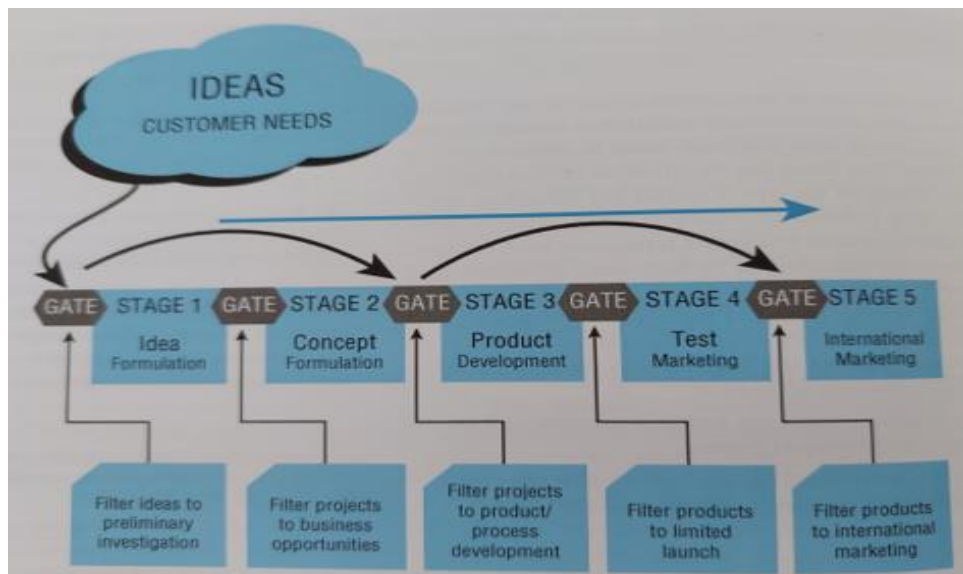


New Product Development Brief – Assessment B

Synopsis

To develop a product which meets both clinical and personal requirements to detect in real time if someone has been infected with the virus. Production volumes starting at 750k units rising to 3M units per annum.

The business is at now at stage three of the innovation process – product development. The concept detailed in the first line of the synopsis has been through stage 1 Idea Formulation and stage 3 Concept Formulation and we now look to embark on stage 3 of this process as detailed in the following figure.



Cooper R.G., (2011) Winning at New products fourth edition taken from Tidd J., Bessant J. managing Innovation seventh edition page 352

One of the key challenges facing the organisation of new product and process development is that most organisations have not been designed to do this but are structured for a different purpose usually to serve some operational need. (Tidd J., Bessant J (2021) *Managing Innovation (seventh edition) page 350*). The product design specification (PDS) will if followed ensure that all parts of the organisation will have their input through every step of the process. Whilst the preliminary PDS has been drafted in detail it is only through leveraging the skills and knowledge of every individual and following the systematic process afforded by the PDS that the development of the unit will be completed on time, within budget and meet our customers' demands.

The product design specification (PDS) is dynamic rather than static. The starting point for any design activity is market research from which a comprehensive PDS must be prepared. To be successful you have to be systematic and thorough paying meticulous attention to detail from beginning to the end of the design activity. At the end of the design activity, the design must be

in balance with the PDS even though the PDS will have changed on the way through (*Pugh S. (1991) Total design Page 44 & 45*).

As per Pugh The PDS which follows this synopsis is a living document and must be embraced by the team leader and the team involved in the product development. Whilst the new opportunity is exciting and could significantly add to the product range, reputation and size of the organisation if we get it right it could prove damaging to the organisation on all three counts if not executed effectively. At the end of the process the product delivered should match the PDS. That does not mean that the PDS below has to be slavishly followed what it does mean is that it will change and evolve as more and more detail is known about our customers feedback the process the PDS takes us through but at each stage of evolution the changes will have to be considered and if necessary to deliver the best product amended in a controlled manner.

No aspect of the PDS should be ignored or deemed to be insignificant only by having the rigour to follow the process diligently from Aesthetics through to Weight will we have the confidence in delivering the right product at the right price to our customers around the world.

