

Management of New Product Development – Level 7

Mark Gibbons (student no. 2126988) – 22nd September 2023

Assignment B – Developing the Design Brief

Synopsis

The company has identified an opportunity to develop our range of chemical alcohol detector system to detect other organic materials including those generated in the breath as a result of virus infections, in particular COVID-19.

We have already gained certification from the medical device regulatory agencies to produce a new virus breathalyser detector.

It is expected that will produce 750,000 units in year 1 increasing to 3,000,000 units per annum afterwards. Production of these units could be in either the UK/Europe or the far east (China/Malaysia), the electronics will need to be contained on a single circuit board.

The Problem: We need to completely design a new product which is capable of achieving reliable and instantaneous results for the testing for viruses in human breath and must be able to bring it successfully to the market place.

To do this we need to produce a product design specification (PDS) from working through the design brief, this is where your help, advice, knowledge, opinion and honesty are critical to the success of the project. There are 36 elements within the design brief, some of these elements are related or influence each other, when looking at the elements you have been assigned could you also look at the “Influence of Elements Matrix” in Appendix I to look at those other elements that are influenced by your element or which influence your element.

	Aesthetics	Branding	Company constraints	Competition	Customer	Circular economy	Documentation	Environment	Ergonomics	Installation	Intellectual property	Legal	Life in Service	Materials	Manufacturing facilities	Market constraints	Maintenance & repair	Packaging	Performance	Politics	Processes	Prototyping	Product cost	Product life span	Quality	Quantity	Reliability	Safety	Size	Shelf life & storage	Shipping	Social & cultural	Standards & specifications	Testing	Time scales	Weight
Aesthetics	✓	✓			✓	✓			✓				✓	✓					✓	✓					✓			✓		✓						✓
Branding	✓		✓		✓	✓						✓			✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	✓					✓			
Company constraints	✓		✓		✓	✓									✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓							✓	
Competition		✓	✓		✓						✓	✓				✓				✓												✓				
Customer	✓	✓	✓		✓				✓	✓			✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓					✓			✓
Circular economy	✓	✓	✓		✓	✓							✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓				✓				
Documentation		✓	✓				✓				✓	✓					✓			✓		✓	✓					✓					✓	✓		
Environment								✓		✓			✓	✓				✓					✓							✓						✓
Ergonomics	✓				✓			✓	✓				✓	✓					✓				✓													✓
Installation					✓			✓		✓			✓	✓									✓													✓
Intellectual property			✓			✓					✓		✓				✓						✓													

Design Brief

Aesthetics

Do we want this product to be attractive and sustainable thereby ensuring the user doesn't want to discard it as soon as a new or different model is developed by a competitor? Can it give joy and meaning to the person engaging with the product or do we need it to be simply functional? Does it need to have a different colour to distinguish it from other testing instruments that look the same? such as the alcohol breathalyser already in the product portfolio?

Consider:

- Colour, traditional or current trend? Distinguish the product?
- Touch, easy to tell which function does what? Partially sighted friendly?
- Materials, smooth, metals or plastic
- Branding, where on product?
- Display, easy to see, bright
- Physical shape, slender, discreet or bold

Branding

What is our "Mission statement"? how will be different from the rest and who do we want to target? Does we want to change our logo for this product to make it appear different from our traditional "Law Enforcement" products or do we want the product to be associated with that strong brand?

Consider:

- Buyer persona, ideal customer, who are they and what do they want?
- "Go to" market strategy, Circular economy, reliability?
- Brand familiarity, attitude formation, know what "they're getting"
- Logo, New or "tried and tested"
- Advertising tools, social media, journals, web sites.
- Colour combinations and font type, "devil is in the detail"
- Quality images, how do we best "show off" our product?

Company constraints

There are three major governing project factors which will affect and constrain the development of this product, these are Cost, Scope and Time. How do we ensure that none of these factors become a constraint?

Consider:

- Functional Teams, people from different areas must be part of the same team to eliminate all possible "cross department" activities, how do we do this?

- Materials and hardware, access?
- Decision making and structure, can decisions be made quickly?
- Capacity of bottlenecks, dependency on certain people can become a bottleneck as they become overloaded, how can we make sure this doesn't happen?
- Is everyone on the "same page" and working towards the same goal?
- Personalities, understanding the individual make-up of the available team, colour energies, Belbin teamworking preferences – do we need to fill all of the roles?

