Name:

International SCHOOL OF LONDON Qatar

SL

DP DESIGN TECHNOLOGY

TOPIC 5

INNOVATION AND DESIGN

NOTES & GUIDANCE BOOKLET

2020-2022

This booklet contains the Notes, and teaching support material

DP DESIGN WITH

MR MONEEB

Contents Page

Teaching & Learning Presentations

Topic 6: What is covered?

These are the topics covered in Topic 6:

CORE TOPICS		Topic Covers	Approx Lessons hours on each topic	Total Lesson Hours	Checklist (✓)	Exam Mark	Exam (%)
5	Innovation and Design	5.1. Invention	2	14			
		5.2. Innovation	2				
		5.3. Strategies for innovation	2				
		5.4. Stakeholders in invention and innovation	2				
		5.5. Product life cycle	2				
		5.6. Rogers' characteristics of innovation and consumer	2				
		5.7. Innovation, design and marketing specifications	2				

5.1 Invention

ESSENTIAL IDEA

The protection of a novel product that solves a problem is a major factor in commercial design.

NATURE OF DESIGN

Invention by lone inventors or in collaborative, creative teams is at the forefront of design. Designers must not only be creative and innovative, but also understand the concepts that will make a new product viable. A designer must use imagination and be firmly grounded in factual and procedural knowledge while remembering the needs and limitations of the end user.

AIM

Invention is the process of discovering a principle which allows a technical advance in a particular field that results in a novel/new product.

PRINCIPLES AND CONCEPTS

Drivers for invention
The lone inventor
Intellectual property (IP)
Strategies for protecting IP: patents, trademarks, design protection, copyright.
First to market
Shelved technologies

Guidance

Drivers for invention include personal motivation to express creativity/for personal interest, scientific or technical curiosity, constructive discontent, desire to make money, desire to help others
The advantages and disadvantages of being a lone inventor
Benefits of IP include differentiating a business from competitors, selling or licensing to provide revenue streams, offering customers something new and different, marketing/branding, its value as an asset
IP symbols and their application to products and services: patent pending, TM, ®, ©, SM
The effectiveness of strategies for protecting IP
Reasons why some innovators decide not to protect their IP and alternative strategies to ensure success
Reasons why some patented inventions are shelved

s / Activities

Drivers/Motivators for invention

Personal motivation to invent. It could be out of personal interest (a tinkerer) or creative expression
To assist people and make life better – like in the BBC series The Big Life Fix more info https://www.bbc.co.uk/programmes/b084ztrw (full episode https://www.youtube.com/watch?v=R586pAl9Tqs&t=1363s)
Constructive discontent
To make money
Inquisitive scientific or technical thinking
Necessity – maybe a new and novel material is developed and so a new tool is needed.

Ask yourself related to your IA: What are your drivers for inventing?
Where does this personal interest come from?

"Dyson engineers always start with a problem," says Sam Bernard, global director of the company's personal-care division. In this case, the problem was the irreparable hair damage caused by curling irons and other hot styling tools. Dyson's solution? Use its prowess in air technology to create a single tool, the $549.99 Airwrap, that dries and styles hair at once, no twisting or heating required. The Airwrap uses the powerful Dyson digital motor V9 to "vacuum" sections of hair, and low heat to create waves or curls. "Before the Airwrap, consumers just accepted that in order to create the style they wanted, they would need to damage their hair with extreme heat," Bernard says. "Since the introduction of our products, they have a choice in the matter." —Cady Lang

The Dyson Airwrap, one of Time Magazines choosen best invention 2019 based on key factors, including originality, creativity, influence, ambition and effectiveness.

Here is the full list:
https://time.com/5733385/how-we-chose-best-inventions-2019/
Activity: Find two novel products or

The lone inventor

An individual working outside or inside an organization who is committed to the invention of a novel product and often becomes isolated because he or she is engrossed with ideas that imply change and are resisted by others.

Was Tesla a lone inventor? Read the comic

https://theoatmeal.com/comics/tesla

http://www.women-inventors.com/

Advantages	Disadvantages
Full control over the development of their invention	Lack business acumen
Driven: with a goal of the complete invention of a new and somewhat revolutionary product	May not comprehend or give sufficient care to the marketing and sales of there product
Have ideas that are completely new and different	Their ideas, because of how different they are are often resisted by other employees and workers
	Are having a harder time to push forward their designs, especially in a market where large investments are required for success
	Are usually isolated, and have no backing towards their design.
	Trouble working in teams because of their emotional attraction to their invention

Intellectual Property (IP)

IP

anything referring to 'creations of the mind' used in a commercial setting eg: inventions, literature, art, design, symbols, names, images
IP rights: patents, trademarks, copyright *(see next slide)
balance between rights of inventor and market wants
IP is protected by law

Benefits

differentiating a business from competitors
allowing sale or licensing, providing an important revenue stream
offering customers something new and different
marketing/branding
establishing a valuable asset that can be used as security for loans.

https://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf

Strategies for protecting IP

Patents: *An agreement from a government office to give someone the right to make or sell a new invention for a certain number of years.*
Trademarks:*A trademark is a symbol, word, or words legally registered or established by use as representing a company or product.*
Design protection: *A simple and cost-effective way to protect an innovative shape, appearance or ornamentation.*
Copyright: *A legal right that grants the creator of an original work exclusive ownership for its use and distribution. Usually for a limited time and within geographical boundaries, copyright allows the creator to receive compensation for their intellectual effort.*
Service Mark: *A trademark used to identify a service rather than a product in the USA*

P
TM
R
C
SM

What is a Patent?

A patent is an exclusive right granted for an invention – a product or process that provides a new way of doing something, or that offers a new technical solution to a problem.

Nike Swoosh corporate **trademark** was created in 1971 by Carolyn Davidson while she was a graphic design student at Portland State University

Notes / Activities

First to market & Shelved technologies

FIRST TO MARKET

- The first product of this type to be rushed onto the market
- When a company or a person has or think they have a innovative idea or product, therefore will rush to have it on the market before anyone else.

SHELVED TECHNOLOGY

- Is technology that is shelved for various reasons.
- Sometimes shelved technologies will be rediscovered or taken off the shelf and brought to market again.

Bar codes were originally conceived by Bernard Silver and Norman Woodland in 1948. Their system relied upon light reading a set of concentric circles, but computers weren't advanced enough at the time to make their idea practical.

It was 25 years later, 1973, when IBM introduced the universal product code, which has since become the bar code standard.

https://www.businessinsider.com/first-to-market-products-that-failed-2011-5?international=true&r=US&IR=T#bar-codes-were-invented-in-1948-before-computers-were-even-advanced-enough-to-read-them-3

Reasons why some patented technologies are shelved

Cost effectiveness
The technology is available, but the cost of using it in products makes it too expensive for the consumer. eg. 3D printers for home use - although this is changing now.

3D printing at home

Flexi phone- Samsung

Social
- Market not ready for change
- Football goal line technology - the beautiful game
- Market perceives product as unsafe
- Collision avoidance in cars
- Cultural reasons
- Amish beliefs around use of technology

Goal line technology- World Cup 2014

Referees indicator

Technological
- The science and underpinning ideas have been developed, but technology is not resolved enough to introduce the product. eg. flexible phones

Timing - strategic release of products
- Products are released in a strategic order. The iPad could have been released before the iPhone, but Apple didn't want to confuse the market with new products in that order.

Collision avoidance devices

Social implications- Amish USA

Exam style questions

2017

6 .Which individual is more likely to finance the development of a product?
A. An inventor
B. A product champion
C. An entrepreneur
D. A designer

8. Which symbol represents the most suitable protection for the brand of the Denny Bike?
A. ©
B. ®
C. ™
D. SM

12.What is often not a characteristic of a lone inventor?
A. Business-like
B. Creative
C. Determined
D. Tenacious

Notes / Activities

2018

3. Explain how copyright can be used as a strategy for the protection of intellectual property. [3]

Award [1] for each of three distinct points in an explanation of how copyright can be used as a strategy for the protection of intellectual property (IP).
Do not award marks for answers referring to patents, products, logos, brands or names.
Answer in brackets is not required to award the mark

2017

10. Figure 3 shows a safety pin made of steel wire. The safety pin was invented by Walter Hunt while wondering how to pay back a fifteen-dollar debt to a friend. In 1849, Hunt patented his invention and sold it to a manufacturing company for mass production. Steel wire is manufactured from pig iron in a number of steps of treatment in order to achieve the desired properties. Safety pins may be made from steels with different percentages of carbon depending on the intended user. Hospitals would require safety pins with relatively high carbon content, whereas those purchased from stationery shops have a relatively low carbon content.

(ii) Outline why there is no longer a patent for the safety pin. [2]

Q2 Intellectual property is defined as exclusive rights to creations of the mind. Which of the following would be considered to be examples of IP rights?

A Contracts, forms & agreements
B Declaration, accords & contracts
C Certificates of ownership, company logo & products
D Copyright, trademarks, & patents

Q4 Which of the following terms best describe invention?

A Being the first to market with a new idea or concept
B Identifying new materials & processes and applying them successfully to a new idea
C An idea or thought that remains secret to the inventor
D The process of discovering a principle, a technical advance resulting in a novel product.

Q8 Not all patented inventions are placed in the market, this is called shelved technologies. Look at the example below - the flexible phone developed by Samsung in 2016.
Explain 2 possible reasons why this technology hasn't been placed in the market (4).

Notes / Activities

5.2 Innovation

ESSENTIAL IDEA

There are many different types of innovation

NATURE OF DESIGN

Designers will be successful in the marketplace when they solve long lasting problems, improve on existing solutions or find a 'Product gap'. The constant evaluation and redevelopment of products is key, with unbiased analysis of consumer and commercial opportunities.

AIM

In order for an invention to become an innovation, the idea if the product needs to be effectively communicated. The communication can take many forms and be between many stakeholders.

PRINCIPLES AND CONCEPTS

Invention and innovation
Categories of innovation: sustaining innovation, disruptive innovation, process innovation
Innovation strategies for design: architectural innovation, modular innovation, configurational innovation
Innovation strategies for markets: diffusion and suppression

Invention and innovation

Credit for invention has frequently been claimed for someone who conceived an idea, but the inventor is the person who not only had the idea but also worked out the method of putting it into practice. Leonardo Da Vinci conceived the idea of flight and created many sketches and drawings to begin to prove his concepts.
Many inventions take many hours of discovering and testing, others take form by chance, and many others in collaboration with other inventors ideas, thoughts and hunches.

The invention of the aeroplane however, through the use of this existing knowledge, was credited to the Wright brothers in the first decade of the 20th Century.

Leonardo Da Vinci- aero drawings

Wright Brothers- first flight

Definitions

Invention: *the process of discovering a principle which allows a technical advance in a particular field that results in a novel/new product.*

Innovation: *making an invention useful and successfully entering it into the marketplace.*

Reasons why a few inventions become innovations

Marketability- Low product demand or not readily saleable

Financial support- There is little monetary backing from the organisation or an outsider. The invention would need more sponsors to financially aid the product.

Marketing- Is the process of getting products from the producer or vendor to the consumer or buyer, which includes advertising, shipping, storing, and selling. Invention would need to be advertised as a product the public would want.

The need for the invention- Examples include alternative energy resources to combat our insatiable need for oil however if oil prices are low or there is a ready supply of oil then the alternative energy invention will not take hold.

Notes / Activities

Reasons why a few inventions become innovations

Price - Affordable, cost effectiveness or value for money … therefore it may be too expensive to buy, or to manufacture and the consumer may not see it worth its cost compared to its use.

Resistance to change - People and organisations can be resistant and reluctant to change, feeling comfort and security in the familiar thus resist new ideas/products.

Aversion to risk - "Risk aversion is a concept in economics, finance, and psychology related to the behaviour of consumers and investors under uncertainty".

Kick Starter uses the concept of crowd-sourcing which is the practice of funding a project or venture by raising monetary contributions from a large number of people, typically via the Internet.[1] One early-stage equity expert described it as "the practice of raising funds from two or more people over the internet towards a common Service, Project, Product,

Categories of innovation

Sustaining innovation

A new or improved product that meets the needs of consumers and **sustains manufacturers**. Innovative ideas that are constantly updated in order to maintain their success, this allows manufacturers to **sustain** sales and continue in the market. The new changes involve improvements in performance and new features.

Most breakthrough products will not last very long without a continuous process of sustaining innovation to give new life into new iterations and versions.

Companies may sustain innovation in several ways:

- Adding new functions or abilities and/or improving existing functionality
- Cost reduction: As production increases, companies can take advantage of economies of scale and pass on the savings to consumers.
- Product expansion: As the product begins to grow in the market, companies may offer different versions, sizes, or colors to meet a broader range of user's needs and tastes.

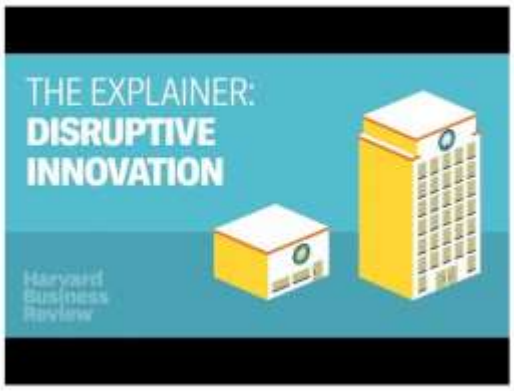
Categories of innovation

Disruptive innovation

A product or type of technology that challenges existing companies to ignore or embrace technical change. Examples include the iPod which changed the way we managed and listened to music. Mobile phones so we were no longer restricted to landlines.