Product Design Specification

Aesthetics – how pleasing it is to particularly to look at. It gives us pleasure and satisfies our senses. To this end consideration should be given to the following for both the customer making the purchase and person being assessed in a medical environment: -

- Colour
- Shape
- Pattern, if any
- Monitor display, colours, brightness, and clarity
- Branding
- Balance
- Sensory constraints

It is being used to sample for a virus consider how calming all the above are.

Link to: - Branding

Branding – is a series of choices made to communicate the brand to the customer base. Effective branding will, build trust, increase brand recognition & value, attract new customers, and retain existing ones.

When reviewing the branding there are many aspects to assess: -

Logo – shows customers who we are

Typography – impacts how people see the brand

Colours – each colour elicits a different psychological impact, for example blue is a calm and cold colour which has a calming effect.

Layout – how it all comes together when these various aspects are combined

Link to: - Aesthetics, Packaging, Shipping,

References: - Kramer L. (2021) The 8 types of Branding (and how to use them). Available at <https://99designs.com/blog/logo-branding/types-of-branding/> (Accessed 24th June 2023)

Company Constraints – things within the organisation inhibit the development of the detector: -
access to funding etc. to design prototype, market and deliver to our customers.

internal personnel resource constraints – numbers/skills

elements within the organisation who function as blockers to the development

production, stocking limits do we have enough space and equipment within the space, can
production lines be readily adapted/changed

commercial limitations, does this product complement the existing portfolio or do we need to
penetrate a different market segment

Procurement of all materials used to produce the product is our supply chain robust enough to
take on this product is looking to service.

Link to: - Competition, manufacturing facilities

Competition – who provides equipment in this segment.

Does anyone else have this product on the market or something similar

Who manufactures and what type of products are available able to determine if an individual
has a virus and what can we use to differentiate the product

For suppliers of viral detection systems who are their customers.

How does the competitions system stack up in terms of cost, speed of analysis, accuracy of test
results and what weight do potential customers place on each of these

Link to: - Customer, quality, reliability

Customer – Research consumer demand and market segments that may use the product.

Identify how many of our existing customers could use the product, e.g., instead of
breathalysers could law enforcement use this to identify persons not complying with lockdown.

Consider what other applications this technology could be adapted to in the future

If international are their barriers to market imposed by government

Social trends may play a factor these need to be considered

Procurement teams, will they inhibit supplies, understand how to manage these as opposed to the end user

Link to: - Competition, ergonomics, performance, quality, reliability

Circular economy – how does the product fit in.

How much of the materials can be made from recycled products effectively focusing on upcycling materials.

Can individual components from other products be recycled and repurposed for use in the testing unit

Is it possible for kits be made available to enable customers to effect simple repair/replacement of components ideally with the opportunity to return the failed unit for in house repair

Link to: - materials, maintenance & repair, quality reliability and life in service

Documentation – instructions for use and maintenance requirements, easy to follow linked to branding. Troubleshooting guide for self-diagnosis and repair.

Laminated card if potential that multiple users of one product.

Warranty information.

What languages should all information be supplied in consideration for the use of icons etc. to make information easier to understand internationally

Is document issued in braille or other formats

Link to: - branding, installation, maintenance and repair, packaging, safety, social & cultural

Environment - where will the product be used, i.e., outdoors / indoors or both

If potential for outdoor use, is it waterproof, does the display work well in sunlight is it illuminated at night.

Temperature ranges the device will operate lower threshold upper threshold

How and where should it be stored to ensure it does not fail prematurely

If designed to withstand a drop is the unit protected from falls to carpet or does it need to survive a fall onto concrete

Link to: - materials, performance, product life span

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Ergonomics – to optimise the safety, comfort, and performance of the test unit. It uses anthropometrical data to find out the best size, shape, and form making it easier to use.