Competition

Do we know if there are any other companies or institutions making a COVID breathalyser that is available on the market or in testing? If yes how does it work compared to our product? Can we get hold of these products?

Consider:

- What type of products similar to our product do they produce? Can we get one?
- Single use or multi-use?
- Instantaneous result (Rapid) or does the customer need to wait for a period of time longer than our product to obtain a result? How much time?
- Produced in UK or outside? Quality of product? Legislative constraints of exporting/importing the product
- Production facilities and capabilities of production
- Market, different or similar to our target market?
- Customers, will they identify with this product compared to our product

Customers

Have we determined who our Customers are? Law Enforcement, Education, Entertainment, Business and Industry? Or in fact all of these segments!

Consider:

- Research, market segments, do they need our product? Do they want our product?
- Customer Personas
- Will our customers find our product simple and easy to use? Have we tested it with them? What was the feedback? Did we listen (voice of the customer)?
- Do we aim our product at GOV.UK first?  gov.uk <https://gov.uk> Similar to Lateral flow tests? If adopted would this make increasing our customer base easier? How would we do it?
- International customers, what legislation will we need to adhere to? Competitive market?
- Reputation, how do we build on.. how do we use to our advantage..
- Should we provide a "product as a service" to the market segments and take control of the life of the product? How could we do this..

Circular Economy

How do we design our product to be able to be completely recyclable and re-use the materials to make our product again? Do we understand where are raw materials come from? What do they do to ensure they are part of the circular economy?

Consider:

- What materials are used in the production of our product, are they primary raw materials? Do they need to be, or can they be recycled materials? Circular supply chain
- How do we design our product to have longevity or be returned to us to be fully recycled and reused in production of a new product? Does this have value for the customer..
- How many component parts will need to be replaced over the life of the product batteries, analyser component, touch buttons? Should we offer a “rebuild option” to our customers or a simple “overhaul” kit.. Reduce waste for large multiple use?
- Robustness of the product, not a “throw-a-way” product
- Be able to prove....
- How do we eliminate “waste” in the production process (six sigma) to improve circular Economy? A more efficient operation will use less energy & resources....



Documentation

What should we provide to the people who purchase our product? What do we need to supply to the Countries we hope to export to..

Consider:

- What documentation do we need to have in place to obtain approval from the Home Office to be able to supply to Government bodies? UK specifications, British Standards
- Export documentation
- User guide, how many languages?
- Suitability for partially sighted
- Text style and readability
- Maintenance & care instructions

Environment

Do we expect our product to be used in multiple types of environments?

Consider:

- Outdoors, rain, sunlight..
- Indoors, effect of lighting, easy to see in the dark?
- Robust, will the product be able to withstand rough handling? Think about the use of production materials..
- Temperatures, can it work in more extreme temperatures? Hot/Cold, can it be operated when the operator is wearing gloves for example?

Ergonomics

We need to think about how our product design will mean that we make sure the product made fits the people who will be using it in the most effective way.

Consider:

- Customer Characteristics, how mobile are they, training of how to use the product, culture and ability
- Physical area the product will be used in, layout and size of customers workspace? What will the customers posture be like when using the product? Repetition, manual handling..
- Psychological influences, stress levels, workload..
- Trial different designs?

Installation

Will our production need to be installed at our customers sites? It is a handheld device but what happens with it when it is not in use?

Consider:

- Storage, wall mounted holding bracket, weight of product?
- Person, carrying belt/holster

Intellectual Property

This is a crucial part of our product design, it basically encompasses Design rights and Patents. “Design rights” protect the visual appearance of the product whereas “Patents” protect the functional aspects of our product.

Consider:

- Patents, how the product works, what it does, how is it made and what is it made of?
- Trademarks,
- Design, visual appearance of our product
- Copyright, what are we trying to protect? Do we need outside experts?
- Trade secrets, confidentiality secrets, do we need a non-disclosure agreement (NDA)?

