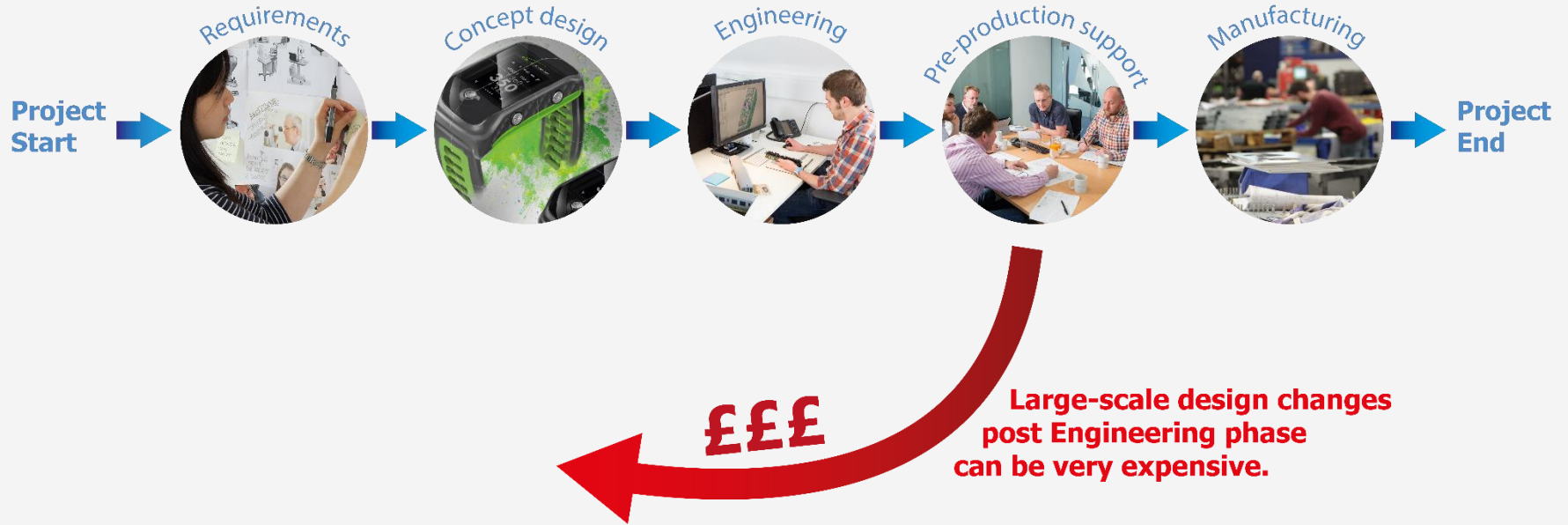
High volume processes (i.e. Low thousands to millions of units) like injection moulding and die casting will attract tooling costs but can ultimately result in parts that are a fraction of the cost.