The start of the process would be to identify how people using the equipment and being tested vary in mobility, senses, mental ability, experience, training, and culture

Areas to consider are but not restricted to: -

Physical - Repetitive movement, Manual handling, workplace layout

Psychological - Mental workload, decision making, interaction with the testing unit, stress

Organisational – Communication, staff design, quality management

Link to: - materials, performance, quality, reliability, social & cultural, weight

References: - Invest Northern Ireland (2023) User-centred design, The importance of ergonomics. Available at <https://www.nibusinessinfo.co.uk/content/importance-ergonomics> (Accessed 24th June 2023)

Installation – handheld and portable the installation at a customer's site will have to primarily focus on: - storage, charging / battery replacement and any other equipment required for the person being tested to deliver an optimal sample.

Intellectual property – a specially trained individual must be included early in the design process to identify: -

Is there any other unit in production, design or under patent which uses the technology and design of the unit we are currently designing.

Protection during development, and early marketing to ensure that any individuals / companies we engage with during the design and development period are managed to protect our rights and intellectual property.

Ensure all novel aspects of the unit are patented and the intellectual property protected to the right level covering necessary geographies and to the correct level of detail to prevent third parties impinging of our IP

Link to: - legal, politics

Legal – Other than that identified under the Intellectual property banner it is important that legal opinion is sought from the outset particularly but not restricted to: -

regulatory requirements, if the testing unit is to be sold across a large geographical area into multiple markets consideration will have to be made into how it links with different legal frameworks.

product liability risks: - If misused is there a potential for physical harm, consequences of failure i.e., battery fire. Incorrect test results either due to a faulty machine, inappropriate training, or sub-standard instructions.

Supply and payment – terms of business

Link to: - Intellectual property, politics, standards, and specifications

References: - Cohen J.L. (2023)_Integrated New Product Development: What's Law Got to Do with It? The Role of Legal Counsel in New Product Development. Available at Integrated New Product Development: What's Law Got to Do with It? The Role of Legal Counsel in New Product Development (Accessed 24th June 2023)

Life in Service – the period from point of sale until the unit is discarded. The following factors can affect it: -

- Quality of manufacture
- Materials used
- How often used
- Operating condition / environment
- Care taken while stored, transported, and used
- Built in obsolescence
- Repairs and maintenance

At the design phase the design life should be identified and once that is done the factors detailed above have to be assessed to ensure they each are capable of returning the life in service required.

Link to: - Environment, materials, maintenance and repair, packaging, quality

References: - Design Buildings, the construction Wiki (2021) Service life of products. Available at https://www.designingbuildings.co.uk/wiki/Service_life_of_products (Accessed 24th June 2023)

Materials – understanding their characteristics enables the best material for the test unit. Overcomes the limits and constraints in a design where materials and transformation technologies should be seen as variables of the design process. The materials selected enrich the perceptive and sensorial experience undergone of the customer.

When selecting materials for the test unit think about -

- Touch and feel
- Durability
- Ability to protect from damage
- Water ingress

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- Weight
- Finish and look
- Compatibility
- Availability
- Recycling potential

Link to: - Aesthetics, environment, branding, life in service, maintenance and repair, performance, product cost, quality, reliability, safety, weight

References: - Del Curto B. (2009) The importance of materials and technologies in design. Available at

<https://library.iated.org/view/DELCURTO2009THE#:~:text=The%20knowledge%20of%20materials%20characteristics,variables%20of%20the%20creation%20process.> (Accessed 24th June 2023)

Manufacturing Facilities – The requirement to meet planned production rates, the manufacturing facility will need to: -

- Offer protection for the elements and facilities for the employees
- Storage and packing space – to suit the test unit
- Availability of a workforce in the area
- Transport and shipping links for both raw materials for shipping to customers
- Tax and other incentives to construct the unit
- Operational costs e.g., electricity
- Organisation of the manufacturing unit to optimise production – ideally on one floor

Link to: - Environment, politics, processes, shipping

Market Constraints – to understand these there needs to be a comprehensive review of the overall market is the customer base: -

Regional, National, or International

What will impact on the market in different areas – money for purchasing units, recession, funding etc.

Political issues limiting opportunity

Are there any social or cultural norms which prevent use of the unit

Price Alignment with the Market, ensure the product manufacture can be achieved within the price the market will bear. In other words, the amount of money spent on making the product must be enough to deliver what is being developed and delivered to customers.