Legal

Has any of our competitors or in fact anyone else in the world produced the same or similar product before? We need to ensure that our new product does not infringe on someone else's registered design. We also need to ensure that the product we produce is safe for our customers to use and follows the legal requirements in terms of labelling

Consider:

- Infringement of someone else's earlier rights, pre-use clearance search.
- Obtain a registered design
- Licensing
- Product Liability
- Product Safety, check "The General Product Safety Regulations 2005 (GPSR)
- Product Labelling

Life in Service

This is not only the life of our product whilst it in service and being used but may also include from the point of manufacture to the point of it no longer being serviceable and being able to be used. Would there for example be any effects on our product being placed in storage prior to being used and would this affect the serviceable life of the product? Could component parts be replaced to give our product a "second life"..

Consider:

- Materials product is made from, robust? Quality of materials?
- Conditions product is expected to be used in, wet, dry, hot, cold..
- Design the product to have a "second life"
- Replacement components, easily changeable
- Manufacturing process, do we / can we control this and therefore control quality of manufacture
- Maintenance & care, what should how customers do to help reach the designed service life of our product?

Materials

The mechanical element of our product is to be fabricated from injection moulded parts, does this process limit or prohibit the types of materials our suppliers can use? What do we want from the production process?

Consider:

- Injection moulding materials, think about temperature, pressure, biological & chemical interactions
- Weight of product
- Product finish
- Recycle the product
- Touch and feel of the product
- Colouring

- Robustness of product

Manufacturing Facilities

We expect to manufacture 750,000 units in year 1 rising to 3,000,000 in year 2 and onwards, if all component parts are being manufactured off site will we have the capability to assemble this number of additional units at our current facility?

Consider:

- Assembly facility, do we have capacity in our current operation?
- Area, could we increase the size and production..
- Power requirements and availability of electricity
- Do we have enough people, how easy would it be to recruit more staff?
- Better facilities closer to the market and distribution networks
- Could we assemble abroad, labour costs, quality..
- Does the product still want to identify as being a Welsh produced product?

Market constraints

These could hinder our ability to achieve our goal in getting our product into the market, how can we limit the impact of these factors?

Consider:

- Does our product actually meet the market needs
- Are we able to obtain all the component parts we need to assemble our product
- Will we be able to assemble enough products to take to market
- Budget, how much do we need to market the product effectively?
- Pricing, where will we “pitch” the product
- Ineffective promotion, what do we need to do to really sell our product?

Maintenance & repair

Should we fundamentally design our product to be maintained and repaired by either the customers themselves by returning back to our facility? Do the benefits of reducing the effect on the environment (mining for rare earths etc.) outweigh the revenue received from selling a brand-new product back to an existing customer?

Consider:

- Circular economy benefits
- EU policy on waste: repair & reuse perceived better than recycling...
- How easy will it be to replace component parts, can the customer do this or will the unit need to be returned (service as part of purchase price?)
- Can any software upgrade be completed remotely..
- Ensure product is designed not to “fail into disuse”

Packaging

There are three basic principles of packaging Protection (and security), containment and identification. There is a balance to be met with the above principles and the optimal overall packaging cost (transport, palleting).

Consider:

- Attractiveness
- Usability and robustness, needs to be functional
- Distinctiveness, uniqueness, different from the rest
- Market research, what do our customers need, prefer, expect?
- Brand, colours, fonts, reinforce recognition
- Sustainability, reuse or recycle
- Clarity, communicate what the product is and what it offers
- Transport, maximise transport space..

Performance

How can we / should we measure the performance of our product, it needs to be robust and accurate but how do we test this? We can also consider the performance of the NPD process in delivering the project.

Consider:

- Performance matrix, effectiveness vs efficiency
- Accuracy of the product, has been achieved and is it repeatable?
- Does the product do what we wanted it to do?
- Trials, was the product reliable and robust, was it easy to use...
- Have we or are we going to change any aspect of the product?

Politics

There are two principal drivers that affect politics within the design process, the effect of internal politics within our company and the effect of external politicians and policy makers, one of these “effects” we should be able to control the other one we can only influence.