Another example is video streaming platforms, like netflix

More info on https://www.forbes.com/sites/aalsin/media-disruptions-revolutions-and-the-distribution/#3cdcc90260b9



Notes / Activities

Categories of innovation

Disruptive innovation

Disruptive innovation isn't about winning a technology race, but about delivering innovations aimed at a set of customers whose needs are being ignored by industry leaders. A disruptive innovation trades off performance along one dimension for performance along another, such as simplicity, convenience, ability to customize, or price.

Dell Computers used off the shelf components.

Apple Nano - low tech/low cost music

VOD changing the way we watch video

Ride sharing services changing the way people move

3D printing changing the way we make things

Categories of innovation

Process innovation

An improvement in the organization and/or method of manufacture that often leads to reduced costs or benefits to consumers.

There are many examples of process innovation. Henry Ford developed the modern assembly line which enabled Ford Motor Company to offer affordable cars to the masses. Tesla is another automobile company that devotes lots of resources to innovating in the assembly line.

Categories of innovation

Process innovation

Another example of process innovation is IKEA - in 1950 by developing manufacturing processes based around self-packing, easy delivery and self assembly.

Flat pack furniture is the key feature of IKEA, allowing for modern, stylish and affordable furniture. The retail experience of shopping at IKEA is also a type of process innovation. Learn more about IKEA here.

IKEA's Space 10 Innovation Lab

Retail Innovation at IKEA

Innovation strategies for design

Architectural or modular innovatic

Designers may approach innovation from two different directions: Architectural or Modular. Key to understanding these two concepts is the type and degree of innovation.

Architectural innovation focuses on how the parts of a design are arranged and interact with each other.

Modular innovation focuses on changing a single part of the design, while other parts remain unchanged.

Bicycles: Introduction of the chain
Early bicycles had no chain. The pedals were directly attached to axle of the wheel--there was no chain connecting the pedal to the back wheel as in today's bicycles. Thus, the relationship of between the pedals and the wheels has changed -- this is an example of **architectural innovation**. The parts (wheel and pedals) are the same, but how they interact is different (connected by a chain).

Left: Penny-Farthing bicycle
Right: Modern mountain bike

Video created by the Erasmus university of Rotterdam
https://www.coursera.org/lecture/innovation-management/1-4-architectural-and-modular-innovations-FHCGL
Explains well the difference between architectural and modular innovations

Notes / Activities

Architectural or modular innovati

Examples of modular innovation are

- Replacing analog, rotary dialing mechanisms with a keypad
- Spring based balance scales replaced by digital devices

The essential components of a camera have not changed. Cameras require a lens to focus light and a surface to record the light. Analog cameras use film which chemically reacts when exposed to light. Digital cameras use a digital light sensor that detects light and converts it into a digital signal. The architecture of the camera is essentially the same, only one component has been changed (the sensor). You can see this in how modern high-end digital cameras (DSLRs) physically resemble the shape and form of analog SLR cameras.

Film camera

Digital camera

Innovation strategies for markets

Diffusion

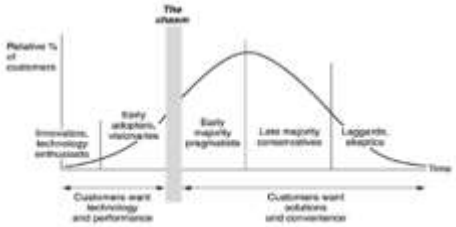
Diffusion: is a process where a market will accept a new idea or product. Examples of widely diffused products include the, light bulb, refrigerator (100%), ATM cards, Music CD's (now mp4 format). Once widely accepted they often become dominant designs.

An example of the diffusion of music players

Diffusion occurs through a five–step decision-making process. It occurs through a series of communication channels over a period of time among the members of a similar social system. Rogers five stages of diffusion are

- knowledge
- persuasion
- decision
- implementation
- confirmation

Diffusion has taken place once the product, system or service is adopted. Adoption of an innovation runs through a hierarchy of groups of potential users.



Innovation strategies for markets

Diffusion

ATM cards are good example of technology as they have become the de facto method for for accessing and using ATM machines and making purchases. Interestingly, these are now being challenged by digital payment services such as Apply Pay, Square, Google Pay and other systems, which use online, mobile, and wireless technologies to make payments.

ATM card being used for payment

Wireless payment being made on the Square platform.

Innovation strategies for markets - Suppression

Suppression: is a process where a new idea or adoption of a product by the market is actively slowed. This may be due to difficulties competing with a dominant design, ambiguity over patent ownership, competing companies actively petitioning against a new product it perceives as threatening, or the natural resistance to an unfamiliar concept.

Notes / Activities

Exam style questions

Q3 A product that is first to market, with a new technology, can also create a new market with a new category. What is a term that can be given to a product that possesses the features that are required & desired by the user?

Sony Walkman WM-2 - First to market in 1978.

A Desirable
B Innovative
C Dominant
D Creative

Q5 Which of the following best describes innovation?

A The idea must be put into action and be diffused into the marketplace
B Any innovative thought or process that results in a new product
C Creative outcome to a design problem that is solved in an innovative way
D A product with high sales volumes in it growth phase

Q6 Explain why companies such as Apple use a strategy called 'sustaining innovation'? (2)

1 mark per each reason explained - maximum 2 reasons

- *Large company with the resources to develop generations 2,3,4,5 of i-phones or i-pads*
- *Company can continue to invest in breakthroughs as the sustaining innovations keep income coming in*

Q7 Explain what is meant by the term disruptive innovation? (2).

1 mark per reason and 1 mark per explanation or example

- *Disrupt market behaviour, making existing products obsolete*
- *Delivering innovations set of the customers needs, often ignored by industry leaders*
- *I-pod is a good example of disruptive behaviour - it's a simple product to use, convenient, can be customised*

2017 exam

5. The Apple Watch, see Figure 7 below, is a product that works with a system to provide its functions. It offers new technology for a watch and is part of a new organizational chain between the watch, an iPhone and the iTunes software.

What type of innovation is best described by the Apple Watch system?

A. Configurational
B. Architectural
C. Modular
D. Technology transfer

2017 exam

Please read the case study carefully and answer the questions.

Search GPS from Rip Curl, is a GPS watch for surfing that communicates with an app* for analysing performance and sharing experiences with fellow surfers. The watch, see Figure 10 below, comes in a variety of colours and is worn during surfing. It records data such as the number of waves surfed, the surfer's location and the time in the water.

As this is the first smart sports watch developed specifically for surfers, the designers have involved members of the surfing community in the development of the product. All functions of the watch are controlled via three large buttons.

38. Rip curl claim this is the first smart watch for surfers. Which type of innovation best describes the product?

A. Sustaining innovation
B. Disruptive innovation
C. Process innovation
D. Architectural innovation

Notes / Activities

5.3 Innovation

ESSENTIAL IDEA

Designers have a range of strategies for innovation

NATURE OF DESIGN

Companies encourage advancements in technology and services, usually by investing in research and development (R&D) activities. Even though the R&D may be carried out by a range of different experts from varied fields of research, the development process is often based on common principles and strategies to identify the direction of development. This methodology structures the R&D of new technologies and services.

AIM

Innovation should always occur in context and a deep understanding of the culture as well as the behaviours, needs and wants of the consumer is required.

PRINCIPLES AND CONCEPTS

- Act of insight
- Adaptation
- Technology transfer
- Analogy
- Chance
- Technology push
- Market pull

GUIDANCE

Design contexts where each strategy has been applied

Act of insight

The eureka moment often referred or spark of genious, a sudden image of a potential solution is formed in the mind, usually after a period of thinking about a problem.

When stuck on a problem, taking a distance or letting it go can give you new ideas or insights.

An example

In more recent times, American engineer Willis Carrier is said to have hit upon the the idea of air-conditioning while watching fog move across a train station platform. He is said to have had a sudden vision of fog being used to cool buildings. Willis patented the idea and became wealthy on the proceeds of his innovation.

History of the Eureka moment when Archimedes finds his principle.

Adaption

Adaption describes how a solution in one field is used to provide a solution to a new problem in a different field.

Dyson noticed that the design of large industrial extraction units could be adapted and scaled down to the size of a portable vacuum cleaner.

Taking a technology, concept or system from one application and then applying to a new product is described as **adpation.** Adapting or changing the application is common in design and is found in a number of high profile examples.

James Dyson, inventor innovator and entrepreneur used the cyclonic technologies used as extraction units in industrial location, and transferred it by scaling them down to fit and suit his dual cyclone vacuum cleaners.

Notes / Activities

Technology transfer

Technological advances that form the basis of new designs may be applied to the development of different types of products/systems, for example, laser technology. Originally thought to have a few practical uses, was transferred to a variety of different application including surgery, welding, cutting metal, barcode readers and audio CDs.

CR rom uses laser readers

Barcode reader

The invention of the microwave came through technology transfer.

Analogy

An idea from one context is used to stimulate ideas for solving a problem in another context.

Compact fluorescent globes are an example of analogous design. Inspired by the need to reduce energy during the energy crisis of the 1980s designers transferred and modified existing technologies and processes and translated these into a different context within the same field to generate an entirely new product.

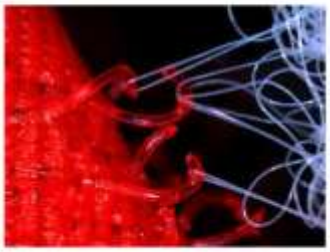
Dolphins provide the analogy of sonar

Bats provide the analogy for ultra-sonic tracking devices

Chance

An unexpected discovery leads to a new idea.

Velcro was developed when a chap walking with his dog found lots of seed pods stuck to his socks and dog. He looked under the microscope and made his discovery of the pods having many little hooks.



Examples like Teflon and Penicillin are examples that occurred by chance.

Notes / Activities

Technology push

Scientific research leads to advances in technology that underpin new ideas. This is where the driving force for a new design emerges from a technological development - where companies then look for marketable applications to make them commercially viable.

Nike sensor shoe system, walkman, i-pod are good examples of technology push. Consumers were unaware of the need or want.

Some things get better every day

Our vision is that no one should be seriously injured or killed in a new Volvo car.

Since 1927, when the founders of Volvo Cars decided to focus on safety as one of the core values of the company, we have been a leader in the field. That will never change. What will change is the breadth of technologies we employ to improve your driving experience and safety.

This is a statement on volvo's website. They were leading in the car industry in pushing on safety. They set the tone with the three point seatbelt. Nowadays with airbags, collisions avoidance, lane warning systems, ...

Here is some more background information.

https://www.forbes.com/sites/douglasbell/2019/08/13/60-years-of-seatbelts-volvos-great-gift-to-the-world/#6d1697a422bc

Market pull

A new idea is needed as a result of demand from the marketplace. The phone market had wishes biggers screens, as seen in the evolution of the iphone.

- Implemented on platforms
- Platforms are open ended and can evolve based on changing needs
- Has low market related risk because application is known
- Has low technology related risk because solution is not known

Exam styles questions

8. Which combination of factors is most likely to lead to an invention becoming an innovation?

A.	Financial support	Advertising
B.	Financial support	Market pull
C.	Market pull	Technology push
D.	Advertising	Market pull

(Total 1 mark)

Q9 How is technology push best described?

A Technology that is promoted by companies through marketing & advertising
B Encouraging technology adoption
C Accelerating to use of technology in the community
D As scientific research that leads to advances in technology that underpin new ideas.

Q10 How is market pull best described?

A Where consumers sales are beyond expectation of the manufacturer
B As a new idea that is needed as a result of demand from the marketplace
C Where the market is undecided on whether a new idea is useful or not
D As a new idea that consumers move to from another dominant product

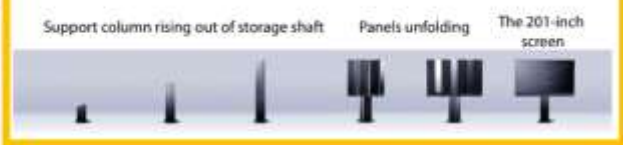
Notes / Activities

Specimen paper

6. The C SEED 201, shown in Figure 9, is an outdoor TV (television) by Porsche Design Studio.
When the TV is not being watched, it is stored underground in a waterproof shaft.
The touch of a button on the TV's remote control opens the lid of the storage shaft.
A pillar-shaped support column then rises to as high as 4.6 metres. Once the stand reaches its set height, seven large screen panels unfold to form the 201-inch TV, in less than a minute, as shown in Figure 10.

Figure 9: The C SEED 201 outdoor TV

Figure 10: Stages of assembling the C SEED 201 outdoor TV



(b) Explain the innovation strategy behind the C SEED 201 name. [3]

(b) Award [1] for stating the innovation strategy behind the C SEED 201 name and [1] for each of two distinct correct points in an explanation [3 max].

11. Figure 9 shows the Juicy Salif Citrus Squeezer designed by Philippe Starck and made from casting aluminum which is then polished.
Philippe Starck was having lunch on the Amalfi coast. As he ordered a plate of calamari. Glancing down at his plate, he realised that he had no lemon. Starck was suddenly seized by an idea. He began scribbling on his paper napkin.