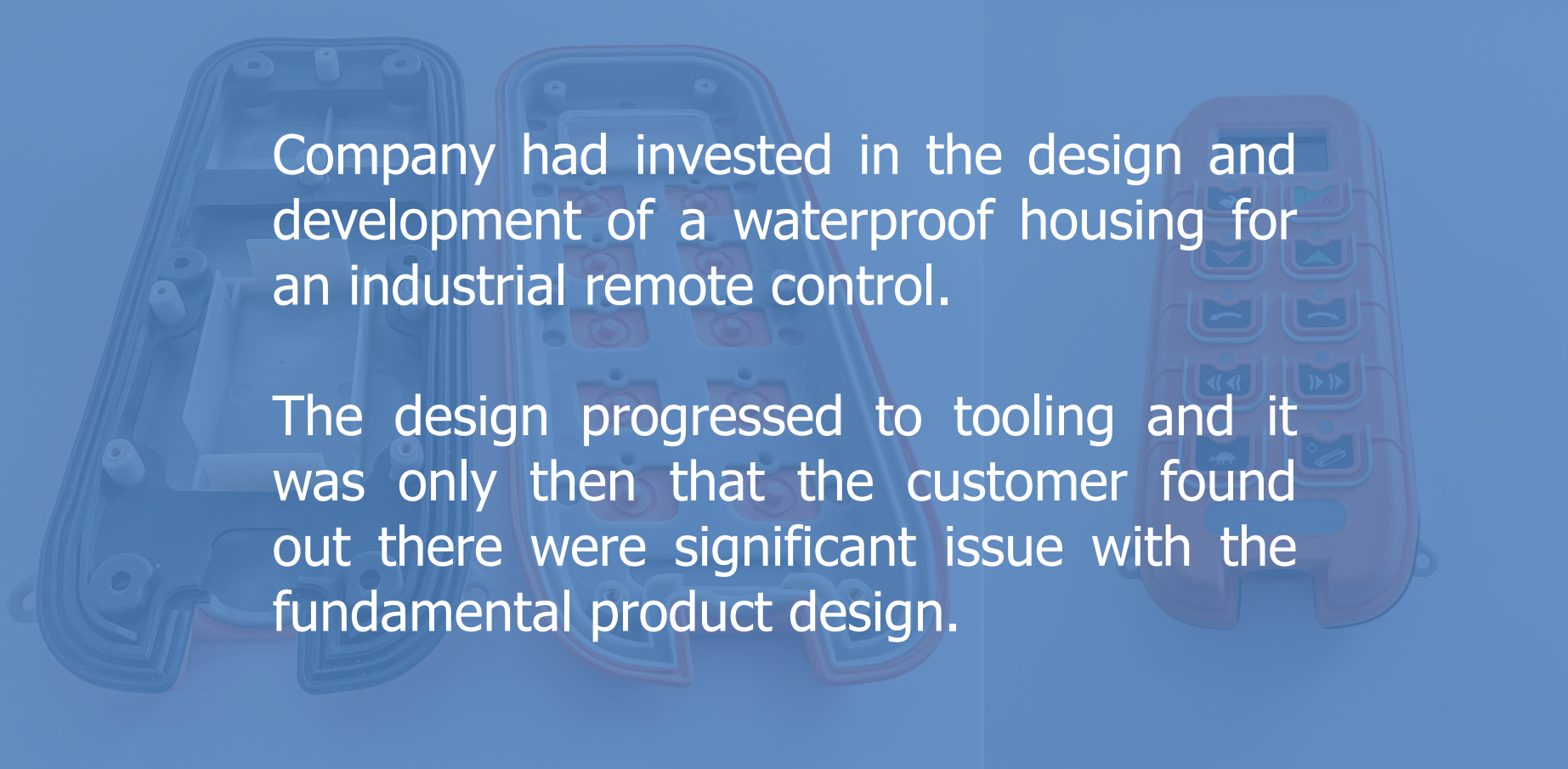
It's important to note that even before the steel is cut for tools you could have to pay a 40-50% deposit (10s of thousands of £s).

Also, if you are having the tools made in the Far East then specify whether you expect them to design the tools for export as additional costs may apply depending on their set-up.



- There is also a factor of contingency which should be worked into the budget to incorporate design changes based on the results of verification testing or late changes to the marketing requirements which create new and conflicting technical requirements.
- These changes can be normal and accounted for in the initial design budget.





Company had invested in the design and development of a waterproof housing for an industrial remote control.