Consider:

- Does our design team structure allow for the transfer of information efficiently to allow decisions to be made quickly? How does this happen
- Bias, does anyone more element of the “elements matrix” have any more bias on the direction of the product design process and is this ok if it does?
- Are there policies produced by Government that can help the production of our product, financial, incentives, “design thinking” approach (Observatory of public sector innovation)
- Do foreign policies prohibit export of our product? Can our politicians help in this scenario?
- If we decide to manufacture abroad is the Government stable/willing

- Do we expect any new legislation which will affect the product design, positive or negative
- Statutory bodies, specify our product for their use, for example UK Home Office

Processes

There are a number of different design processes available with most following an 8 point systematic approach to building a new product, these being, Idea generation, Idea screening, Concept development and testing, Marketing strategy development, Business analysis, Product development, Test marketing and Commercialisation.

If we consider the above approach is a standard approach maybe we should also try a different approach.

TRIZ

TRIZ (Theory of Inventive Problem Solving) is problem-solving philosophy based on logic, data and research rather than on intuition, someone, somewhere has already solved the problem (or similar), this could really help if we become “stuck” in our design process.

Consider:

- Define our specific problem
- Find the TRIZ generalised problem that matches it
- Find the generalised solution that solves the generalised problem
- Adapt the generalised solution to solve our specific problem

Prototyping

This is our first change to turn all of our designs into a physical product, it is an essential part of the design process and allows us to test and validate the product before it goes into production.

Consider:

- How did our product feel and look
- Did it work? How easy was it to use
- Was it robust enough to withstand the testing process
- Did we use the right materials in its fabrication
- What was the quality like
- What do people outside of the team think about it
- How easy was it to change parts
- Concept design testing

Product cost

It is essential to understand the “true” cost of the fabrication of our product including where we have “waste” within our entire process. Think about every point that the product “touches” within the production/fabrication process, we should calculate the cost of these individual fabrication costs for each of these points. Only by understanding the “true” cost can we then

establish a reasonable and sustainable selling price for our product. It will also allow us to see where we have the potential to reduce “waste” and look for opportunities to look for efficiencies, this we could call this “Production for Profit” or “P4P”.

Consider:

- Fabrication/manufacture “touch” points
- Realistic costs for above
- Unnecessary “waste”, what is it, how can we reduce/eliminate it?
- Materials
- Assembly
- Packaging
- Distribution
- Marketing
- Reliability, how much time & cost do we invest?

Product lifespan

This is essentially the designed point from when our product is first used to the time when it is discarded (should we also consider if the amount of time our product is kept in storage prior to being used for the first time?)

Consider:

- Does the lifespan represent “good value for money” to the customer
- How often to we want to sell a “repeat” product
- Maintenance and repair, “second life”
- Social benefits – circular economy
- Lifespan of materials used
- Ability to upgrade software

Quality

How do we ensure that the quality of our product we produced is the same as we intended? Did we listen to the “voice of the customer” when designing our product to produce the product they wanted?

Consider:

- Quality control at each point of manufacture
- Prototype testing, success or failure?
- Performance, accuracy, repeatable..
- Design life of product, did it last as long as designed?

Quantity

What was our reasoning for needing to produce 750,000 units in year1 and 3,000,000 in year2 and beyond? Can we produce and distribute this many units and are there enough customers who will want to buy them?

Consider:

- Market intelligence
- Competitors, what are they producing
- Production & distribution
- Customers

Reliability

This is fundamentally the cornerstone of our products success in the market, if it cannot be relied upon to produce both consistent & reliable results or in fact reliably work then this will ultimately result in the failure of the product. Without this our ability to be able to supply Statutory bodies with our product would be at least extremely compromised or in fact impossible.

How do we demonstrate “reliability” of our product? Should we use a “Verification and Validation” model?

Consider:

- Prototyping success or failure, design changes
- Further testing..
- Customer feedback
- Commercial impact
- Company reputation
- Technical report, external verification & validation

Safety

The operational safety of our product is not only a legal obligation under various legislation and acts but is foremost a moral obligation, it is our duty as a supplier to provide our customers with a product which is safe to use.

How do we demonstrate compliance with relevant product safety regulations?

