MP482
PRODUCT DEVELOPMENT AND DESIGN

MODULE I

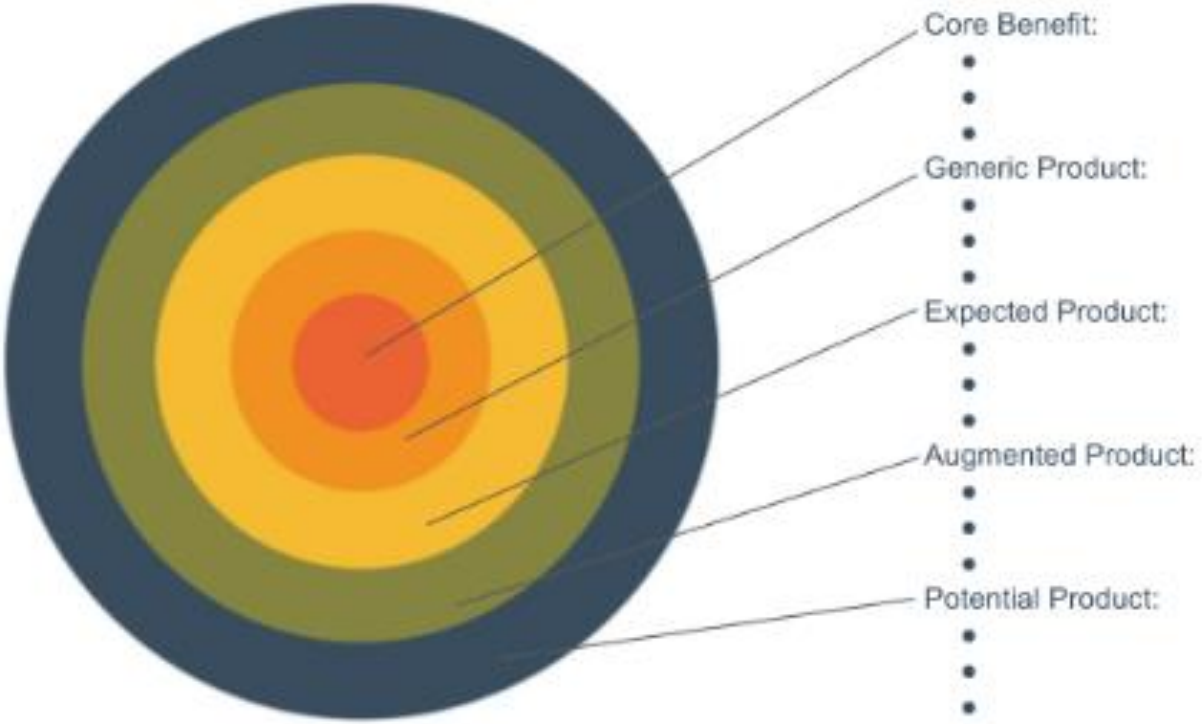
Introduction: Classification / Specifications of Products. Product life cycle. Product mix. Introduction to product design. Modern product development process. Innovative thinking. Morphology of design.

PRODUCT

- A product can be anything that can be offered to the market to satisfy a want or a need.
- A bundle of attributes, offering for use/consumption by the final customer
- **Products that are marketed include**
  - Physical goods
  - Services

LEVELS OF A PRODUCT

- 5 basic levels
- Each level adds more customer value
  - CORE BENEFIT
  - BASIC/GENERIC PRODUCT
  - EXPECTED PRODUCT
  - AUGUMENTED PRODUCT
  - POTENTIAL PRODUCT


Core Benefit:
Generic Product:
Expected Product:
Augmented Product:
Potential Product:

Levels of a Product

Core Benefit

- Explains what the buyer really buys
- The core benefit is the fundamental need or wants that the customer satisfies when they buy the product.
- For example, the core benefit of a hotel is to provide somewhere to rest or sleep when away from home.

Basic/Generic Product

- The generic product is a basic version of the product made up of only those features necessary for it to function.
- In our hotel example, this could mean a bed, towels, a bathroom, a mirror, and a wardrobe.

Levels of a Product

- Expected Product
  - The expected product is the set of features that the customers expect when they buy the product.
  - In our hotel example, this would include clean sheets, some clean towels, a clean bathroom.
  - Includes brand name, features, design, packaging, quality level, styling, styling, attributes, instructions manual
- Augmented Product
  - The augmented product refers to any product variations, extra features, or services that help differentiate the product from its competitors.
  - In our hotel example, this could be the inclusion of a concierge service or a free map or free wi fi of the town in every room.

Levels of a Product

- Potential Product
  - The potential product includes all augmentations and transformations the product might undergo in the future.
  - In our hotel, this could mean a different gift placed in the room each time a customer stays.
  - For example, it could be some chocolates on one occasion, and some luxury water on another.