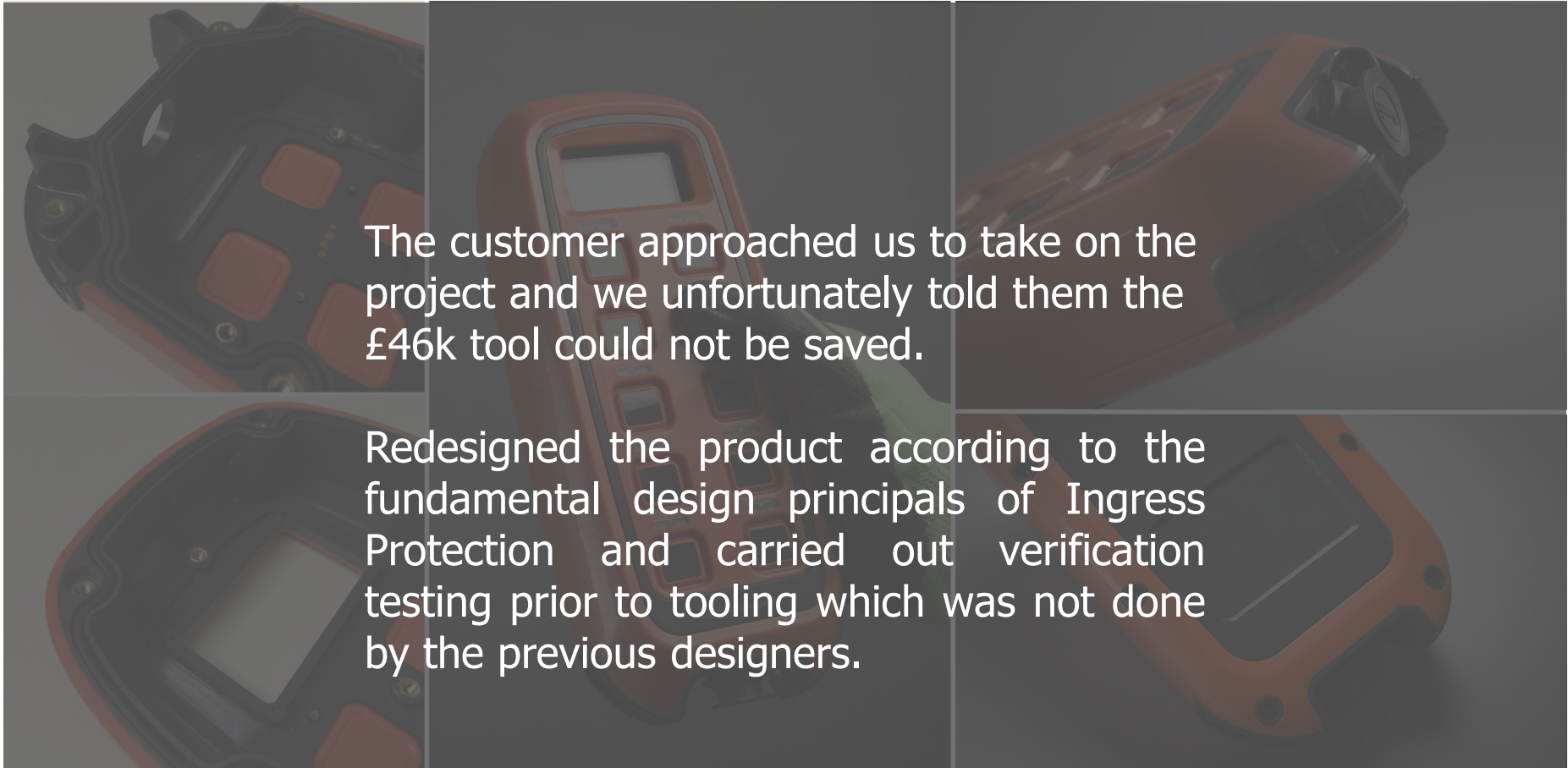
The design progressed to tooling and it was only then that the customer found out there were significant issues with the fundamental product design.



The fastening of the two halves of the electronics enclosure was placed inside of the seal so the device leaked when Ingress Protection tested.