Consider:

- Conformity assessment, should cover: product design, manufacturing process controls, technical documentation & product testing
- Appropriate product markings (UK: UKCA marking, Europe CE marking)
- Packaging and Instruction
- Monitoring product use, sampling & testing
- Process of recording product issues/complaints, reporting of safety issues

Size

We are producing a handheld device for testing breath samples for COVID, what aspects should we be considering in terms of what size our product is? We need to ensure that displays are readable and operational functions (buttons..) are usable whilst considering that our customers will be repeatably using this product.

Consider:

- Prototyping, what did our customers think?

- Materials, heavy/light/expensive!
- New technology, electrical components
- Manual handling & repetitive use
- Storage, on-site, prior to delivery to customers
- Transport costs, number of units per vehicle?
- Production speed, smaller products quicker?

Shelf life and Storage

Is the shelf life of our product an important or critical factor? Do we expect to keep a quantity of our product in storage for long periods of time prior to supplying to our customers or are we producing at “just in time”? if the answer is yes then there are several factors which will or could affect the shelf life and storage of our product.

Consider:

- Packaging, is it sealed completely (moisture, electrical components), can it be penetrated by sunlight, sturdy/robust?
- Moisture, damp storage conditions
- Sunlight (plastic component)
- Battery life
- Stacked, individually, in boxes, on racking..
- Storage, temperature, inside/outside, easily accessible, stock rotation
- Inventory, how many units do we need to store to be able to satisfy our customer's needs?
- Location, close to our customers, close to export facilities, cost of storage

Shipping

Shipping costs can sometimes “make or break” the viability of selling a product, how do we ensure that we achieve the most competitive distribution rates whilst still serving the supply needs of our customers?

Consider:

- Mode of distribution, road, rail, sea, air
- Carrying capacity (weight) or volume (m3) of the transport container, lorry load, shipping container, air container
- What are the size and weight of the boxes we'll be loading, can they be easily carried by a person or do they need to be moved on a pallet?
- Manual handling vs pallet truck
- Distance from storage facility to customers
- What are the ground conditions like at our customers locations for unloading?
- Transport / export documentation

Social & Cultural

Although our product is to be used for a medical reason (instant testing for COVID-19) we do live in a consumer driven society, the desire to own the latest product (fashionable) has become part of our culture. If our product becomes a “fashionable” item because it’s the “fastest” product to give a covid result should we in fact take advantage of this?

That said, we live in a diverse culture and we should think about what is important to all cultures, could our design (colours, shape) and what the product is made of (materials) cause offense? Or do we use these cultural differences in our design? Rainbow coloured product for the LGBTQ social event, or a red, green and white product for use at a Welsh Rugby international event?

Consider:

- Product may not be functional
- Shape, colours of product
- Customer demographics
- Social values
- Circular economy
- Peer pressure, not just person to person but institution to institution (school to school for example)
- Purchasing habits
- Religion
- Regional differences

Standards & Specifications

Before we are able to sell our product to the marketplace we will need to demonstrate that our product meets all legislative requirements, this includes testing, inspection and certification.

How do we demonstrate compliance with relevant product standards & specifications?

Consider:

- Conformity assessment, should cover: product design, manufacturing process controls, technical documentation & product testing
- Appropriate product markings (UK: UKCA marking, Europe CE marking)
- Packaging and Instruction
- Monitoring product use, sampling & testing
- Process of recording product issues/complaints, reporting of safety issues
- Performance expected levels

Testing

We have already used “concept testing” during Prototyping to refine our design process, we now need to “Test” our product to ensure our product is safe, reliable and meets the needs of our customers.

Consider:

- Traditional testing, send our product to selected customers and obtain feedback on opinion and performance of our product
- Review and Share sites, opinions are posted
- Company Website, review on our website?
- Third Parties, provide our product for testing

Time Scale

Needs to be realistic and achievable, no point in setting a delivery date of our product which is unachievable just because a “launch” date has been suggested.

Consider:

- All individuals/teams tasked with the individual or a number of elements for producing our product should give a realistic time frame to complete that element(s)
- Production of a Gantt chart, how many elements can run at the same time? What are the “show stoppers”
- Contingency time
- Be realistic
- Follow the process

Weight

Check how the weight of the product feels, is it too heavy, how would it feel after repetitive use? Does the planned size of our product (so we can read the display etc.) have to affect the weight of the product?