Link to: - Customer, politics, product cost, social & cultural

References: - Bourgeois P (2017) The challenger of product design. Available at <https://studioried.com/the-challenges-of-product-design/> (Accessed 24th June 2023)

Maintenance & Repair – small electronic devices are typically designed to be disposed of on failure. customers want goods to be as environmentally friendly as possible. A key to achieve this is designing the test unit to be repaired and maintained. This will ensure that the unit is safe to use, can be calibrated to a specific standard and runs efficiently.

- Software elements should be capable of update.
- Ability to repair / maintained the unit is a benefit for the customer.
- Any maintenance should be cheaper than replacing the product.
- Limit material usage limiting damage to the environment.
- The unit will require annual calibration / servicing, to ensure the tests remain accurate. This offers an additional revenue stream.
- Being repairable and maintainable, is a cheaper whole life option for the customer.

Link to: - branding, environment, life in service, materials, product life span,

References: - Ryan V. (2017) Why maintenance and repairability should be built into the products we buy. Available at <https://technologystudent.com/prddes1/repair1.html> (Accessed 24th June 2023)

Packaging – must link to the brand so think about: - Colours, Visuals, Typography and Format, which help relate to the brand.

Good packaging design tells a story. Engaging customers through sight, touch, and sound. Helps consumer to understand what the test unit is, how it should be used

What protection must packaging offer to the test unit during shipping to prevent damage.

Costs should be considered on two basis, one-time costs include, the original design work, print setup. Per-item costs include materials and labour. Each box will cost a certain amount,

How easy is it to place the unit in the packaging and prepare for shipping

Is the packaging reusable/recyclable?

How bulky is the packaging, what is the shape, and weight these must be considered when determining the most cost-effective way of shipping the units

How much space is required for storage assembly and packaging of the unit

Are material required for packaging readily available and ideally sourced locally

Link to: - Aesthetics, branding, materials, product cost, shipping, weight

References: - Morr K (2016) The ultimate guide to product packaging design. Available at <https://99designs.com/blog/tips/ultimate-guide-to-product-packaging-design/> (Accessed 24th June 2023)

Performance – there are two key issues.

The product: -

Is it reliable, and robust

Do the materials stand up to daily wear and tear

Are the test results accurate and repeatable

The New Product Development process performance: -

Is the test unit prototype delivered within initial timescales

How many prototypes were needed, the more robust the NPD process the fewer iterations needed to deliver the final prototype, measure twice cut once

Do all members of the design team contribute effectively to the process.

Are metrics regularly reviewed to ensure the design process is on track in terms of time, cost, and manhours.

Link to: - product cost and life span, quality

Politics – this can have a significant impact on both the design including research & development, the manufacture and sale of the test unit.

Before the new product design process begins ask: -

Is the area the design is being conducted in stable and attractive to the team involved in the process. Are there universities/design centres which can offer technical and laboratory support

Does the area chosen offer financial incentives for design, can the costs be recouped

Once established what incentives are available from the government to manufacture and produce the test unit

Cost of operating in the area

Is the operating base in a country / area that has good trading links and benefits from established free trade tariffs etc.

Can politicians be used to market promote the product i.e., as part of a mandated / recommended testing scheme

Are the legal institutions robust ensuring that IP, ISO standards etc. are recognised.

Regulation, is the area relaxed or is there substantial red tape etc. resulting in an uncompetitive cost base i.e., Environmental regulation, labour costs, taxation regime

Link to: - Environment, social & cultural

Processes – Select one of the following methodologies to create the framework with which to complete the NPD for the testing unit

Based on lean principles, Kanban is a workflow management method that emphasises the continual delivery of value., It focuses on visualising work to increase collaboration, limiting the amount of work in process, and continuously improving flow to reduce lead time

Scaled Agile Framework, implements agile and lean principles at scale. It keeps teams aligned with customer needs and the greater vision of the business, promoting regular planning and scheduled integration points so large numbers of agile teams can deliver in together and on time.