TYPES OF PRODUCT

- Can be done in a variety of perspectives
- Consumer-Goods Classification
  - Classified on the basis of shopping habits
    - Convenience products
    - Shopping Products
    - Specialty Goods
    - Unsought Goods
  - Durability and Tangibility
    - Durable Goods and Non durable goods
    - Tangible and intangible goods
- Industrial-Goods Classification
  - Classified in terms of their relative cost and how they enter the production process
    - Materials & parts
    - Capital Items
    - Supplies and Services

Consumer-Goods Classification

- **Convenience products**
- Bought frequently, immediately with minimum comparison and buying effort.
- Inexpensive, frequently purchased.
- Staples, Impulse and emergency goods.
- Are low priced
- Available in many locations
- *e.g. Soap, candy, newspapers, fast food*

Consumer-Goods Classification

- **Shopping Goods**
  - Not as frequently as convenience products
  - Costly
  - Consumer does research before purchase.

Consumer-Goods Classification

- Specialty Goods
  - Unique features
  - Consumer is prepared to pay a premium price.
- Has unique characteristics or brand identification for which a significant group of buyer is willing to make a special purchase effort.

Consumer-Goods Classification

- **Unsought Product;**
- Consumer either does not know about/ knows about but does not normally think of buying it.
- Require a lot of advertising, personal selling and marketing efforts.
- *e.g. Life insurance, Encyclopedia.*

Industrial Products:

Industrial Products:

- Distinguished from consumer products on the basis of usage
  - **Materials & parts**
  - **Capital Items**
  - **Supplies and Services**
  - *e.g. A lawn mower.*

Industrial Products:

Materials & parts

i. ***Raw materials & parts:***

- - Farm products, (wheat, cotton, livestock, fruits, vegetables)
- - Natural products (fish, lumber, crude oils, iron ore)

ii. ***Manufactured materials & parts:***

- - component materials (iron yarn, cement, wires)
- - Component parts (small motors, tires, castings)

Industrial Products

- ***Capital items***

Aid in buyer's production or operations

i. *Installations:*

- Major purchases (factories, offices)
- fixed equipment (generators, elevators, computer systems)

ii. *Accessory equipments:*

- - Portable factory equipments and tools (hand
- tools, lift trucks)
- - Office equipments (computers, fax machines, desks)

Industrial Products

c. ***Supplies and Services:***

Are convenience products

i. Supplies

- Operating supplies (Lubricants, coal, paper, pencil)
- Repair and maintenance (paint, nails, brooms)

ii. Services

- Maintenance and repair services (window clearing, computer repair)
- Business advisory services (legal, management, consulting, advertising)

BASED ON DURABILITY AND TANGIBILITY

- **Nondurable Goods**
  - Tangible goods consumed in one or few uses
  - Purchased frequently
  - Strategy : availability , low priced , heavily advertised

BASED ON DURABILITY AND TANGIBILITY

- **Durable Goods**
  - Tangible goods that survive many uses
  - Require more personal selling and service
  - Higher margins and requires seller guarantee

BASED ON DURABILITY AND TANGIBILITY

- Services
  - Intangible product
  - Requires more quality control and credibility

PRODUCT LINE

- **Product Line :** A group of products that are closely related because they function in a similar manner, are sold to the same customer groups, are marketed through the same types of outlets, or fall within given price ranges.
- A product line is that combination of products which;
  - Belongs to a single manufacturer
  - Shares similar Attributes
  - Serves the common general purpose but;
  - Targets different market segments

PRODUCT MIX

- A Product Mix is the set of all products and items a particular seller offers for sale.
- **A product mix has certain width, length, depth and consistency**
- The width of a product mix refers to how many different product lines the company carries.
- Product Length refers to the total number of items the company carries within its product lines.
- The depth of a product mix refers to how many variants are offered for each product in the line.
- The consistency of the product mix describes how closely related the various product lines are in the end use.

Product Mix of ITC

FMCG	Hospitality	Paperboard & Speciality Papers	Packaging	Agri Business	Information Technology
Cigarettes & Cigars	Hotels	Coated Boards	Carton Board Packaging	Agri Commodities and Rural Services	ITC Infotech
Foods	Branded Accommodation	Graphic Boards	Flexible Packaging	Agri Business-ILTD	
Personal Care	Restaurants	Fine Papers	Tobacco Packaging	E-Choupal	
Education & Stationery		Thin Printing Papers			
Lifestyle Retailing					
Agarbatti					
Safety Matches					

Product Mix of ITC

Cigarettes	Foods	Personal Care	Stationery	Lifestyle Retailing	Safety Matches	Agarbatties
Insignia	Aashirvaad	Essenza Di Wills	Classmate	Wills Lifestyle	Aim	Mangaldeep
India Kings	Sunfeast	Vivel	Paperkraft	John Players	I Kno	
Wills Navy Cut	Bingo	Fiama DI WIlls				
Classic Regular	Kitchens of India	Engage				
Gold Flake	Yippee	Superia				
Navy cut	B Natural Juices	Vivel Cell Renew				
Bristol	Mint -o	Savlon				
	Candyman	Shower to Shower				

Product Specifications

- Customer needs are generally expressed in the “language of the customer.”
- Customer needs are typical in terms of the subjective quality of the expressions.
- For this reason, development teams usually establish a set of specifications, which spell out in precise, measurable detail *what* the product has to do.
- Product specifications do not tell the team *how* to address the customer needs.
- Establishing specification is a two stage process.
- Target specifications and final specifications

Product Specifications

- A *specification* (singular) consists of a *metric* and a *value*.
- For example, “average time to assemble” is a metric, while “less than 75 seconds” is the value of this metric.
- Note that the value may take on several forms, including a particular number, a range, or an inequality.
- Values are always labeled with the appropriate units

(e.g., seconds, kilograms, joules).