Consider:

- Materials used, light weight?
- Shape and size
- Repetitive use
- Manufacturing process
- Packaging
- Storage & shipping

Appendix – 1

Influence of Elements Matrix

	Aesthetics	Branding	Company constraints	Competition	Customer	Circular economy	Documentation	Environment	Ergonomics	Installation	Intellectual property	Legal	Life in Service	Materials	Manufacturing facilities	Market constraints	Maintenance & repair	Packaging	Performance	Politics	Processes	Prototyping	Product cost	Product life span	Quality	Quantity	Reliability	Safety	Size	Shelf life & storage	Shipping	Social & cultural	Standards & specifications	Testing	Time scales	Weight	
Aesthetics		✓			✓	✓			✓				✓	✓											✓						✓						✓
Branding	✓				✓	✓	✓					✓			✓	✓			✓	✓					✓			✓	✓					✓			
Company constraints		✓			✓	✓								✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓							✓	
Competition		✓	✓		✓						✓	✓				✓				✓													✓				
Customer	✓	✓	✓	✓					✓	✓			✓	✓				✓	✓				✓	✓	✓		✓	✓	✓				✓	✓			✓
Circular economy	✓	✓	✓			✓							✓	✓				✓	✓				✓	✓	✓		✓	✓	✓					✓			
Documentation		✓	✓								✓	✓					✓			✓									✓					✓	✓		
Environment								✓					✓	✓				✓					✓								✓					✓	
Ergonomics	✓				✓				✓	✓				✓					✓					✓												✓	
Installation					✓				✓	✓				✓									✓													✓	
Intellectual property				✓			✓					✓		✓			✓						✓	✓													
Legal		✓		✓		✓														✓								✓							✓		
Life in Service	✓				✓	✓		✓						✓	✓			✓	✓				✓	✓	✓	✓	✓	✓	✓			✓	✓				
Materials	✓		✓		✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓				✓	✓		
Manufacturing facilities			✓										✓		✓	✓				✓				✓	✓	✓	✓	✓	✓	✓				✓			
Market constraints			✓	✓		✓								✓	✓	✓			✓	✓				✓												✓	
Maintenance & repair			✓		✓	✓	✓				✓		✓	✓										✓													
Packaging		✓	✓		✓			✓					✓	✓														✓	✓	✓	✓	✓					✓
Performance		✓			✓									✓													✓	✓	✓								✓
Politics				✓			✓					✓			✓	✓													✓						✓		
Processes			✓																			✓	✓	✓	✓	✓	✓	✓	✓							✓	
Prototyping			✓		✓		✓				✓	✓	✓	✓					✓			✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	
Product cost			✓		✓			✓			✓				✓	✓							✓	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
Product life span			✓		✓	✓								✓	✓		✓					✓	✓	✓	✓	✓	✓	✓	✓	✓							
Quality	✓		✓		✓								✓	✓	✓							✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			
Quantity			✓											✓	✓				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓						✓	
Reliability		✓	✓		✓								✓	✓								✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	
Safety		✓	✓		✓	✓		✓				✓	✓	✓								✓	✓	✓	✓	✓	✓	✓	✓						✓	✓	
Size	✓				✓									✓								✓	✓	✓	✓	✓	✓	✓	✓	✓							✓
Shelf life & storage								✓						✓	✓	✓							✓	✓	✓	✓	✓	✓	✓	✓							✓
Shipping	✓																						✓	✓	✓	✓	✓	✓	✓	✓							✓
Social & cultural				✓	✓	✓																	✓	✓	✓	✓	✓	✓	✓	✓							✓
Standards & specifications		✓			✓		✓					✓	✓	✓	✓				✓	✓			✓	✓	✓	✓	✓	✓	✓			✓	✓	✓			✓
Testing						✓																	✓	✓	✓	✓	✓	✓	✓						✓	✓	
Time scales			✓					✓	✓	✓					✓								✓	✓	✓	✓	✓	✓	✓								
Weight	✓				✓			✓	✓	✓				✓	✓							✓	✓	✓	✓	✓	✓	✓	✓	✓							