Scrum, an agile methodology. Delivers work in sprints. At the start of each sprint, a sprint goal is set, the scope of work agreed. Once the sprint is finished the team presents the completed work for review. Using this it is possible to integrate change throughout the project lifecycle while enabling teams to deliver.

Waterfall delivers projects in phases. Best used in projects where requirements can be clearly defined in advance with little change. Best used in manufacturing and construction where products develop in a linear way. Delivers a fixed scope of work at the end of the project.

Link to: - Manufacturing facilities, time scale

References: - Aha Labs (2023) Common product development methodologies. Available at <https://www.aha.io/roadmapping/guide/product-development-methodologies> (Accessed 24th June 2023)

Prototyping - used to help visualise a product before it goes into production. Helping to determine if the test unit is feasible and if customers want to purchase.it. A prototype is a rough effort at the final test unit.

It gives you an opportunity to test the following: -

What does it feel like to use and touch

- Can it be easily used
- Is the unit robust
- Is it effective – can it test for virus's
- What could fail

Additionally: -

- Deliver on your idea and provide value for potential customers
- Function as planned deliver test results in a manner suitable to customers
- Used to try again and again ensuring before manufacture bugs are removed.
- Obtain information and ideas to prepare for manufacture

Link to: - Aesthetics, customer, life in service, materials, performance, quality, reliability, safety, size, testing, weight

References: - Aha Labs (2023) Common product development methodologies. Available at <https://www.aha.io/roadmapping/guide/product-development-methodologies> (Accessed 24th June 2023)

Product Cost – it is essential that the true cost is known to ensure a commercially viable offering.

The product cost must include details of: -

Development process

Manufacture of the test unit

Packaging of the product, instruction information, warranty etc. and associated branding

Shipping to the customer

Whole life cost including maintenance and repair – for this you will need to understand the units design life.

Materials costs, determine which ones' offer the correct balance between cost and performance

Link to: - life in service, maintenance and repair, packaging, quality, reliability, shipping, testing

Product Life Span – the time between when it is sold until it is discarded. It is vital that the development process understands the optimum life of the test unit providing profit for the organisation and value to the customer factors to consider when determining the life span include: -

- Quality of materials used in manufacture – robust in routine use but also how it withstands abnormal events e.g. drops, exposure to water etc.
- Opportunity to upgrade software used to complete the test and download the information to an operating system
- Repair and maintenance – schedule service and calibration
- Availability of spare/replacement parts

Link to: - life in service, materials, maintenance and repair, product cost

Quality – will have a key impact on the success and ultimately profitability of the testing instrument. By using a diverse cross-functional team product quality will be optimised. This combined with ensuring the companies customers views, opinions are considered and how focused on quality the organisation is will determine ultimate product quality.

Using processes such as house of quality which brings the customers voice to the fore. This can be based on the sales teams' experience with customers or surveys. Potentially use statistical techniques which allow customers to state their preferences with respect to existing and this new product.

There also needs to be a balance between quality and cost, the reputation of the business should not be compromised in producing the testing unit, but costs of development and manufacture must be balanced

Link to: - competition, materials, product life span

References: - Hauser J.R and Clausing D. (1988) The house of quality. Available at <https://hbr.org/1988/05/the-house-of-quality> (Accessed 24th June 2023)

Reliability – given the use of the product this has to be front and centre of the design considerations. If the unit is not reliable both in terms of operation but also the test results delivered relative to the type of virus and viral load. It should provide a predictable consistent user experience.

Product reliability will be driven by decisions made during the design process. Building-in product reliability is costly involving significant expenditure during the design, development and production. Not having excellent reliability is expensive as failures result increased warranty costs but also reduces revenue due to the negative reviews from customers.

Deciding on how much to invest in building a reliable test unit requires the right approach including the views on life cycle and use of mathematical models

In essence it is important that the technical impact of building-in reliability and the commercial consequences of unreliability must be carefully considered.