(a) Outline one reason why the concept development of the Juicy Salif Citrus Squeezer may be considered as an act of insight. [2]

17. In 1826, John Walker noticed a dried lump on the end of a stick while he was stirring a mix of chemicals. When he tried to scrape it off it created sparks and a flame. Following on from this discovery, Walker marketed the first friction matches as "Friction Lights" and sold them at his pharmacy, see Figure 5.

Figure 5: The "Friction Lights" match

Which of the following innovation strategies applies to John Walker's invention?
A. Adaptation
B. Constructive discontent
C. Chance
D. Technology transfer

18. Which of the following are innovation strategies?
I. Market pull and technology push
II. Property recovery and waste mitigation
III. Act of insight and analogy

A. I and II
B. I and III
C. II and III
D. I, II and III

Notes / Activities

5.4 Stakeholders in Invention and Innovation

ESSENTIAL IDEA

There are three key roles in invention and innovation, which can be shared by one or more people.

NATURE OF DESIGN

Collaborative generation of knowledge and high efficiency information flow allow for diversity, increased resilience, reliability and stability within an organization. Through participatory research, stakeholders can make full use of the resulting innovation and invention, by transferring findings relevant to the sector in which they are positioned. A designer's increased awareness through shared industry knowledge enhances profitability and policy.

AIM

On occasion, the inventor needs to act as both entrepreneur and product champion. The adoption of these additional roles requires a significant amount of learning to take an idea from the mind, realize it and then diffuse it successfully into the marketplace

PRINCIPLES AND CONCEPTS

The inventor, the product champion, the entrepreneur
The inventor as a product champion and/or entrepreneur
A multidisciplinary approach to innovation

GUIDANCE

Roles of the product champion and entrepreneur in the innovation of products and systems
Reasons why inventors often take the role of product champion and/or entrepreneur
The advantages and disadvantages of multidisciplinary teams

The lone inventor

The lone inventor is an individual working outside or inside an organization who is committed to the invention of a novel product and often becomes isolated because he or she is engrossed with ideas that imply change and are resisted by others. Lone inventors are:

Individuals with a goal of the complete invention of a new and somewhat revolutionary product.
Have ideas that are completely new and different.
May not comprehend or give sufficient care to the marketing and sales of their product.
Are usually isolated, and have no backing towards their design.
Are having a harder time to push forward their designs, especially in a market where large investments are required for success.
Their ideas, because of how different they are are often resisted by other employees and workers.

Thomas Edison | Marc Zuckerberg | Margaret Calvert | Ingvar Kamprad | Jonathan Ive

Product Champions

An influential individual, usually working within an organization, who develops enthusiasm for a particular idea or invention and "champions" it within the organization. Profile of a Product Champion

Has business experience in the domain
Can speak intelligently about the issues
Acts as a good facilitator
Works and plays well with others
Accepts responsibility for the product
Defends the team's ability to produce the product
Is willing to make hard decisions about scope
Treats the team as knowledgeable professionals
Sets reasonable performance expectations
Communicates with the team, the customer, management, sales, and marketing
Has a willingness to learn—from everyone
Doesn't trust everyone; does trust the right people

Notes / Activities

Entrepreneurs

An influential individual who can take an invention to market, often by financing the development, production and diffusion of a product into the marketplace.

Profile of an Entrepreneur

The ability to make good judgements and take quick decisions in Business
Self-control
Self -confidence
Sense of urgency
Comprehensive Awareness
Realism • Conceptual Ability
• Status Requirements
• Interpersonal Relation

Andrew Carnegie led the expansion of the American steel industry in the late 19th century and became one of the richest Americans in history. He became a leading philanthropist in the United States and in the British Empire. And gave us the peace palace.

The Inventor as product champion &/or entrepreneur

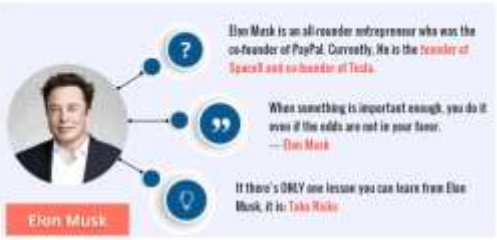
James Dyson is a British inventor, industrial designer and founder of Dyson company. Dyson is a classic example of a **lone inventor** who **took his invention to market by championing the significance of this design**.
After years of research and development, that when into making his invention and innovation in the market, Dyson **developed entrepreneurial skills** to take his company to be a success.

Inventors often take the role of product champion and/or entrepreneur because ...

1. Their idea is to novel
2. Too novel or 'out there' for a company to take a risk on
3. Can't find a backer or company to produce it
4. The inventor will have to 'champion' their product to different companies

Inventor as product champion &/or entrepreneur

Sometimes an inventor may have developed skills or profiles of a product champion and/or entrepreneur.



Multi-Disciplinary approach to innovation +/-

Effective design draws from multiple areas of expertise, and this expertise can be utilized at different stages of product development. Most products are now extremely complex and rely on expertise from various disciplines. Most designs are developed by multidisciplinary teams.

Advantages	Disadvantages
• wide range of knowledge that others may not have considered • wide range of expertise and/or backgrounds that foster cross-fertilization of ideas • wide range of expertise and/or backgrounds meaning that people look at ideas through a different set of lens	• may not want to share ideas for fear of losing ownership • individual may not be use to working in teams • different working styles and speed • chance of miscommunication

Notes / Activities

Exam Questions

3. What do the lone inventor and the product champion have in common?

I. Determination

II. Knowledge

III. Design ability

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

(Total 1 mark)

9. Why is it becoming increasingly difficult to be a successful lone inventor?

A. Lone inventors usually work by themselves

B. Increasing use of CAD/CAM

C. Products often include a range of technologies

D. Companies spend less on R&D

(Total 1 mark)

22. Modern products are often very complex, containing digital and physical elements. What approach do many companies employ to deal with this complexity?

A. Focus on a core technology
B. Employ a product champion
C. Multidisciplinary approach
D. Monodisciplinary approach

13. (a) State **one** reason why innovators may have difficulty in obtaining financial support for an invention.

.....

.....

(1)

(b) Compare the lone inventor with the product champion.

.....

.....

.....

.....

(3)
(Total 4 marks)

Notes / Activities

5.5 Product Life Cycle

ESSENTIAL IDEA
There are several key stages in the product life cycle.

NATURE OF DESIGN
Designers need to consider the whole product cycle of potential products, services and systems throughout the design cycle and beyond. Products may have an impact not only on the direct consumer but also on society at large and the environment.

AIM
An understanding of the product life cycle allows the designer to design a product with obsolescence in mind. Doing this at the design stage can potentially eliminate the effect of a product on the environment when it is no longer in use

PRINCIPLES AND CONCEPTS

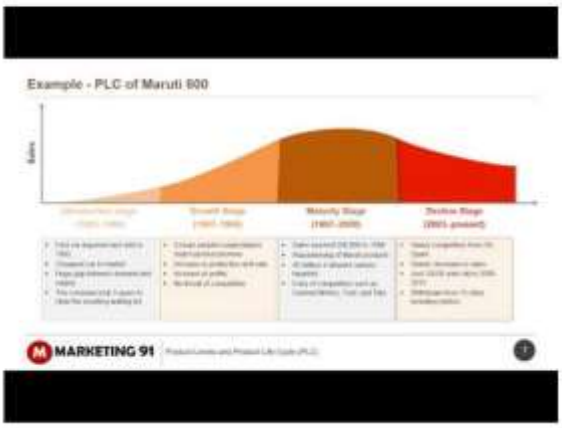
Key stages of the product life cycle: launch, growth, maturity, decline
Obsolescence: planned, style (fashion), functional, technological
Predictability of the product life cycle • Product versioning/generations
Product versioning/generations

GUIDANCE

Examples of products at different stages of the product life cycle including those new to the market and classic designs
Length of the product life cycle considering the effect of technical development and consumer trends

Advantages and disadvantages for a company of introducing new versions and generations of a product

What do you understand by Product Life Cycle?



1. Discuss it with your table group
2. Do you know already the stages that define PLC?
3. Maybe you learn it already in another subject? If so, share it with your group

Key stages

1. Launch: There are slow sales and little profit as the product is launched on the market.

2. Growth: The market gradually accepts the product, so diffusion starts and sales expand.

3. Maturity: Sales peak but remain steady, so maximum profit is achieved.

4. Decline: Market saturation is reached and sales start to reduce as well as profit

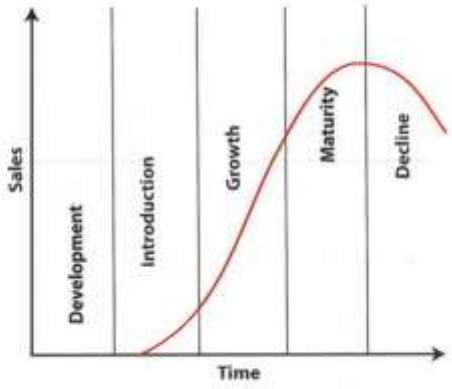


Figure 5.5.1 Product life cycle stages

Notes / Activities

PLC exercise

Activity: Find two products that are in each stage of the product life cycle and write a sentence describing why.

	Launch	Growth	Maturity	Decline
Product 1	MIITO - 2022 product Kacey Musgraves Lonely Weekend Self-Care Kit Collection - Kacey Musgraves fans were happy when the singer Launched her Lonely Weekend Self-Care Kit in the summer of 2020. It was a kit that consisted of apparel, games and DIY art projects. However, at $100 it wasn't super accessible to everyone.	Tesla- the gradual acceptance of electric vehicles in the market have lead to sales of Tesla's electric cars to expand significantly within the past couple of years leading to more competitors into the market.	All generations of AirPods -Continuous profit with no decline -Other companies recreating initial idea (Galaxy Pros)	CD/DVD players DVD sales have been on the decline for over a decade, but a slew of new streaming services and a shift in how consumers are watching movies and TV shows could be the final death knell for the technology.- CNBC
Product 2	Cubinote - just started business	Fitbit - Fitbit releases new models around October in order to satisfy demands and wants. During this stage, fitbits had increasing sales due to popularity which resulted in more profits and funding towards future models. However, I would say that fitbits have overcome this stage since sales have been declining for the past few years.		

Obsolescence

Discuss with your group what is the meaning of Obsolescence?

Obsolescence

Obsolescence affects the product life cycle.

Planned: A product becomes outdated as a conscious act either to ensure a continuing market or to ensure that safety factors and new technologies can be incorporated into later versions of the product.

Style (fashion): Fashions and trends change over time, which can result in a product no longer being desirable. However, as evidenced by the concept of retro styling and the cyclic nature of fashion, products can become desirable again.

Functional: Over time, products wear out and break down. If parts are no longer available, the product can no longer work in the way it originally did. Also, if a service vital to its functioning is no longer available, it can become obsolete.

Technological: When a new technology supersedes an existing technology, the existing technology quickly falls out of use and is no longer incorporated into new products. Consumers instead opt for the newer, more efficient technology in their products.

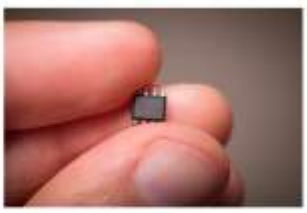
Activities

1. Find one example of a product for each of the types of obsolescence

2. identify and describe one product (other than PCs, phones, tablets or MP3 players) that have a shortened PLC.

3. Discuss why for many products the PLC has shortened. You might want to consider safety features, latest technology or trends in fashion.

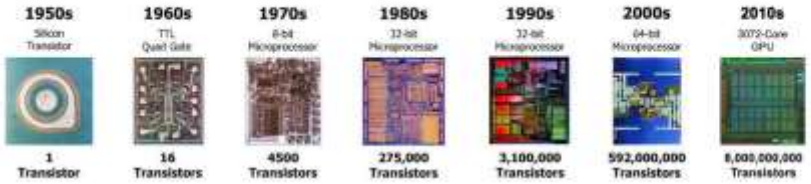
Predictability of Product Life cycle



Factors that affect the length of the product life cycle are

- Fashion trends
- Technological change
- Global competition

Additional to these factors are manufacturer's interests for planned obsolescence and society's not thinking much of disposing consumer items on a regular basis.



Notes / Activities

Product versioning/generations

A business practice in which a company produces different models of the same product, and then charges different prices for each model.