Total word count 5022

Text 4215

References 807

References

	Author, edition & Title	Accessed
A	Arellano, J, 2018, Handbook of research on ergonomics and product design, <i>Published by Engineering Science Reference</i> , https://librarysearch.uwtsd.ac.uk	16/09/2023
B	Batat, W, 2019, Experimental Marketing: Consumer Behaviour, Customer Experience and The 7Es, <i>Published by Routledge</i> Belbin, M, 1996, Team Roles at Work, <i>Published by Butterworth-Heinemann</i> BBC News, Gallagher, J, Sept 2020, Coronavirus testing: Simple test gives results in 90 minutes, https://www.bbc.co.uk/news/health-54190434 BBC News, Nov 2020, Covid: New breath test could detect virus in seconds, https://www.bbc.co.uk/news/uk-wales-5418848 BBC, Impact on culture – New and emerging technologies, https://www.bbc.co.uk/bitesize/guides/zn4bcj6/revision/6	22/08/2023 15/09/2023 15/09/2023 15/09/2023 21/09/2023
C		
D	Drucker, P, 1993, First edition, Innovation and Entrepreneurship <i>Published by Harper & Row, Publishers inc.</i>	18/08/2023
E		
F	Fixson, S & Tucker M, 2019, The Innovation Navigator: Transforming Your Organisation in the Era of Digital Design and Collaborative Culture, <i>Published by University of Toronto Press</i> , https://www-jstor-org.ezproxy.uwtsd.sc.uk/stable/10.3138/j.ctv2fjwxdc	14/09/2023
G	GOV.UK, Order COVID-19 rapid lateral flow tests, https://www.gov.uk/order-coronaavirus-rapid-lateral-flow-tests GOV.UK, June 2004, Breath alcohol screening devices: a guide to type-approval procedures used for law enforcement in Great Britain, https://www.gov.uk/government/publications/breath-alcohol-screening-devices-a-guide-to-type-approval-procedures# GOV.UK, Nov 2022, Guidance: National technical validation process for manufacturers of SARS-CoV-2 (COVID-19) tests, https://www.gov.uk/government/publications/assessment-and-procurement-of-coronavirus-covid-19-tests GOV.UK, Jan 2022, Guidance: IP Basics, https://www.gov.uk/government/publications/ip-basics GOV.UK, March 2019, Guidance: Product safety advice for businesses, https://www.gov.uk/guidance/product-safety-advice-for-businesses GOV.UK, March 2021, Office for Product Safety & Standards: UK Product Safety Review, https://assets.publishing.service.gov.uk GOV.UK, March 2019, Guidance: Product safety law: compliance advice for manufacturers and importers, https://www.gov.uk/guidance/product-safety-law-compliance-advice-for-manufacturers-and-importers# Galic, K, 1997, Vol.37, issue 1, Article Food Science & Nutrition, Shelf life of Packaged Bakery Goods – A Review, <i>Published by Philadelphia, PA: Taylor & Francis Group</i> , https://Librarysearch.uwtsd.ac.uk	15/09/2023 16/09/2023 16/09/2023 19/09/2023 19/09/2023 20/09/2023 20/09/2023 21/09/2023
H	Harper, k, 2018, Aesthetic Sustainability: product design and sustainable usage <i>Published by Routledge</i>	14/09/2023 19/09/2023