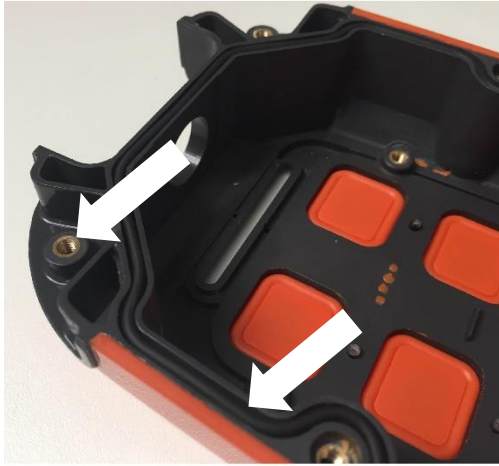
There were also fragile parts extending beyond the soft overmoulding which snapped under the drop test.



The customer approached us to take on the project and we unfortunately told them the £46k tool could not be saved.

Redesigned the product according to the fundamental design principals of Ingress Protection and carried out verification testing prior to tooling which was not done by the previous designers.

What is the development budget and target unit cost?





- Make sure the team (in-house or external) have the experience to undertake not just the conceptualising of the vision but the detailed engineering and introduction to production.
- If you are working with a design partner or manufacturer to complete the design, make sure that you are getting a quote that covers you right from the start and through to gold standard production samples.