Product Versioning is offering a range of products based on a core or initial product market segments. A company can maintain a pioneering strategy and consistent revenue flow by introducing new versions or generations of a product to a market. Apple uses this strategy effectively, creating multiple versions and generations of their iPod®, iPhone® and iPad® products. Or like the Apple Watch

As the market continues to grow, manufacturers introduce a range of versions of the same product. This allows for a greater penetration and market growth. Version variations cater for some or all of the following

- Specific regional/cultural tastes
- a range of prince points
- differentiation in product features from basic to extended
- special and limited edition releases marketed to a specific niche market

Exam Questions

1. What has had most impact on the shortening of the product cycle?

A. Computer aided design

B. Better qualified designers

C. More manufacturers

D. Technology

(Total 1 mark)

4. What has the **least** influence on the product cycle?

A. Planned obsolescence

B. Fashion

C. New technology

D. Ergonomics

(Total 1 mark)

5. Why do mobile phones tend to have short product cycles?

A. They are in the mature stage of development

B. Planned obsolescence

C. They are sold in a competitive market

D. The market is saturated

(Total 1 mark)

10. Which aspect of a product does a designer have least control over?

A. End of life disposal

B. Materials used in production

C. Product use

D. Length of life cycle

(Total 1 mark)

Notes / Activities

5.6 ROGERS' CHARACTERISTICS OF INNOVATION AND CONSUMERS

ESSENTIAL IDEA innovations take time to diffuse into a target audience

NATURE OF DESIGN Rogers' four main elements that influence the spread of new ideas (innovation, communication channels, time and a social system) rely heavily on human capital. The ideas must be widely accepted in order to be self- sustainable. Designers must consider various cultures and communities to predict how, why and at what rate new ideas and technology will be adopted.

AIM By categorizing consumers, the designer can identify particular segments with a market sector to gain feedback. By engaging with these stereotypes, the designer can utilize their experiences with a prototype in order to guide further development.

PRINCIPLES AND CONCEPTS

Diffusion and innovation
The impact of Rogers' characteristics on consumer adoption of an innovation
Social roots of consumerism
The influence of social media on the diffusion of innovation
The influence of trends and the media on consumer choice
Categories of consumers in relation to technology adoption

GUIDANCE

Examples of product innovations for each of Rogers' characteristics
The impact of Rogers' characteristics on consumer adoption of an innovation can be considered in terms of relative advantage, compatibility, complexity, observability, trialability
The social roots of consumerism include lifestyle, values and identity
Issues for companies in the global marketplace when attempting to satisfy consumer needs in relation to lifestyle, values and identity
Categories of consumers include innovators, early adopters, early majority, late majority, laggards

Diffusion and Innovation

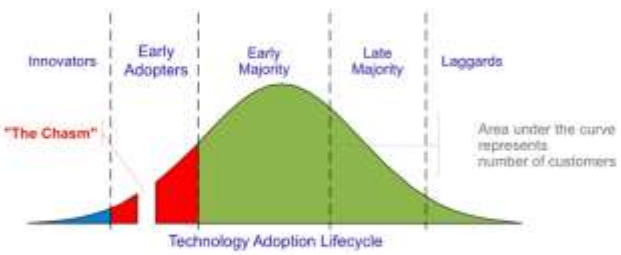
Everett Rogers attempted to identify and explain the factors that lead people to adopting or accepting an innovation. Understanding these characteristics is important for a designer because they can ensure a greater success of their product being accepted and used.

Knowing these characteristics, designers and design teams can plan how to address them when designing and marketing their product.

Diffusion is the wide acceptance and sale of a product or innovation. People do not readily adopt a new product; Rather, it is a deliberate decision. In order for an innovation to be self-sustaining, it must be widely adopted.

Categories of consumers in relation to technology adoption

Different categories of consumers adopt innovative technologies in different ways. For designers and design teams, it is important to recognize that each group has distinct characteristics, needs, beliefs, and values. As such, they need to be marketed to differently.



Innovators – *are the first individuals to adopt an innovation. They are characterised by being well informed and willing to take risks.*

Early adopters – *are the second fastest category to adopt an innovation, usually well informed individuals, who enjoy being ahead. Companies use this group to provide early feedback.*

Early majority – *the third group, tends to take more time to consider adopting new innovations and is inclined to draw from feedback from early adopters before taking the risk of purchasing new products.*

Late majority – *adopts the innovation after it has been established in the marketplace, as they are cautions and sceptical about innovations.*

Laggards – *are the last to adopt an innovation. They tend to prefer traditions and are unwilling to take risks. They acquire products that have been superseded, usually at a discounted price.*

Notes / Activities

The impact of Rogers' five characteristics on consumer adoption of an innovation

Relative advantage is how improved an innovation is over the previous generation. Such as the electric washing machine saw consumers move away from hand powered washers and ringers because of the time and physical energy saved.

Compatibility is how compatible a design is with the beliefs, needs, wants and values of a target market.
Car seat belts, while considered an essential safety device today, were not accepted by the public until the 1970s when government legislation began to mandate their installation and use.
Mobile phones on the other hand, were readily compatible with society's desire to to communicate while on the move was great. This desire is now seen as a norm.

Seat Belts: Initially, low compatibility with social norms until governments started to require their use

Mobile Phones: High compatibility with social norms as the desire to communicate is great.

The impact of Rogers' five characteristics on consumer adoption of an innovation

Complexity is the degree to which a design is perceived as easy to use. Effective Graphical User Interfaces (GUI) of a computers, devices, and applications are key to the success of the product. In the case of the original iPhone, this UI was the essential design innovation that brought all other innovative components together. Successful designs do not need to be simple but well designed and intuitive to allow the user to accomplish their goals.

Observability refers to the idea that the benefits of the innovation are visible to the user. If users are able to readily identify the benefits, the rate of adoption is greater. Essentially, the more visible the product is in day to day life, advertising, and media, the greater chance it will be successfully adopted by users.
The transition from videotape to DVD provided consumers with obvious advantages such as durability, storage capacity and picture quality.

Side-by-side comparison: If consumers are able to see the difference compared to other products, then they are more likely to adopt it. Showing a side-by-side comparison allows consumers to see the differences

The impact of Rogers' five characteristics on consumer adoption of an innovation

Trialability refers to the ability to try out a product before investing time or money in it. Mobile phone stores allow consumers to try out the products and experience. Car dealers will allow potential customers to take a car for a test drive. Some online paid services will allow a "free-trial" period.

Figure 6 shows the PlayShapes product by Miller Goodman. PlayShapes is a set of 74 modular hardwood shapes which are finished with paint or varnish. They can be used by young children of various ages to create hundreds of three-dimensional designs.
Task -Explain Rogers' characteristics of relative advantage, compatibility, complexity, observability and trialability in relation to anticipated consumer adoption of the PlayShapes product.

Figure 6: PlayShapes product by Miller Goodman

Notes / Activities

Relative advantage

Complexity

Figure 6 shows the PlayShapes product by Miller Goodman. PlayShapes is a set of 74 modular hardwood shapes which are finished with paint or varnish. They can be used by young children of various ages to create hundreds of three-dimensional designs.
Task -Explain Rogers' characteristics

Observability

Compatibility

Trialability

Social roots of consumerism

Consumerism is a set of behaviours found in all cultures predominantly based around the consumption of goods and services. It is also a way of handling down values and cultural norms from one generation to another one.

Companies operating in the global marketplace need to satisfy consumer needs by considering their lifestyle, values, and identity.

Activity
Detail what issues may a company have when satisfying consumer needs? And why that may be?

Social groups based on interests, hobbies, space, money, etc
Social environments are particularly influential, may be based around family, friends, work colleagues, etc
Cultural identities are often handed down from generations through the transmission of values, norms and customs

Video on the history of Consumerism

Depressing animation on consumerisme. Ever heard of the quote: " "We buy things we don't need with money we don't have to impress people we don't like." by Dave Ramsey

The influence of social media on the diffusion of innovation

Social media can be used to generate support for an innovation. Social networks such as Facebook, LinkedIn and Twitter are used as methods of raising brand awareness.
Crowdfunding platforms allow the public to invest in creative products or projects. A designer proposes an idea or project, and people pledge money to support it. If the minimum amount of pledges is reached, the project goes ahead. Kickstarter and Indiegogo are two of the biggest crowdfunding platforms.

Example of a Kickstarter project

Exam style question

2018
Rogers is well known for characterizing aspects of innovation.
What is the term given to product improvements over previous generations?
A. Compatibility
B. Relative advantage
C. Trial-ability
D. Complexity

2018

6. Wakati is the world's first standalone solution for the preservation of fruits and vegetables without the use of cooling. Wakati is a solar-powered and standalone solution against food losses.
With only one liter of water a week, Wakati enables you to store up to 200kg of fruits and vegetables.
Powered by a small solar panel, no extra care is needed.
Affordable and low-energy on-farm fruits & vegetables storage for smallholder farmers in developing countries, without using cooling.
Smallholder farmers can store there produce on farm by a protective microclimate inside a tent with a storage of 200 -1000 kg. the protective microclimate works by 1) Increasing the humidity to keep cell structure in tact 2) ozone sterilisation to reduce mold growth 3) oxidising storage, the ripening hormone of fruits and vegetables by ozone.

(b) Rogers identifies five characteristics that affect the consumer's acceptance of an innovation. One of these characteristics is compatibility.
Explain how compatibility will affect consumer adoption of an innovation such as the Wakati One tent. [3]

Notes / Activities

2016 exam paper

Figure 6 shows the PlayShapes product by Miller Goodman. PlayShapes is a set of 74 modular hardwood shapes which are finished with paint or varnish. They can be used by young children of various ages to create hundreds of three-dimensional designs.

(d) Explain Rogers' characteristics of relative advantage, observability and complexity in relation to anticipated consumer adoption of the PlayShapes product. [9]

Figure 6: PlayShapes product by Miller Goodman

10. The image shows a VR headset. Ten years ago VR was the preserve of wealthy "early adopters". Now you can pick up a reasonable VR set for £600. It is believed that the price will continue to fall, as will the size of the headset, until it becomes more like wearing a pair of glasses.

a) Define what is meant by the term 'early adopter' [2 Marks]

a) Compare the adoption characteristics of an early adopter with late majority. [3 Marks]

11.Identify the category of consumer most likely to be skeptical towards innovations and unlikely to be influenced by any advertising strategies [1 Mark]

12. The image shows a screenshot of a user's review for the Amazon Echo Dot. [It's not necessary to read the actual review]
Explain the influence of social media on the successful diffusion of an innovation
[3 Marks]

Notes / Activities

5.7 INNOVATION, DESIGN AND MARKETING SPECIFICATIONS

ESSENTIAL IDEA

Successful innovations typically start with detailed design and marketing specifications.

ESSENTIAL UNDERSTANDING

Designers must establish clear parameters for a marketing specification in order to create unique and creative solutions to a problem. Designers need to collect valid and useful data from the target market and audience throughout the design cycle to ensure the specification includes certain essential components.

AIM

The ability to transform their research findings into a series of specifications is a skill that designers must develop to become successful. Being able to express parameters and requirements succinctly allows the designer to develop focused solutions to the design problem and meet a client or the target market's wants and needs.

PRINCIPLES AND CONCEPTS

- Target markets
- Target audiences
- Market analysis
- User need
- Competition
- Research methods
- Design specifications

GUIDANCE

How market sectors and segments can be used to establish target markets
How a target audience is used to establish the characteristics of users

Design contexts for different target markets and audiences

Market specifications

Marketing specifications are developed from careful analysis and research of the target market and user need.

Classifying your users is an essential component of your IA. You can use this information in Criteria A1, A2 and A3 to create specifications, identify extreme users, as well as determine which individuals to interview, observe, or involve in user testing.

Target market and target audience

A target market describes the sectors and segments within a population. It is a general term that describes a large group of people that are targeted for advertising, marketing, or a particular product or service.

Target markets can be separated in the following ways:

Segmented: Divided according to shared geographic characteristics (address, location, climate, country, etc.)

Demographic or Sociographic: gender, age, income, education, stage in the family life cycle

Psychographic: similar attitudes, values, or lifestyles (eg. religion, political or religious values, environmental activism.)

Behavioral : the types of behavior consumers display when making a purchasing decision. It is related to their knowledge of, attitude towards, use of, and response to a particular product.

Target Market and **Target audience**

A target market is a specific, well-defined segment of consumers that a company plans to target with its products. The term "target audience" is a bit narrower; it refers specifically to the group of consumers targeted by advertisements. For example, a company's target market might be "snowboarding enthusiasts age 15 to 30," whereas the target audience may be "snowboarders age 15 to 30 living in Denver, Colorado."

[http://smallbusiness.chron.com/target-market-vs-target-audience-1037.html]

Ask yourself related to your IA: Who is your target audience? What are their characteristics?

Notes / Activities

Target market and target audience

In the **target market** the Market segments need to be identified

MARKET SEGMENTS			
Geographic	**Demographic**	**Psychographic**	**Behavioural**
Continent	Age	Lifestyle	Occasions
Country	Gender	Social class	Degree of loyalty
Country region	Family size	Interest	Benefits sought
City	Occupation	Activity	Usage
Density	Income	Opinion	Buyer readiness
Climate	Education	Personal values	User status
Population	Religion	Attitudes	
Subway station	Race		
City area	Nationality		

Video about market Segmentation for Sport Participation

It is important to differentiate between the target market and the target audience. When determining the target audience, characteristics of the users should be established.

Market analysis

An appraisal of economic viability of the proposed design from a market perspective, taking into account fixed and variable costs and pricing, is important. It is typically a summary about potential users and the market. The economic viability of a product refers to ability of the product to make a profit.

During all stages research and analysis should be done.

- It starts with market **investigation** through product evaluation (Like your criteria D in your AI).
  This is important to keep checking
  Generate new product ideas, literature research (secondary research), checking patents,
  Market testing thru for example focus groups
  Ability to work successfully: Viability (including cost, price, place)
  Gather product review and feedback

User need

A marketing specification should identify the essential requirements that the product must satisfy in relation to market and user need. Market successful innovation can be influenced by:

expectations of demand
size of the user need
expectations of profit
positivity of market perception
IP protection afforded by patents

User need: A marketing specification should identify the essential requirements that the product must satisfy in relation to market and user need

Competition

A thorough analysis of competing designs is required to establish the market need.