	Hallgrimsson, B, 2012, Prototyping and modelmaking for product design, <i>Published by Laurence King Publishing</i> , https://Librarysearch.uwtsd.ac.uk	
I		
J	Journal of product & brand management, 1992, Vol.1 <i>Published by MCB University Press</i> Journal of product & brand management, Oct 2022, Impact of brand familiarity on attitude formation: insights and generalisations from a meta-analysis, https://www.emerald.com/insight/content/doi/10.1108/JPBM-10-2020-3166/full/html Jaideep, S, (article shared by), Developing New Products: Definitions, Features, Reasons and Constraints, https://www.yourarticlelibrary.com/products/developing-new-products-definitions-features-reasons-and-constraints/48617 Jaideep, S, (article shared by), Developing New Products: Definitions, Features, Reasons and Constraints, https://www.yourarticlelibrary.com/products/developing-new-products-definitions-features-reasons-and-constraints/48617 Journal of Management Studies, 2007, Vol.44, Belbin's Team Role Model: Development, Validity and Applications for Team Building, <i>Published by Oxford, UK: Blackwell Publishing Ltd</i> , https://Librarysearch.uwtsd.ac.uk Jolly, A, 2007, The Handbook of European intellectual property management: developing, managing and protecting your company's intellectual property, <i>Published by Kogan Page</i> , https://librarysearch.uwtsd.ac.uk Journal of Cleaner Production, Jaeger-Erben, M, Dec 2020, Why do users (not) repair their devices A study of predictors of repair practices https://Librarysearch.uwtsd.ac.uk	14/09/2023 14/09/2023 14/09/2023 15/09/2023 15/09/2023 15/09/2023 19/09/2023 19/09/2023
K	Kalemkarian, G, 2006, Six Sigma for Dummies, <i>Published by Alexandria: Taylor & Francis</i> , https://librarysearch.uwtsd.ac.uk Kang, Y, 2009, The study of New Product Designing Method by Using TRIZ, https://Librarysearch.uwtsd.ac.uk	14/09/2023
L	Lewis, J, Aug 2019, Article, When design meets power: design thinking, public sector innovation and the politics of policymaking, https://bristoluniversitypressdigital.com/view/journals/pp/48/1/article-p-111.xml	19/09/2023 19/09/2023
M	ManGo Industrial Design, https://www.mangoproductdesign.com Montague, M, 2017, The Amazing Role of Aesthetics in Product Design, https://boltgroup.com/aesthetics-in-product-design Minto, B, 1991, The Pyramid Principle: Logic in Writing and Thinking, <i>Published by BCA by arrangement with Pitman Publishing Ltd</i> Materials Science and Engineering, 2019, Vol 627, Measuring effectiveness and efficiency of a new product development project using performance matrix – The PROTON case, <i>Published by Bristol: IOP Publishing</i> , https://Librarysearch.uwtsd.ac.uk Mobin, M, 2019, Vol.190, Reliability, engineering & system safety: An approach for design Verification and Validation planning and optimisation for new product reliability improvement, <i>Published by Barking: Elsevier Ltd</i> , https://Librarysearch.uwtsd.ac.uk	14/09/2023 14/09/2023 30/07/2023 19/09/2023 20/09/2023
N	Nebulum Product Design, What does ergonomics mean in product design, https://nebulum.com/fag/what-does-ergonomics-mean-in-product-design/	16/09/2023

O			
P	i ii	Piercy, N, 2009, 4th edition, Market-Led Strategic Change Transforming the Process of going to Market <i>Published by Elsevier Ltd</i> Piercy, N, 2017, 5th edition, Market-Led Strategic Change Transforming the Process of going to Market <i>Published by Elsevier Ltd</i> Pivot International, June 2018, https://www.pivotint.com/blog/legal-issues-to-consider-during-product-development	21/08/2023 21/08/2023 19/09/2023
Q			
R		Reich, Yoram, Levy & Eyal, 2004, Article: Managing product design quality under resource constraints, https://librarysearch.uwtsd.ac.uk	15/09/2023
S		Sarma, S & Singh, S, 2015, Cases on branding strategies and product development: successes and pitfalls <i>Published by Business Science Reference</i> Sinicki, A, 2019, Branding and design, <i>video file produced by Springer Nature (Firm) production company, published by Springer Nature</i> , https://video-alexanderstreet-com.ezproxy.uwtsd.ac.uk	14/09/2023 14/09/2023 14/09/2023
T		Tucker, M & Fixson, S, 2019, The Innovation Navigator: Transforming Your Organisation in the Era of Digital Design and Collaborative Culture, <i>Published by University of Toronto Press</i> , https://www-jstor-org.ezproxy.uwtsd.sc.uk/stable/10.3138/j.ctv2fjwxdc Trott, P, 2012, 5th edition, Innovation Management and New Product Development, <i>Published by Pearson Education</i> Tidd, J & Bessant, 2018, 6th edition, Tidd, J & Bessant, J, 2018, 6th edition, Managing Innovation: Integrating technological, Market and Organisational change, <i>Published by Wiley</i>	14/09/2023 11/08/2023 11/08/2023
U			
V			
W			
X		Xometry, July 2021, Design Tips for Injection moulding, https://xometry.eu/en/design-tips-for-injection-moulding	19/09/2023
Y			
Z			