Link to: - Customer, Life in service, materials, maintenance and repair, processed, product life span

References: - Murthy D.N.P, Rausand M, Viryanen S. (2009) Investment in new product reliability. Available at <https://www.sciencedirect.com/science/article/abs/pii/S0951832009000775> (Accessed 24th June 2023)

Safety – The company is responsible for the safety of the goods supplied. The testing unit must pose either no risk or a minimum acceptable level of risk, considering normal or reasonably foreseeable use of the product. All aspects including, how it is presented, the effect on other products it could be used with, and the risk to consumers who use it.

All legislation dealing with safety applicable to the test unit must be reviewed, one of either British, European or other international can be followed and referenced to show it is safe. Remember to consider the instructions and warnings ensuring it is used safely.

A 'conformity assessment procedure', will have to be followed including manufacturing to standards and assessment by an independent third party.

Once sold the test processes must be in place if a fault is found such as product recall.

Link to: - documentation, legal, quality, reliability, standards and specifications

References: - Department of Business and Trade (2023) Product Safety. Available at <https://www.businesscompanion.info/en/quick-guides/product-safety> (Accessed 24th June 2023)

Size – is important when considering usability by the consumer, how heavy should it be, can it be used with one hand, how easy are the controls and functions accessed when testing someone. The outputs of the results if on screen should be clear and legible. It may be possible to construct a smaller unit however usability and feedback from consumers should be key in determining this.

Installation of the unit will have to consider the size.

Storage of finished stock and warehousing must be included, included in this is potential for automated stock handling where size and shape will influence efficacy of the process.

Size will be together with weight and packaging the key determinant of the distribution costs which if supplying globally in single units or bulk could impact on the value proposition to our customers.

Link to: - customer, installation. Packaging, storage, shipping, weight

Shelf Life & Storage –storage is an important consideration for warehousing, optimising storage can be broken down into: -

- Inventory Levels, what needs to be held in stock to minimise inventory whilst maximising customer service.
- Storability, how easy is it to store the test unit in its box and the processes for placing it into storage and subsequently picking it for delivery to customers
- Speed Units move in and out of storage, this can be measured to ensure units are manufactured in time to meet demand. Fast moving units stored close to loading and stocking areas less popular products further away optimising this process.

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For storage itself, is the warehouse large enough, is the racking or storage spaces adequate, is the environment suitable for storing the units – cool dry area designed to ensure electrical components etc. do not deteriorate.

Link to: - manufacturing facilities, packaging, quantity, size, shipping, weight

References: - Warehousing etc. (2023) Efficiently use warehouse space for the storage of goods. Available at <https://warehousingetc.com/considerations-for-the-storage-of-goods/> (Accessed 24th June 2023)

Shipping – In developing a shipping strategy, packaging in particular will have a significant impact on shipping which together with weight will determine pricing.

Other issues to consider: -

- Where is the warehouse, where are our customers
- Size and weight of unit / how many can you store on a pallet and in one standard container
- How many do we expect our customers to buy
- Cost of shipping, do we use one shipping company or different one's dependant on units and destination.
- What do we have to consider for exports in terms of documentation again can we partner with a shipping agent who can deal with taxes, insurance customs etc.
- Also ask what our customers' expectations are in terms of packaging, cost, speed, ease

Links to: - branding, manufacturing facilities, packaging, quantity, size, weight

References: - Ugino M. (2023) The Quick Guide to Product Shipping: Everything You Need to Know. Available at <https://www.sellbrite.com/blog/quick-guide-product-shipping-everything-need-know/> (Accessed 24th June 2023)

Social & Cultural – our test unit should look to gain broad international appeal. Ideally through marketing considerations we will begin assessing the social and cultural impacts on our specific market segments. Key issues to consider are our customers: -

- Lifestyles values
- buying habits
- education social classes
- religion sexuality
- demographics attitudes.

Link to: - legal, materials, politics, product cost,

Standards and Specifications – the test unit will have to have a technical specification recognised by a standardisation organisation e.g., an ISO, EN, BS etc. Following on from this it must have undergone a conformity assessment to ensure the requirements relating to a product, process, service, system, person or body have been fulfilled.

Conformity assessment procedures may be based on standards but, where no standards exist, they may rely on the content of recommendations of the European Commission, best practices, and current knowledge or technical information.