Every product you take to market, even ones that are new inventions or improvements on old products, face competition. This is because customers buy products for many different reasons. Some are interested in the innovation of new products, others care more about price point and clever marketing schemes. Your competition will capitalize on these buyer preferences and seek to edge out your product from the market. Identifying the competition in your marketing specification helps the organization to clarify how it can edge out and respond to the competition.

The Importance of Competition

To check compliance with national or international standards

Many products will fall under national or international standards. Although these standards are not usually mandatory consumers will want and expect their products to meet the standards. Products that do not meet standards are unlikely to gain success in the marketplace

Notes / Activities

Research methods

Literature search
Usually performed using authoritative sources as academic journals, books, theses, consumer magazines, government agency and industry publications.

Quantitative and qualitative research
Qualitative research obtains information about some quality aspect of the subject. These techniques include

- Interviews
- Observation
- Focus groups
- Questionnaires
- Telephone surveys

Quantitative research obtains numerical data such as example quantity. These techniques include

- Data logging or data acquisition
- Scale models
- Full-scale product testing
- Questionnaires
- Computer simulations
- Controlled experiments

Design Specifications

A design specification relates to the requirements of a product and details aspects of:

aesthetic requirements
cost constraints
customer requirements
environmental requirements
size constraints
safety considerations
performance requirements and constraints
materials requirements
manufacturing requirements.
any others that pertain to the design context

For your IA design specification
All of the requirements, constraints and considerations must be specific, feasible and measurable.

All of the requirements, constraints and considerations must be specific, feasible and measurable.

The design specification must be developed from the design brief and research.

Exam style questions

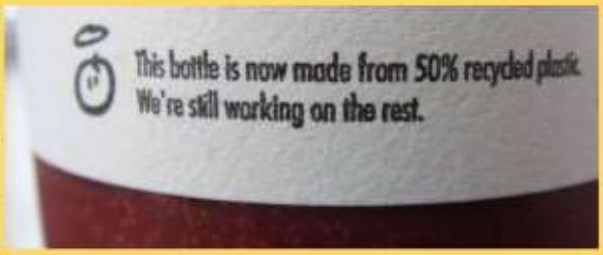
1. The image shows the Juicy Salif lemon squeezer, designed by Philippe Stark. First produced in 1990, this squeezer is as controversial as many of Starck's other designs. Some say it doesn't work very well. Others celebrate it as a piece of form over function. It is 29 centimetres high, is made from cast and polished aluminium and is still available for £43 for Alessi.com. Alessi has also produced 10,000 gold-plated versions, which were never intended for use as the citric acid in the lemon discolours the juicer. Starck is rumoured to have said: "It's not meant to squeeze lemons, it is meant to start conversations." Describe the possible characteristics of the Target Market likely to purchase the Juicy Salif
[3 Marks]

Market segments			
Geographic	Demographic	Psychographic	Behavioural

Notes / Activities

2. The images show a racing bicycle on the left and a bicycle commonly found in rural parts of China on the right
Discuss the impact of the needs of the different target segments had on the designs of the bicycle
[3 marks]

3. The image shows the packaging for the 'Innocent' smoothie drinks, with a close up of the packaging label.



Outline a specific characteristic of the target market the Innocent drinks company are trying to appeal to with this message
[2 Marks]

4. The image shows a bedroom lamp aimed at young children and a lamp aimed at adults
Discuss how these two different target markets would have impacted at least two areas of the design specifications
[6 Marks]

5. The table shows an example of a competitor analysis for a new company (My Company).
Discuss the reasons for a carrying out a competitor analysis
[3 Marks]

Company	Competitor 1 (Small shop)	Competitor 2 (Small shop)	Competitor 3 (Chain)	My Company
Revenues	€ 750,000	N.A.	€ 1,500,000	€ 400,000 (year 1 target)
Nb. employees	10	5	20	5
Size	1 shop in Caen, 1 shop in Cabourg	1 shop in Caen	3 shops in Caen	1 shop in Caen
Price	Low	Average	Average	High
Quality	Low	Average	Average	Superior
Choice	Large	Low	Very large	Average
Delivery	No	€ 50	Free from € 100	Free

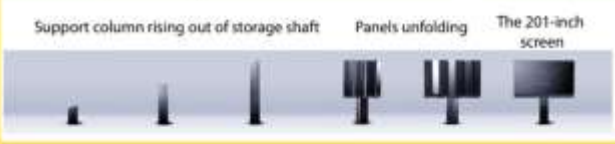
Notes / Activities

6. The image shows a focus group as part of a company's research strategy for understanding its market. Explain the benefits of using a focus group
[3 Marks]

Specimen paper
7. The C SEED 201, shown in Figure 9, is an outdoor TV (television) by Porsche Design Studio.
When the TV is not being watched, it is stored underground in a waterproof shaft.
The touch of a button on the TV's remote control opens the lid of the storage shaft.
A pillar-shaped support column then rises to as high as 4.6 metres. Once the stand reaches its set height, seven large screen panels unfold to form the 201-inch TV, in less than a minute, as shown in Figure 10.

Figure 9: The C SEED 201 outdoor TV

Figure 10: Stages of assembling the C SEED 201 outdoor TV



(d) Explain how the safety, convenience and technology specification may have influenced the design of this TV. [9]

Notes / Activities

Summary Notes
Q&A

Topic 5
Innovation + Design

5.1 Invention

The protection of a novel idea of how to solve a problem is a major factor in commercial design. Invention by lone inventors or in collaborative, creative teams is at the forefront of design. Designers must not only be creative and innovative, but also understand the concepts that will make a new product viable. A designer must use imagination and be firmly grounded in factual and procedural knowledge while remembering the needs and limitations of the end user.

Define an **Invention**	Invention is the process of discovering a principle which allows a technical advance in a particular field that results in a novel/new product.
Drivers for Invention/Motivation for Invention	Drivers for invention include personal motivation to express creativity/for personal interest, scientific or technical curiosity, constructive discontent, desire to make money, desire to help others. A few of the many reasons that drive invention are listed below • a personal motivation to invent in order to express one's creativity or personal interest • scientific and/or technical curiosity • constructive discontent with an existing invention/design • desire to make money • desire to help others.
The Lone Inventor What are the advantages and disadvantages of being a lone inventor	**The lone inventor** is an individual working outside or inside an organization who is committed to the invention of a novel product and often becomes isolated because he or she is engrossed with ideas that imply change and are resisted by others. Individuals with a goal of the complete invention of a new and somewhat revolutionary product. • Have ideas that are completely new and different. • May not comprehend or give sufficient care to the marketing and sales of their product. • Are usually isolated, and have no backing towards their design. • Are having a harder time to push forward their designs, especially in a market where large investments are required for success. • Their ideas, because of how different they are are often resisted by other employees and workers.
Intellectual Property (IP)	A legal term for intangible property such as "creations of the mind" such as inventions and designs that are used in a commercial setting. Intellectual property is protected by law.
What are the **benefits of IP**	Benefits of IP include differentiating a business from competitors, selling or licensing to provide revenue streams, offering customers something new and different, marketing/branding, its value as an asset. The benefits of intellectual property include: • differentiating a business from competitors • allowing sale or licensing, providing an important revenue stream • offering customers something new and different • marketing/branding • establishing a valuable asset that can be used as security for loans.
What are **effective strategies for protecting IP**	**Patents**: "An agreement from a government office to give someone the right to make or sell a new invention for a certain number of years".
	Trademarks: A trademark is a recognisable sign, design or expression which distinguishes products or services of a particular trader from the similar products or services of other traders.
	Copyright: Copyright is a legal right created by the law of a country, that grants the creator of an original work exclusive rights to its use and distribution, usually for a limited

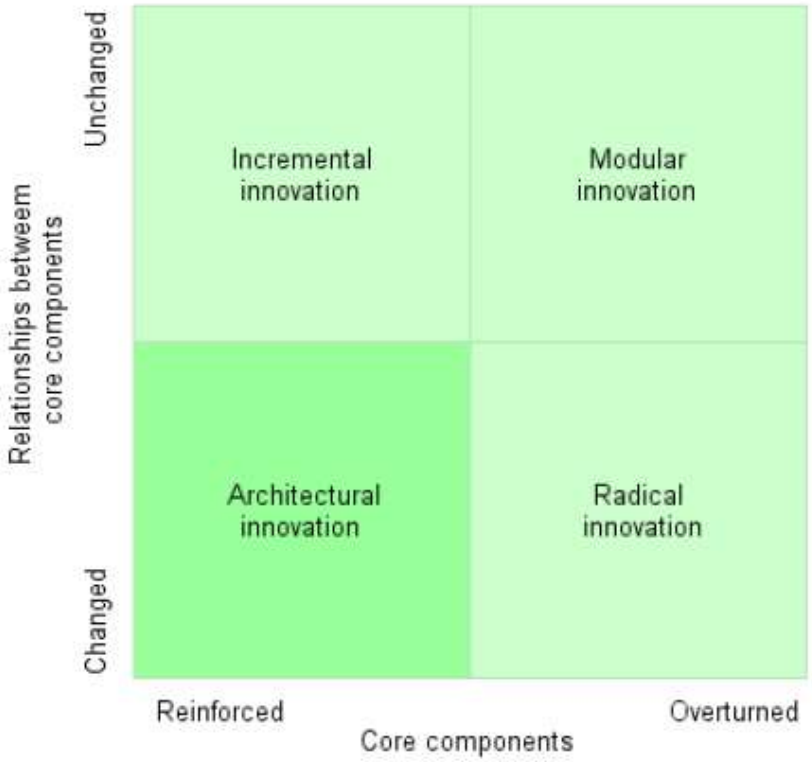
	time, with the intention of enabling the creator (e.g. the photographer of a photograph or the author of a book) to receive compensation for their intellectual effort.
Patent pending	An indication that an application for a patent has been applied for but has not yet been processed. The marking serves to notify those copying the invention that they may be liable for damages (including back-dated royalties), once a patent is issued.
First to market	When a company or a person has or think they have a innovative idea or product, therefore will rush to have it on the market before anyone else. Some innovators decide not to protect their IP as an alternative strategies to ensure success by allowing them to get first to market rather than spend money on patents or waste time.
Shelved technologies- Reasons why some patented inventions are shelved	Technology that is shelved for various reasons. Sometimes shelved technologies will be rediscovered or taken off the shelf.

5.2 Innovation

There are many different types of innovation. Designers will be successful in the marketplace when they solve long-standing problems, improve on existing solutions or find a "product gap". The constant evaluation and redevelopment of products is key, with unbiased analysis of consumers and commercial opportunities.

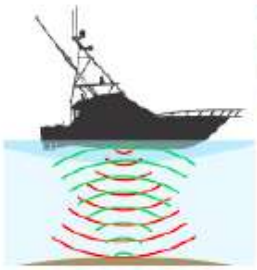
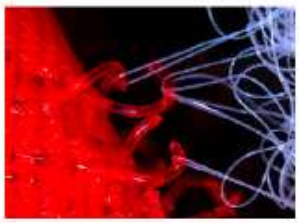
Define an **Innovation**	The business of putting an invention in the marketplace and making it a success.
Reasons why **inventions become innovations**	Few inventions become successful innovations due to the following reasons: • **Marketability-** Low product demand or not readily saleable • **Financial support-** There is little monetary backing from the organisation or an outsider. The invention would need more sponsors to financially aid the product. • **Marketing-** Is the process of getting products from the producer or vendor to the consumer or buyer, which includes advertising, shipping, storing, and selling. Poor marketing strategies or wrong target markets. Invention would need to be advertised as a product the public would want. • **The need for the invention-** Examples include alternative energy resources to combat our insatiable need for oil however if oil prices are low or there is a ready supply of oil then the alternative energy invention will not take hold. • **Price-** Affordable, cost effectiveness or value for money … therefore it may be too expensive to purchase, or to manufacture and the consumer may not see it worth its cost compared to its use.Keep in mind, the product's price needs to be equivalent to the income of the specific age group that would buy the majority of the product. • **Resistance to change-** People and organisations can be resistant and reluctant to change, feeling comfort and security in the familiar thus resist new ideas/products. • **Aversion to risk-** "Risk aversion is a concept in economics, finance, and psychology related to the behaviour of consumers and investors under uncertainty".
Sustaining Innovation	Innovative ideas that are constantly updated in order to maintain their success. A new or improved product that meets the needs of consumers and sustains manufacturers. 
Disruptive Innovation	 A product or type of technology that challenges existing companies to ignore or embrace technical change. Examples include the iPod which changed the way we managed and listened to music. Mobile phones so we were no longer restricted to landlines.