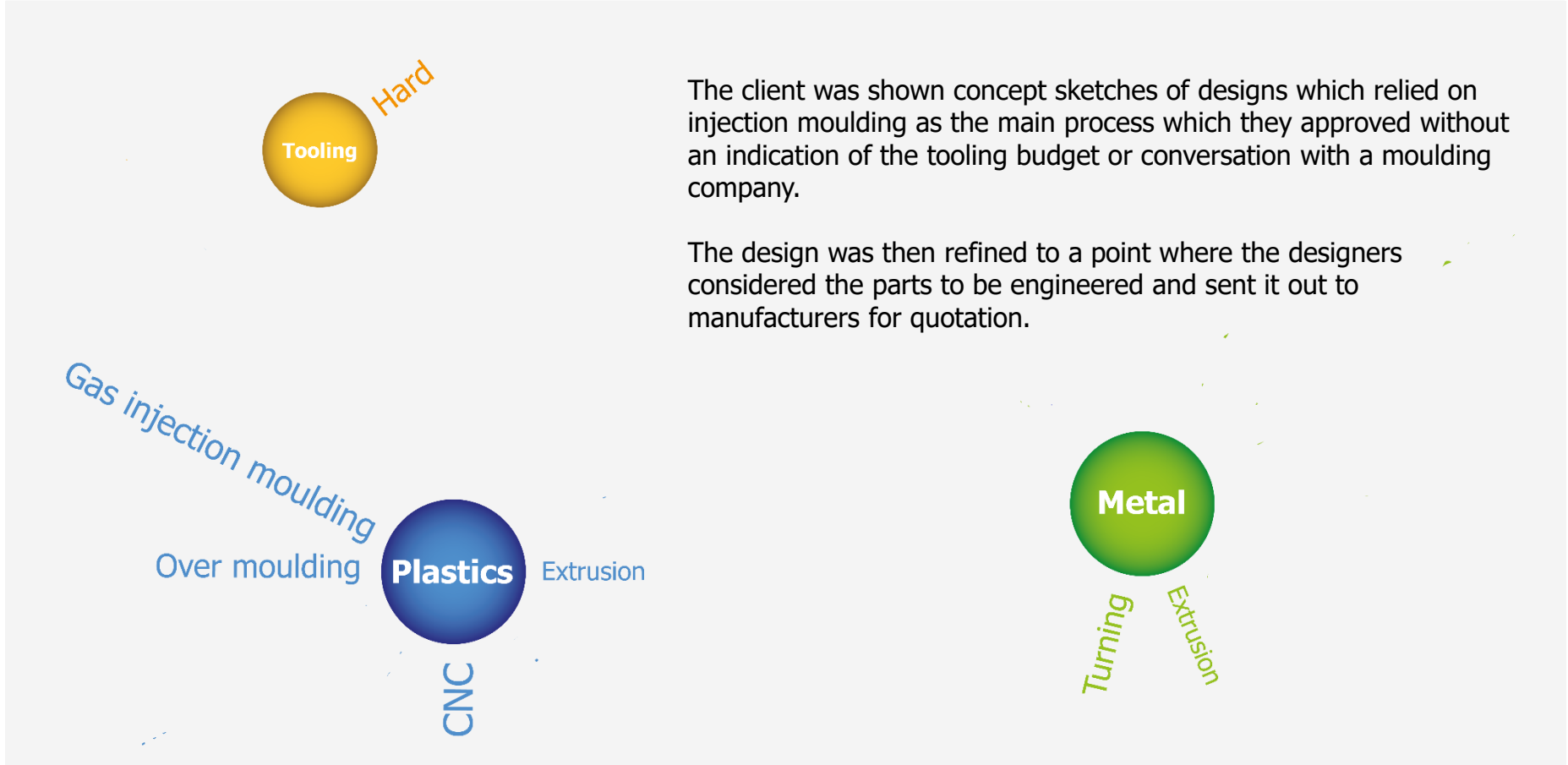


i4pd encountered a company whose designers had been given the brief to a design firm to create series of assisted living aids that had superior aesthetics to the current products in the market.

The company had raised £100k for feasibility, concept design and prototyping of 4 different products.

The customer was inspired by Joseph Joseph kitchen products so their designers utilised plastic and silicone as the primary materials to produce the desired geometry, superior finish to feel to the product.

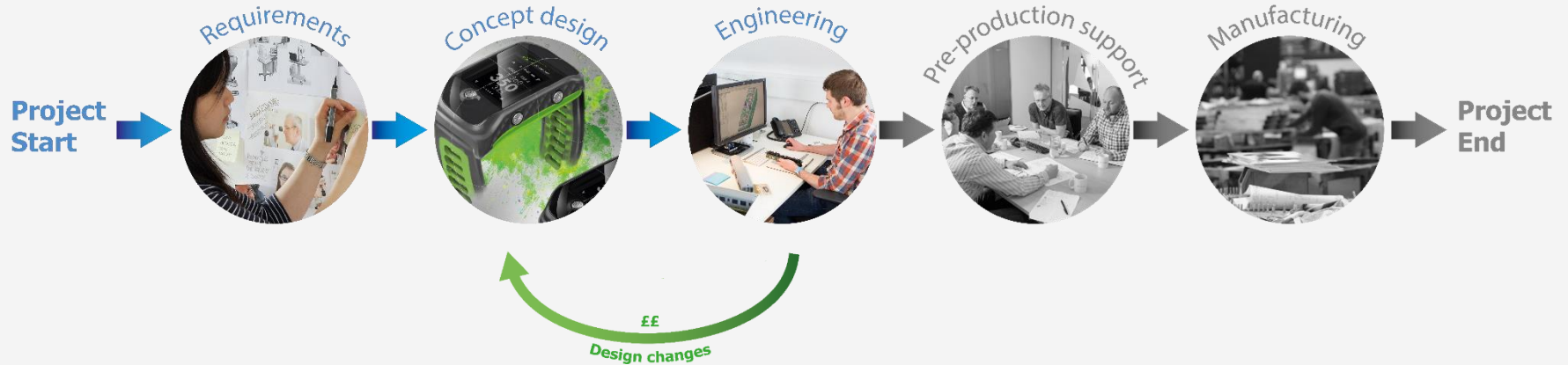




The client was shown concept sketches of designs which relied on injection moulding as the main process which they approved without an indication of the tooling budget or conversation with a moulding company.

The design was then refined to a point where the designers considered the parts to be engineered and sent it out to manufacturers for quotation.