Ultimately, we will have to consider issues such as: -

- quality performance levels
- environmental protection, health & safety
- name of the unit terminology used in branding and documents
- symbols used in documents testing and testing methods
- packaging marketing.

Link to: - branding, documentation, intellectual property, legal, packaging, politics, testing

References: - Gobierno de Espana (2023) Product standards, technical specifications and certification Directorate-General of Public Governance. Available at https://administracion.gob.es/pag_Home/en/Tu-espacio-europeo/derechos-obligaciones/empresas/productos/normas-especificaciones/info-general.html (Accessed 24th June 2023)

Testing – this is the final stage of the design process. It ensures that unit meets our customers' requirements whilst simultaneously confirms that the product functions effectively from a technical perspective and works as needed. The key benefits of testing the unit gives us a better understanding of user requirements and makes sure the unit meets them. In addition, we can find problems before the production run begins.

The four steps of the testing process are: -

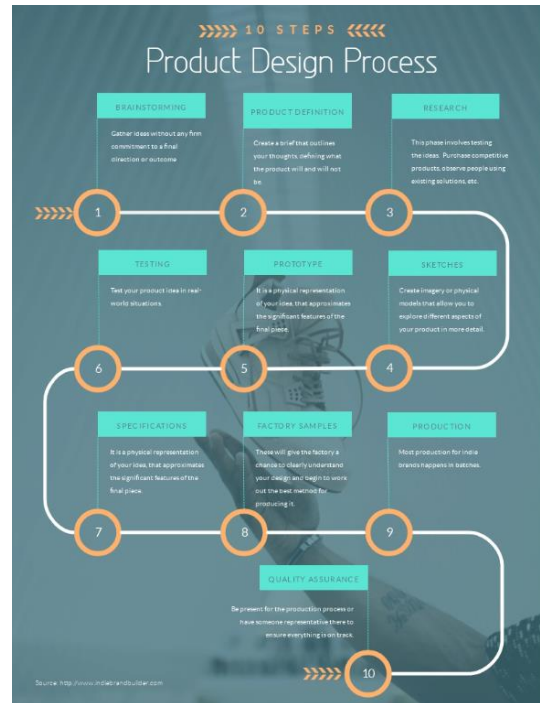
- identify problems which need solving prior to production
- selecting the right testing protocols and methods.
- The right people are chosen to lead the process.
- Use the testing process to make the product better, identifying improvements until none can be found. Use of Beta testing, and customer surveys should be considered.
-

Link to: - customer, ergonomics, materials, performance, quality, reliability, safety

References: - Product Management (2023) Product design testing process and methods for delivering better products. Available at <https://userpilot.com/blog/product-design-testing-process/> (Accessed 24th June 2023)

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Time Scale – when should the test unit be available to our customers needs to be one of the questions which is answered at the beginning of the project. This answer will determine the resources and provide the team with a clear time frame to complete the 10 steps of the product design process detailed in the following figure.



Link to: - company constraints, competition, customer, materials, prototyping

References: - Visme (2023) Product Design Process 10 steps. Available at <https://www.visme.co/templates/infographics/product-design-process-timeline--infographic-template-1425279633/> (Accessed 24th June 2023)

Weight – from a customer's perspective this is important from a safety perspective (manual handling) and for the user of the unit the handling and operation ergonomics will be determined by the weight.

The size and geometry play a part in the weight and should be considered at design stage to meet the users' requirements. Once this is determined materials can be compared weight and availability vs cost of materials and ultimately price to the user.

The shipping of the units will also be affected by weight therefore this must be weighed against weight for user and cost of materials to determine the optimum weight.

By assessing the issues detailed above the optimum weight can be determined.

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Link to: - customer, materials, quality, packaging, size, shipping,

References: - Luedeke, Tobias, Vielhaber, Michael (2013) Consideration of weight properties during the design of weight-optimised mechatronic products. Available at <https://www.designsociety.org/publication/35006/Consideration+of+weight+properties+during+the+design+of+weight-optimized+mechatronic+products> (Accessed 24th June 2023)

Word Count

4,970	Total
481	References
4,489	Body text