Process Innovation	An improvement in the organization and/or method of manufacture that often leads to reduced costs or benefits to consumers. Example is in the automobile industry such as Ford with the introduction of assembly line production and Toyota with lean manufacturing. 
Architectural Innovation	 The technology of the components stays the same, but the configuration of the components is changed to produce a new design. Putting existing components together in novel ways. Examples include: electric cars, Sony Walkman
Modular Innovation	 The basic configuration stays the same, but one or more key components are changed. Example include a new type of switch/button on a toaster. Also known as **incremental design**
Configurational Innovation	  Modifying arrangements of components to improve performance, usability and function (buttons, interface, dials, better heating element, 4 slots rather than 2, etc).
Radical Innovation	 Changing the paradigm of the market that the new product is produced in: invention of smartphones changed the phone industry. It is similar to diffusion but the difference is that a radical innovation might not be successful as it might not be accepted into the marketplace e.g. Sinclair C5 electric car Radical could include new materials, manufacturing, etc.

	
Innovation strategies for markets: **Diffusion** and **suppression**	**Diffusion**: is a process where a market will accept a new idea or product. The rate it accepts the new idea or product can be increased by several factors. • Examples of widely diffused products include the, light bulb, refrigerator (100%), ATM cards, Music CD's (now mp4 format). • Once widely accepted they often become dominant designs. **Suppression**: is a process where a new idea or adoption of a product by the market is actively slowed. This may be due to difficulties competing with a dominant design, ambiguity over patent ownership, competing companies actively petitioning against a new product it perceives as threatening, or the natural resistance to an unfamiliar concept.

5.3 Strategies for innovation

Designers have a range of strategies for innovation. Companies encourage advancements in technology and services, usually by investing in research and development (R&D) activities. Even though the R&D may be carried out by a range of different experts from varied fields of research, the development process is often based on common principles and strategies to identify the direction of development. This methodology structures the R&D of new technologies and services.

Act of insight	Often referred to as the "eureka moment", a sudden image of a potential solution is formed in the mind, usually after a period of thinking about a problem. Such as Newton watching an apple fall and gaining insight in gravitation forces.
Adaptation	 A solution to a problem in one field is adapted for solving a problem in another field. The principle of how a hovercraft works was adapted the hover lawn mower.
Technology transfer	Technological advances that form the basis of new designs may be applied to the development of different types of products/systems, for example, laser technology. Laser transferred into surgery or audio or data CDs
Analogy	 **An idea from one context is used to stimulate ideas for solving a problem in another context.** Sonar modelled on how bats navigate and used now in ships to check depth or placement of fish.
Chance	 **An unexpected discovery leads to a new idea.** Velcro was developed when a chap walking with his dog found lots of seed pods stuck to his socks and dog. He looked under the microscope and made his discovery of the pods having many little hooks
Technology push	**Scientific research leads to advances in technology that underpin new ideas.** This is where the driving force for a new design emerges from a technological development. The Sony walkman is an example. • Innovation is created, then appropriate applications are sought to fit the innovation • Did the market ask "please give me an iPod with download store" or a camera phone? Most likely not; so this would be a technology push  © Chappatte - www.globecartoon.com - "Here comes the iPod"

Market pull	A new idea is needed as a result of **demand** from the marketplace. The car market which has separate sectors for the supermini, family cars, mini-vans, executive cars, sports cars, SUV, and so on. "Market" Pull approaches: • Implemented on platforms • Platforms are open ended and can evolve based on changing needs • Has low market related risk because application is known • Has low technology related risk because solution is not known • When the market asks for better safety features in a car then this would be market pull.

5.4 Strategies for innovation

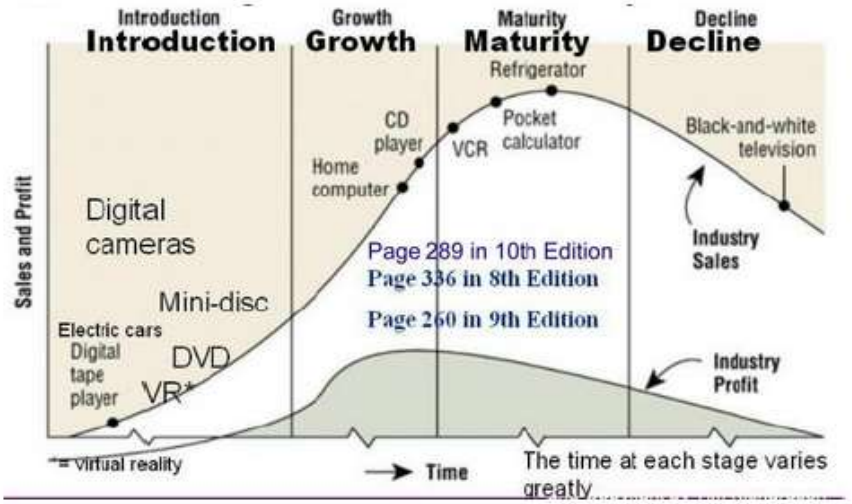
There are three key roles in invention and innovation, which can be shared by one or more people. Collaborative generation of knowledge and high efficiency information flow allow for diversity, increased resilience, reliability and stability within an organization. Through participatory research, stakeholders can make full use of the resulting innovation and invention, by transferring findings relevant to the sector in which they are positioned. A designer's increased awareness through shared industry knowledge enhances profitability and policy.

The **Lone Inventor**	The lone inventor is an individual working outside or inside an organization who is committed to the invention of a novel product and often becomes isolated because he or she is engrossed with ideas that imply change and are resisted by others. Lone inventors are: • Individuals with a goal of the complete invention of a new and somewhat revolutionary product. • Have ideas that are completely new and different. • May not comprehend or give sufficient care to the marketing and sales of their product. • Are usually isolated, and have no backing towards their design. • Are having a harder time to push forward their designs, especially in a market where large investments are required for success. • Their ideas, because of how different they are are often resisted by other employees and workers.
The **Product Champion**	An influential individual, usually working within an organization, who develops enthusiasm for a particular idea or invention and "champions" it within the organization.  Steve Jobs Profile of a Product Champion • Has business experience in the domain • Can speak intelligently about the issues • Acts as a good facilitator • Works and plays well with others • Accepts responsibility for the product • Defends the team's ability to produce the product • Is willing to make hard decisions about scope • Treats the team as knowledgeable professionals • Sets reasonable performance expectations • Communicates with the team, the customer, management, sales, and marketing • Has a willingness to learn—from everyone • Doesn't trust everyone; does trust the right people
The **Entrepreneur**	An influential individual who can take an invention to market, often by financing the development, production and diffusion of a product into the marketplace. Profile of an Entrepreneur • Business acumen • Self-control • Self -confidence • Sense of urgency • Comprehensive Awareness • Realism • Conceptual Ability • Status Requirements • Interpersonal Relationships • Emotional Stability

Roles of the product champion and entrepreneur in the innovation of products and systems	Sometimes an inventor may have developed skills or profiles of a product champion and/or entrepreneur. James Dyson and Thomas Edison are two examples. Edison (later it was discovered that Swan invented the light bulb) used profits from his earlier inventions to bring the light bulb to market. James Dyson is an example of an inventor, product champion and/or entrepreneur. He invented the cyclone technology for suction. At first no-one was interested in this radical design so he 'championed' his product until he found a Japanese company would would take it on. Later he would use the profits to further improvements and novel products. He build an understanding of business.
Comparison between Lone Inventor and Product champion	The lone inventor may lack the business acumen to push the invention through to innovation. The product champion is often a forceful personality with much influence in a company. He or she is more astute at being able to push the idea forward through the various business channels and is often able to consider the merits of the invention more objectively. Inventors often take the role of product champion and/or entrepreneur because … • Their product or idea is novel • Too novel or 'out there' for a company to take a risk on • Can't find a backer or company to produce it • The inventor will have to 'champion' their product to different companies
The advantages and disadvantages of multidisciplinary approach to innovation	Effective design draws from multiple areas of expertise, and this expertise can be utilized at different stages of product development. Most products are now extremely complex and rely on expertise from various disciplines. Most designs are developed by multidisciplinary teams. • Modern Products such as smart-phones, printer/scanners are very complex. • Requires knowledge from many disciplines. • It would be unlikely that a lone inventor would have the expertise in all the disciplines. • Most modern day designs are developed in multidisciplinary teams

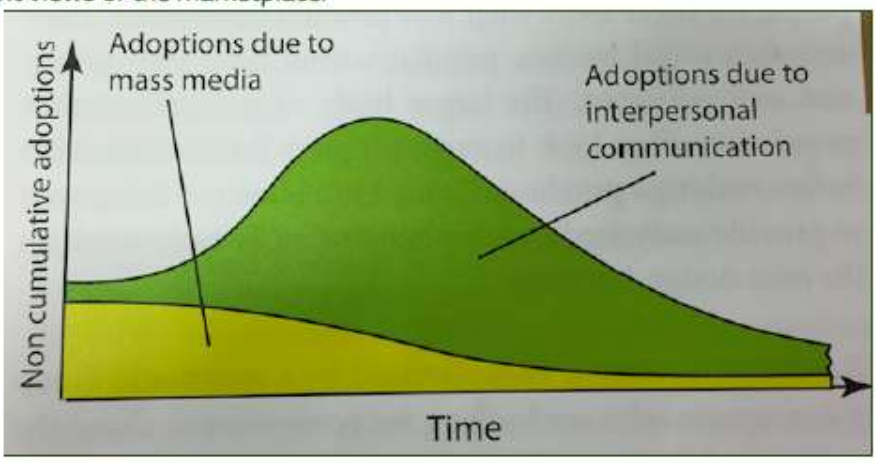
5.5 Product life cycle

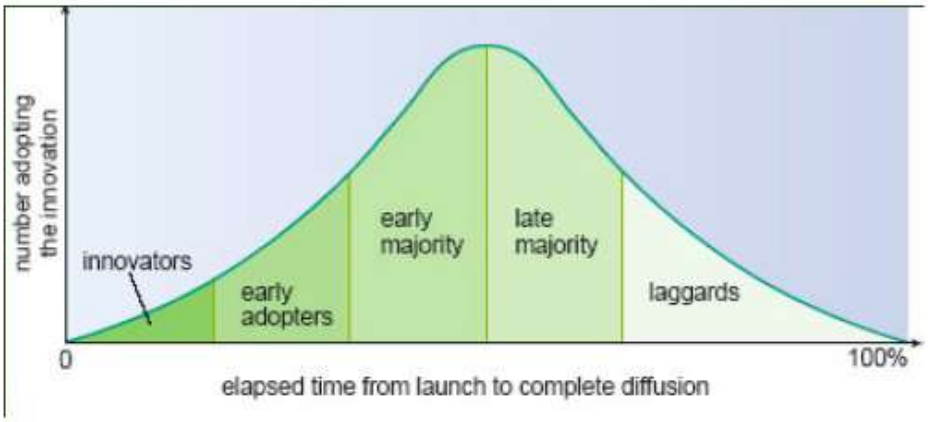
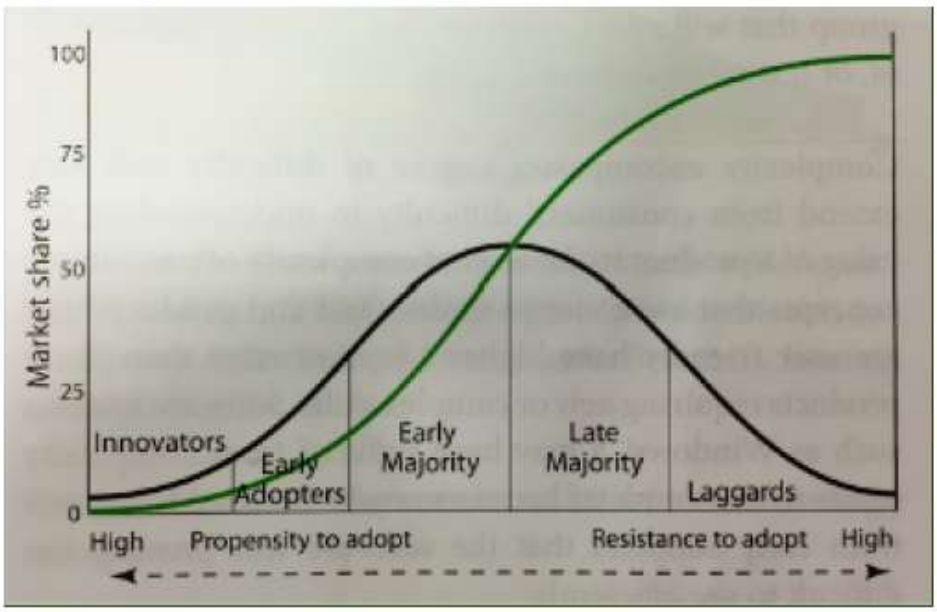
There are several key stages in the product life cycle. Designers need to consider the whole product cycle of potential products, services and systems throughout the design cycle and beyond. Products may have an impact not only on the direct consumer but also on society at large and the environment.