- i4pd was approached by the client when it was clear that **no manufacturer was able to quote** on producing the product as the designs were not in a state where they could be manufactured.
- On reviewing the designs, almost all of the parts had not been designed according to the rules of the intended process such as:
 - not applying draft angle
 - insufficient features for overmoulding
 - radius not sufficient to reduce sharp edges
 - not using uniform wall thickness
 - not using ribs to reduce flexing
 - visible split lines
 - thick sections which will result in sink marks and relied on expensive moving cores.
- It would have appeared that the designer had no experience of how an injection moulding tool is constructed and therefore no insight into how to design a part for this process.

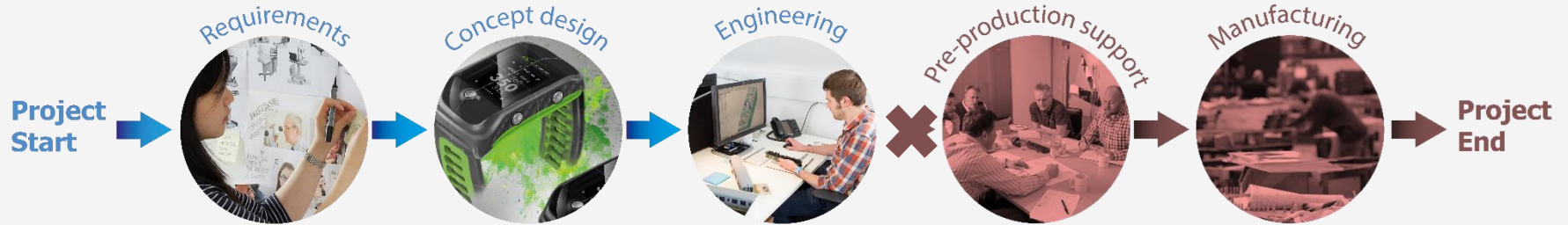


This was not necessarily a show stopper as the parts could be technically redesigned but...

- A large, critical component required gas injection moulding.
- Tooling budget exceeded their expectations (which were never discussed) and what could be raised.



Gas injection moulding machine



Cost of:

Unexpected redesign + Tooling (never discussed) exceed expectations. = Stalled / Dead project



- It's not a contract manufacturer's responsibility to realise a concept by engineering the parts, produce assembly drawings etc.

i4pd's Client's Vision:
To develop the world's first head mounted
wearable device for weightloss.

1. We worked with the client to produce the marketing requirements which included their desires for the look and feel of the product and target Bill of Materials Cost.
2. We agreed an approach to tooling which was a rapid prototype tooling route to seed the market through their crowd funding campaign.
3. A contract electronics manufacturer was identified at the outset of the project by the client so we had open lines of communication early on regarding the assembly/box build of the device.

1. We undertook the industrial design, which was overseen by the mechanical engineering team.
2. We were also responsible for the electronics and this was overseen by the industrial design team to make sure the layout of the PCB would be comfortable when worn and had an intuitive user interface.
3. We prototyped the design throughout the development with higher and higher fidelity models.
4. The manufacturing data pack was reviewed with the injection moulding company and we were involved right the way through to sign off of golden samples.

Visionary? **NO**

We **steered the project away from this** by employing pragmatic creativity and undertaking a truly joined up approach to design.



Practical? **YES**

Visionary? **YES**



To deliver this.

The company went on to sell over \$2 million dollars worth in the first year of sales.

Practical? **YES**

- 1) **BUDGET** comprehensively for your design, prototyping, test, tooling and manufacturing set-up costs (with contingency!)
- 2) Build or partner with a team that has **EXPERIENCE** with the applicable manufacturing processes.
 - Don't get the 'B Team'. Ask to see physical examples of designs by the actual team on the project.
 - Seek external advice early for unfamiliar processes.
- 3) Keep your supply chain as simple and be clear on **RESPONSIBILITIES**.
 - Have open and frank discussions before engaging.



Thank you!

For more information please contact

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