Key stages of the product life cycle: launch, growth, maturity, decline. Including examples of products at different stages of the product life cycle including those new to the market and classic designs	1. **Launch**: There are slow sales and little profit as the product is launched on the market. 2. **Growth**: The market gradually accepts the product, so diffusion starts and sales expand. 3. **Maturity**: Sales peak but remain steady, so maximum profit is achieved. 4. **Decline**: Market saturation is reached and sales start to reduce as well as profit.  *Product Life Cycle with Products*
Obsolescence: planned, style (fashion), functional, technological	Obsolescence affects the product life cycle. **Planned**: A product becomes outdated as a conscious act either to ensure a continuing market or to ensure that safety factors and new technologies can be incorporated into later versions of the product. **Style (fashion)**: Fashions and trends change over time, which can result in a product no longer being desirable. However, as evidenced by the concept of retro styling and the cyclic nature of fashion, products can become desirable again. **Functional**: Over time, products wear out and break down. If parts are no longer available, the product can no longer work in the way it originally did. Also, if a service vital to its functioning is no longer available, it can become obsolete. **Technological**: When a new technology supersedes an existing technology, the existing technology quickly falls out of use and is no longer incorporated into new products. Consumers instead opt for the newer, more efficient technology in their products.
Length of the product life cycle considering the effect of technical development and consumer trends	-Length of the product life cycle considering the effect of technical development -Length of the product life cycle considering the effect of consumer trends including fashion
Product versioning/generations	A business practice in which a company produces different models of the same product, and then charges different prices for each model. Product Versioning is offering a range of products based on a core or initial product market segments. A company can maintain a pioneering strategy and consistent revenue flow by introducing new versions or generations of a product to a market. Apple uses this strategy effectively, creating multiple versions and generations of their iPod®, iPhone® and iPad® products.
Advantages and disadvantages for a company of introducing new versions and generations of a product	Advantages and disadvantages for a company of introducing new versions and generations of a product • Improved consumer choice: consumers can choose the version thats suits them. • Improved consumer choice: can choose a budget level such as Quicken tax software • Maximise profits for the company hopefully through increased sales.

5.6 Rogers' characteristics of innovation and consumers

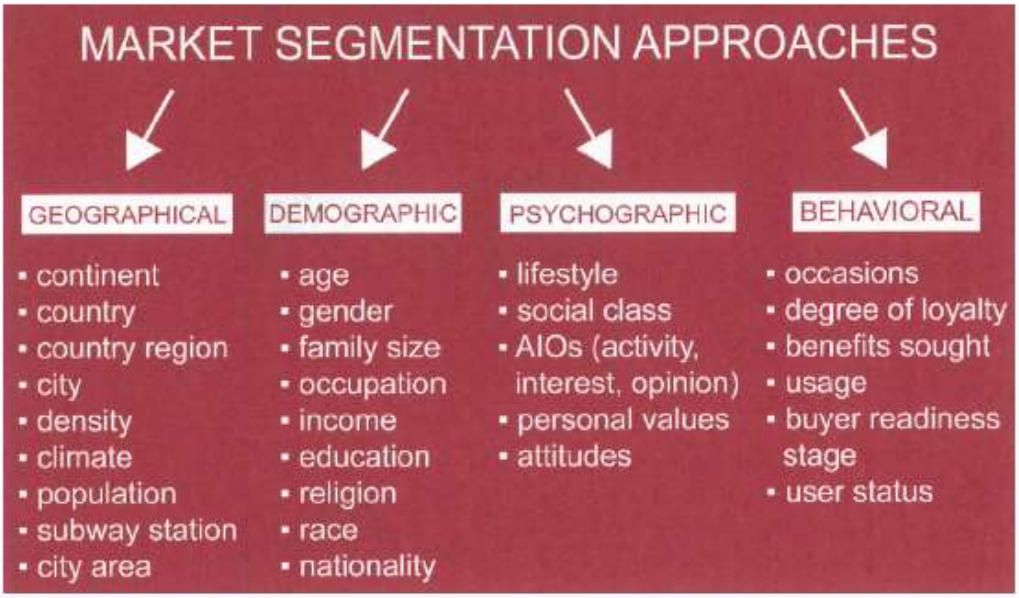
Innovations take time to diffuse into a target audience. Rogers' four main elements that influence the spread of new ideas (innovation, communication channels, time and a social system) rely heavily on human capital. The ideas must be widely accepted in order to be self sustainable. Designers must consider various cultures and communities to predict how, why and at what rate new ideas and technology will be adopted.

The impact of Rogers' **five** characteristics on **consumer adoption of an innovation**	**Five** characteristics identified by Rogers that impact on consumer adoption of an innovation: Relative advantage; Compatibility; Complexity; Observability; Trialability: 1. **Innovation/Relative advantage** – is the "the degree to which the innovation is perceived as better than the idea it supersedes. Relative advantage refers to the extent to which the innovation is more productive, efficient, costs less, or improves in some other manner upon existing practices". 2. **Compatibility** – is 'the degree to which the innovation is perceived as being consistent with existing values, past experiences, and needs of potential adopters. An innovation must be considered socially acceptable to be implemented. And some innovations require much time and discussion before they become socially acceptable'. 3. **Complexity** (simplicity) – is "the degree to which the innovation is perceived as difficult to understand and use". 4. **Observability** – is "the degree to which the results of the innovation are visible to others. The chances of adoption are greater if folks can easily observe relative advantages of the new technology. In fact, after some adopt, observability can improve the diffusion effect, a critical component of technology transfer". 5. **Trialability** – is "the degree to which the innovation may be experimented with on a limited basis. Innovations are easier to adopt if they can be tried out in part, on a temporary basis, or easily dispensed with after trial".
Social roots of consumerism	Issues for companies in the global marketplace when attempting to satisfy consumer needs in relation to **lifestyle**, **values** and **identity.** Consumerism is concerned with protecting customers from all organisations where there is an exchange relationship. The roots of consumerism can be traced through: disillusionment with the system; the performance gap; the consumer information gap; antagonism toward advertising; impersonal and unresponsive marketing institutions; intrusions of privacy; declining living standards; special problems of the disadvantaged; different views of the marketplace. 
The influence of **social media** on the diffusion of innovation	Consumers can influence diffusion of innovation. When considering the influence of social media in rallying support for boycotting of some products/systems, students can explore the concepts behind organizations such as Kickstarter, Sellaband, Seedrs and CrowdCube, which act as crowd-funding platforms for creative products and projects. They can also examine the role of social networks such as Facebook®, LinkedIn® and Twitter® as methods of raising brand awareness.

The influence of **trends** and the media on consumer choice	You will need to consider how consumer choices are influenced by trends and the media, including advertising through magazines, television, radio, sponsorship and outdoor advertising; product placement through film and television; product endorsement; and so on.
Categories of consumers include innovators, early adopters, early majority, late majority, laggards	  This in relation to how adopt consumers technology: • **Innovators** (risk takers) – are the first individuals to adopt an innovation. They are willing to take risks. • **Early adopters** (hedgers) – are the second fastest category to adopt an innovation. • **Early majority** (waiters) – the third group, tends to take more time to consider adopting new innovations and is inclined to draw from feedback from early adopters before taking the risk of purchasing new products/systems. • **Late majority** (skeptics) – adopts the innovation after it has been established in the marketplace and is seldom willing to take risks with new innovation. • **Laggards** (slow pokes) – are the last to adopt an innovation. They tend to prefer traditions and are unwilling to take risks.

5.7 Innovation, design and marketing specifications

Successful innovations typically start with detailed design and marketing specifications. Designers must establish clear parameters for a marketing specification in order to create unique and creative solutions to a problem. Designers need to collect valid and useful data from the target market and audience throughout the design cycle to ensure the specification includes certain essential components.

Target markets	When determining the target market, market sectors and segments need to be identified.
Target audiences	It is important to differentiate between the target market and the target audience. When determining the target audience, characteristics of the users should be established.
How a target audience is used to establish the characteristics of users	Who is most likely to buy this product given its benefits? How can the organization tap into the buying power of these consumers? Where is the target market most likely to find out about the product? Answering these questions helps you to position your product in the correct marketing and distribution channels.
Market analysis	An appraisal of economic viability of the proposed design from a market perspective, taking into account fixed and variable costs and pricing, is important. It is typically a summary about potential users and the market. 
User need	A marketing specification should identify the essential requirements that the product must satisfy in relation to market and user need.
Competition	A thorough analysis of competing designs is required to establish the market need. Every product you take to market, even ones that are new inventions or improvements on old products, face competition. This is because customers buy products for many different reasons. Some are interested in the innovation of new products, others care more about price point and clever marketing schemes. Your competition will capitalize on these buyer preferences and seek to edge out your product from the market. Identifying the competition in your marketing specification helps the organization to clarify how it can edge out and respond to the competition.
Research methods A thorough analysis of competing designs is required to establish the market need.	**Literature search** Usually performed using authoritative sources such as: academic journals, books, theses, consumer magazines, government agency and industry publications **User trial** A trial where members of the community who will use the product are observed using the product. This usually happens in a lab environment and participants have set tasks to perform under controlled conditions.

	User research The questioning of users about their experience using a product. Usually as a questionnaire or focus group. **Expert appraisal** Where an expert (chosen on the basis of their knowledge or experience) is asked to give their opinion. **Performance test** Where the product is tested and data is collected- crash test dummy
Design specifications	All of the requirements, constraints and considerations must be specific, feasible and measurable. A list of requirements, constraints and considerations that a yet-to-be-designed product must fulfil. The design specification must be developed from the design brief and research and requirements would include: • aesthetic requirements • cost constraints • customer requirements • environmental requirements • size constraints • safety considerations • performance requirements and constraints • materials requirements • manufacturing requirements

Topic Questions & Exam Practice

Figure 4 shows the Yogo – an electric scooter manufactured by Econogo and designed in a 1960s retro style. The idea for the Yogo came from James South after he left university looking for a business opportunity. South wanted to buy a scooter to travel around London. He was impressed by the electric cars on the market and wanted an electric scooter but the ones available worked on lead-acid batteries. South obtained enough funds to develop the Yogo which uses a 50V lithium battery. Lithium batteries are more expensive than lead-acid batteries but are more environmentally-friendly, lighter and can be easily removed from the scooter. The Yogo has a top speed of 50 km h^{-1} and a range of 22 miles before it needs recharging. Charging takes one hour and costs a fraction of the cost of using petrol (gas). Since the launch of the Yogo in 2010 other companies have developed similar products. The Yogo costs three times as much as a conventional petrol scooter.

Figure 4: Yogo electric scooter

(ii) Discuss the roles of inventor, innovator and entrepreneur in relation to James South's contribution to the evolution of the Yogo scooter. *[9]*

Figure 1 shows a mobile phone with a standard keypad. **Figure 2** shows a second phone with a QWERTY keypad with an individual key for each letter. Both phones have a full range of features, e.g. high resolution screen, internet connectivity, email and camera.

Figure 1: Mobile phone with standard keypad

Figure 2: Mobile phone with QWERTY keypad

Identify **one** market segment for which the mobile phone with a QWERTY keypad would be the preferred option. *2 marks*

.....

.....

Outline **one** way in which planned obsolescence influences the design specification of mobile phones. *2 marks*

.....

.....

.....

(a) State **one** issue relating to timber as a renewable resource. *[1]*

. . . . . .

. . . . . .

(b) Discuss the use of particle board (chipboard) for a student's desk in relation to planned obsolescence. *[3]*

Figure 4 and **Figure 5** show a Frisbee™ flying disc – a plastic disc-shaped glider 20–25 mm in diameter with a lip so it can be gripped easily. The disc is an aerofoil shape in cross-section allowing it to fly by generating lift as it moves through the air while spinning. Flying discs are thrown and caught as a game either for recreation or competition. There are many variations of Frisbee available.

The Frisbee was developed by Walter Morrison (US) in 1938, when he was playing a flying game on a beach using a cake pan as a disc. Onlookers offered Morrison money for the cake pan so they could play the game. After more design development work, Morrison sold the rights to his design to the toy company Wham-O who named the disc Frisbee. Further refinements improved the disc so it could be controlled more accurately.

Figure 4: Frisbee™ flying disc

[Source: http://en.wikipedia.org/wiki/File:Frisbee_090719.jpg by Wham-O]

Figure 5: The Frisbee™ in action

[Source: http://en.wikipedia.org/wiki/File:Frisbee_Catch-_Fcb981.jpg, by Eric Baetscher]

Outline the influence of market pull and technology push on the design of the Frisbee. *2 marks*

The invention of the transistor in 1947 led to many new innovative products. **Figure 1** shows the first portable all-transistor radio (the PAM710) to be launched in the UK (1956). It was an expensive item costing approximately one month's wages for many consumers. Further design development soon reduced the size of radios and the price. **Figure 2** shows a more recent design, the Roberts RD50G DAB (Digital Audio Broadcast) radio which is electricity or battery operated and has a scrolling text display allowing the user to tune into a station by scrolling through the list of station names and gain information on broadcasts.

Figure 1: UK's first portable radio, the PAM710

Figure 2: Roberts RD50G radio

Outline **one** possible reason for diffusion into the marketplace of the PAM radio in the 1950's. *2 marks*

Figure 8 shows the Water Craft life-saving aid designed by Ross Kemp as his final year project for his design degree. As a student, Ross undertook a lifeguard training course and realized that it was difficult to move a body through water single-handedly. Existing aids were either a paddle board or jet skis but these need two people to launch them. He based his new design on the jet ski but with a sloping back to make it easier to pull someone on it. After graduation, Ross decided to try and create a marketable version of his idea so he produced a number of prototypes to test. The initial testing with the Royal National Lifeboat Institution (UK) was not a great success so further prototypes were done to get to the pre-production stage. Funding for more testing at Bondi beach in Australia was gained after the Water Craft won first prize of £10000 in the Lloyds TSB Enterprise competition and sponsorship was raised from the media attention. **Figure 9** shows a scale model of the Water Craft.

Figure 8: Water Craft prototype

Figure 9: Ross Kemp and scale model

[Source: Image courtesy of Asap water crafts]

(ii) Discuss Ross Kemp as an inventor, innovator and entrepreneur. [9]

Figure 4 shows a wooden (bamboo) wireless keyboard and mouse. The wooden bamboo timber is grown in tropical conditions from a sustainable resource. The keyboard and mouse both have a water and stain resistant gloss finish and are powered by two small batteries. **Figure 5** shows a close up of the keys on the keyboard.

Figure 4: Wooden keyboard and mouse

Figure 5: Keyboard close-up

(ii) Discuss **three** potential target markets for the bamboo keyboard and mouse. [9]

Figure 4 shows leather satchels produced by the Cambridge Satchel Company (UK) available in a range of 10 bright colours and four sizes. **Figure 5** shows a detail of how the strap is joined to the bag. Natural brown leather satchels were popular with school children in the 1950s and 1960s until they became replaced by sports bags and rucksacks (backpacks). The target market for the Cambridge satchel is mainly adults.

Figure 4: Leather satchels

Explain the influence of fashion and planned obsolescence on the design of the satchel in **Figure 4**. [3]

Figure 7 shows the Dyson AM03 bladeless pedestal fan. It incorporates Air Multiplier™ Technology which multiplies the air that is drawn in from the surrounding environment by a factor of 15. In this way the Dyson fan generates smooth air flow. It has a fully variable speed, oscillates 90° and tilts through a range of 40°. It can extend from a minimum height of 1188 mm to a maximum of 1408 mm. **Figure 8** shows a conventional fan.

Figure 7: Dyson Bladeless fan

Figure 8: Conventional fan

(c) (i) Outline **one** way in which the Dyson fan has been designed to accommodate a wide percentile range. *[2]*

(ii) Suggest **three** advantages of the Dyson fan in Figure 7 compared to the conventional fan in Figure 8 in relation to ease of maintenance, safety and aesthetics. *[9]*

Figure 12 shows the first transparent toaster to go into commercial production. It is called Le Toaster Vision and is manufactured by Magimix. A user can see when the toast is brown enough. Four infra-red heating tubes provide the heat to toast the bread. The transparent walls comprise two panels of double insulated glass.

Figure 12: Le Toaster Vision by Magimix.

(c) (i) Outline **one** way in which planned obsolescence would influence the design specification of Le Toaster Vision. *[2]*

2. James Dyson invented the Ball-barrow in 1974 after becoming dissatisfied with the wheels of traditional wheelbarrows (see **Figure 5**) sinking into soft ground. The Ball-barrow has a ball-shaped wheel which rides over soft ground without sinking and absorbs shock when used on rough ground. It also has feet that don't sink in mud and a plastic bin that doesn't rust.

Figure 5: Traditional wheelbarrow

[http://en.wikipedia.org/wiki/File:2008-07-185_Construction_wheelbarrow_at_duke.jpg. Image by Ildar Sagdejev]

Figure 6: Dyson's Ball-barrow

www.dyson.co.uk. Used with permission.

(a) Outline **one** way in which Dyson's Ball-barrow is an example of constructive discontent. *[2]*

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(b) Identify **one** way in which Dyson might have worked with users to develop a clearer understanding of problems experienced with the traditional wheelbarrow. *[2]*

Figure 5 shows the Minima office bottle and can crusher manufactured by Reduit. The outer casing is made from a thermoplastic material. Inside the casing, metal plates are powered by an electric motor to crush plastic bottles and steel or aluminium cans to 20% of their original size. The crushed cans/bottles then drop into a plastic bag. The crusher is operated by pressing a button on the top surface which also has a digital screen to show how much carbon might have been saved each time it is used.

Figure 5: Minima Office Bottle/Can Crusher

[Source: www.minima-eco.com/howitworks. Used with permission.]

Outline how the ideas generating technique of adaptation has been used in the design of the crusher. *[2]*

Figure 9 shows the Breville Radio-Toaster designed in a 1950s retro style. The radio has an illuminated digital display and a facility for 10 pre-programmed radio stations. The toaster has a variable browning function and a mid-cycle cancellation button. The toaster also has a reheat function so cooled toast can be reheated without burning and a defrost button which lengthens the toasting time for use with frozen bread. The Radio-Toaster costs approx £50 (75USD).

Figure 9 : Breville Radio-Toaster

(a) (i) Outline **one** reason why the toaster has a variable browning function. *[2]*

(ii) Outline **one** reason why the toaster has a mid-cycle cancellation button. *[2]*

6. **Figure 4** shows the Samsung Navibot robot vacuum cleaner which sells for approximately US$ 600. It contains a system which allows it to take photographs of a room and use them to create an electronic map to navigate the optimal cleaning path. A sensor can tell when it is about to topple over the edge of a step, at which point the cleaner goes into reverse. The cleaner has 5 cleaning programmes for different surfaces, can be operated by remote control and will run for 90 minutes on a single charge after which it returns to a docking station to recharge.

(ii) Discuss **three** limitations of the Navibot as a potential successful innovation. *[9]*

Figure 9 shows the Breville Radio-Toaster designed in a 1950s retro style. The radio has an illuminated digital display and a facility for 10 pre-programmed radio stations. The toaster has a variable browning function and a mid-cycle cancellation button. The toaster also has a reheat function so cooled toast can be reheated without burning and a defrost button which lengthens the toasting time for use with frozen bread. The Radio-Toaster costs approx £50 (75USD).

Figure 9 : Breville Radio-Toaster

(i) Outline **one** disadvantage of the Radio-Toaster for the consumer. *[2]*

Figure 9 shows the Breville Radio-Toaster designed in a 1950s retro style. The radio has an illuminated digital display and a facility for 10 pre-programmed radio stations. The toaster has a variable browning function and a mid-cycle cancellation button. The toaster also has a reheat function so cooled toast can be reheated without burning and a defrost button which lengthens the toasting time for use with frozen bread. The Radio-Toaster costs approx £50 (75USD).

Figure 9 : Breville Radio-Toaster

(ii) Discuss the Radio-Toaster in relation to invention, innovation and design. *[9]*

Figure 4 shows the *Gtech* SW02 cordless floor cleaner. The cleaner was originally patented by Nick Grey in 2002 after he had spent a year of research and development during which time he produced many models and prototypes to test on friends and family. Grey used £20 000 of his savings to develop the floor cleaner which was manufactured in China and eventually launched onto the market in the US under the name *Shark Sweeper*. The product was an immediate success and then in 2003 was sold in the UK under the company name *Gtech*. Over 20 million sweepers have since been sold and Grey (who still owns 100 % of the company) has invented other products such as a lightweight hedge trimmer. The floor cleaner is suitable for all floor types; has a telescopic handle and runs for 60 minutes before it needs re-charging for 16 hours.

Figure 4: *Gtech* SW02 cordless floor cleaner

(ii) Explain why Nick Grey may be considered an inventor, innovator and entrepreneur. *[9]*

Glossary of Terms

Glossary of Terms

Topic 5: Innovation and design

Term	Definition
Act of insight (innovation strategies)	Often referred to as the "eureka moment", a sudden image of a potential solution is formed in the mind, usually after a period of thinking about a problem.
Adaptation (innovation strategies)	A solution to a problem in one field is used to provide a new idea for a design problem in another.
Analogy (innovation strategies)	An idea from one context is used to stimulate ideas for solving a problem in another context.
Architectural innovation	The technology of the components stays the same, but the configuration of the components is changed to produce a new design.
Chance (innovation strategies)	An unexpected discovery leads to a new idea.
Competition	Any company or product that can fulfil similar functions for a similar market.
Configurational innovation	A change is made in both technology and organization.
Copyright ©	A legal right that grants the creator of an original work exclusive ownership for its use and distribution. Usually for a limited time and within geographical boundaries, copyright allows the creator to receive compensation for their intellectual effort.
Design protection	A simple and cost-effective way to protect an innovative shape, appearance or ornamentation.
Design specification	A list of requirements, constraints and considerations that a yet-to-be-designed product must fulfil.
Diffusion (Markets)	The wide acceptance (and sale) of a product.
Disruptive innovation	A product or type of technology that challenges existing companies to ignore or embrace technical change
Drivers for invention	These include personal motivation to express creativity/for personal interest, scientific or technical curiosity, constructive discontent, desire to make money, desire to help others.
Early adopters	The second fastest category to adopt an innovation.
Early majority	The third fastest group to adopt an innovation, tends to take more time to consider adopting new innovations and is inclined to draw from feedback from early adopters before taking the risk of purchasing new products/systems.
Entrepreneur	An influential individual who can take an invention to market, often by financing the development, production and diffusion of a product into the marketplace.
First to market	The first product of its type to be released on the market.
Functional	Over time, products wear out and break down. If parts are no longer

obsolescence	available, the product can no longer work in the way it originally did. Also, if a service vital to its functioning is no longer available, it can become obsolete.
Innovation	The business of putting an invention in the marketplace and making it a success.
Innovators	The first individuals to adopt an innovation. They are willing to take risks.
Intellectual Property (IP)	A legal term for intangible property such as "creations of the mind" such as inventions and designs that are used in a commercial setting. Intellectual property is protected by law.
Invention	The process of discovering a principle. A technical advance in a particular field often resulting in a novel product.
Laggards	The last to adopt an innovation. They tend to prefer traditions and are unwilling to take risks.
Late majority	The fourth fastest group to adopt an innovation. They do so after it has been established in the marketplace and are seldom willing to take risks with new innovation.
Lone inventor	An individual working outside or inside an organization who is committed to the invention of a novel product and often becomes isolated because he or she is engrossed with ideas that imply change and are resisted by others.
Market analysis	An appraisal of economic viability of the proposed design from a market perspective, taking into account fixed and variable costs and pricing. It is typically a summary about potential users and the market.
Market pull (innovation strategies)	A new idea is needed as a result of demand from the marketplace.
Modular innovation	The basic configuration stays the same, but one or more key components are changed.
Multi-disciplinary approach	On occasion, the inventor is also the product champion and/or entrepreneur. This requires specific skill sets and actions to fulfil these roles and the reason inventors often take on multiple roles. Effective design draws from multiple areas of expertise, and this can be utilised at different stages of product development.
Patent	An agreement from a government office to give someone the right to make or sell a new invention for a certain number of years.
Patent pending	An indication that an application for a patent has been applied for but has not yet been processed. The marking serves to notify those copying the invention that they may be liable for damages (including back-dated royalties), once a patent is issued.
Planned obsolescence	A product becomes outdated as a conscious act either to ensure a continuing market or to ensure that safety factors and new technologies can be incorporated into later versions of the product.
Process innovation	An improvement in the organization and/or method of manufacture

	that often leads to reduced costs or benefits to consumers.
Product champion	An influential individual, usually working within an organization, who develops an enthusiasm for a particular idea or invention and "champions" it within that organization.
Product generations	A business practice in which a company releases a new group of products that have advanced features compared to an earlier group.
Product life cycle	A tool for mapping out the four stages of a product's commercial life: Launch; Growth; Maturity; Decline.
Product versioning	A business practice in which a company produces different models of the same product, and then charges different prices for each model.
Radical innovation	A high risk innovation strategy that introduces a new idea, system or product that is very different from the existing paradigm.
research methods	A thorough analysis of competing designs is required to establish the market need. Methods include user research, user trial, literature search, expert appraisal, performance test.
Rogers' characteristics of innovation and consumers	Five characteristics identified by Rogers that impact on consumer adoption of an innovation: Relative advantage; Compatibility; Complexity; Observability; Trial-ability.
Service Mark (SM)	A trademark used to identify a service rather than a product.
Shelved technology	Technology that is shelved for various reasons. Sometimes shelved technologies will be rediscovered or taken off the shelf.
Social roots of consumerism	Consumerism is concerned with protecting customers from all organisations where there is an exchange relationship. The roots of consumerism can be traces through: disillusionment with the system; the performance gap; the consumer information gap; antagonism toward advertising; impersonal and unresponsive marketing institutions; intrusions of privacy; declining living standards; special problems of the disadvantaged; different views of the marketplace.
Style (fashion) obsolescence	Fashions and trends change over time, which can result in a product no longer being desirable. However, as evidenced by the concept of retro styling and the cyclic nature of fashion, products can become desirable again.
Suppression (Markets)	A process where a new idea or adoption of a product by the market is actively slowed.
Sustaining innovation	A new or improved product that meets the needs of consumers and sustains manufacturers
Target audience	A specific group of people within the target market at which a product or the marketing message of a product is aimed at.
Target market	When determining the target market, market sectors and segments need to be identified.
Technological obsolescence	When a new technology supersedes an existing technology, the existing technology quickly falls out of use and is no longer

	incorporated into new products. Consumers instead opt for the newer, more efficient technology in their products.
Technology push (innovation strategies)	Scientific research leads to advances in technology that underpin new ideas.
Technology transfer (innovation strategies)	Technological advances that form the basis of new designs may be applied to the development of different types of products/systems, for example, laser technology.
Trademark ® or ™	A trademark is a symbol, word, or words legally registered or established by use as representing a company or product.
User need	The essential requirements that a product must satisfy in relation to the user.

DP DESIGN TECHNOLOGY

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Mr Moneeb

TOPIC 5: Guidance and Notes Booklet
2020 - 2022