Together, the metric and value form a specification.

Procedure for establishing target specifications

1. Identify a list of metrics and measurement units that sufficiently address the needs
2. Collect the competitive benchmarking information
3. Set ideal and marginally acceptable target values for each metric (using at least, at most, between, exactly, etc.)
4. Reflect on the results and the process

Step 1:List of Metrics

- Metric list should reflect the degree to which the product satisfies that need.
- For example, consider the need that the suspension be “easy to install.”
- The team may conclude that this need is largely captured by measuring the time required for assembly of the fork to the frame.

Features of a metric

- ***Metrics should be complete.***
- ***Metrics should be practical.***
- ***Some needs cannot easily be translated into quantifiable metrics.***
- ***The metrics should include the popular criteria for comparison in the marketplace.***

Product Specifications Example: Mountain Bike Suspension Fork

Start with the Customer Needs

#	NEED		Imp
1	The suspension	reduces vibration to the hands.	3
2	The suspension	allows easy traversal of slow, difficult terrain.	2
3	The suspension	enables high speed descents on bumpy trails.	5
4	The suspension	allows sensitivity adjustment.	3
5	The suspension	preserves the steering characteristics of the bike.	4
6	The suspension	remains rigid during hard cornering.	4
7	The suspension	is lightweight.	4
8	The suspension	provides stiff mounting points for the brakes.	2
9	The suspension	fits a wide variety of bikes, wheels, and tires.	5
10	The suspension	is easy to install.	1
11	The suspension	works with fenders.	1
12	The suspension	instills pride.	5
13	The suspension	is affordable for an amateur enthusiast.	5
14	The suspension	is not contaminated by water.	5
15	The suspension	is not contaminated by grunge.	5
16	The suspension	can be easily accessed for maintenance.	3
17	The suspension	allows easy replacement of worn parts.	1
18	The suspension	can be maintained with readily available tools.	3
19	The suspension	lasts a long time.	5
20	The suspension	is safe in a crash.	5

Establish Metrics and Units

Metric #	Need #s	Metric	Imp	Units
1	1,3	Attenuation from dropout to handlebar at 10hz	3	dB
2	2,6	Spring pre-load	3	N
3	1,3	Maximum value from the Monster	5	g
4	1,3	Minimum descent time on test track	5	s
5	4	Damping coefficient adjustment range	3	N-s/m
6	5	Maximum travel (26in wheel)	3	mm
7	5	Rake offset	3	mm
8	6	Lateral stiffness at the tip	3	kN/m
9	7	Total mass	4	kg
10	8	Lateral stiffness at brake pivots	2	kN/m
11	9	Headset sizes	5	in
12	9	Steertube length	5	mm
13	9	Wheel sizes	5	list
14	9	Maximum tire width	5	in
15	10	Time to assemble to frame	1	s
16	11	Fender compatibility	1	list
17	12	Instills pride	5	subj
18	13	Unit manufacturing cost	5	US$
19	14	Time in spray chamber w/o water entry	5	s
20	15	Cycles in mud chamber w/o contamination	5	k-cycles
21	16,17	Time to disassemble/assemble for maintenance	3	s
22	17,18	Special tools required for maintenance	3	list
23	19	UV test duration to degrade rubber parts	5	hours
24	19	Monster cycles to failure	5	cycles
25	20	Japan Industrial Standards test	5	binary
26	20	Bending strength (frontal loading)	5	MN

Link Metrics to Needs

	Need \ Metric	1 Attenuation from dropout to handlebar at 10hz	2 Spring pre-load	3 Maximum value from the Monster	4 Minimum descent time on test track	5 Damping coefficient adjustment range	6 Maximum travel (26in wheel)	7 Rake offset	8 Lateral stiffness at the tip	9 Total mass	10 Lateral stiffness at brake pivots	11 Headset sizes	12 Steertube length	13 Wheel sizes	14 Maximum tire width	15 Time to assemble to frame	16 Fender compatibility	17 Instills pride	18 Unit manufacturing cost	19 Time in spray chamber w/o water entry	20 Cycles in mud chamber w/o contamination	21 Time to disassemble/assemble for maintenance	22 Special tools required for maintenance	23 UV test duration to degrade rubber parts	24 Monster cycles to failure	25 Japan Industrial Standards test	26 Bending strength (frontal loading)
1	reduces vibration to the hands.	•		•	•																						
2	allows easy traversal of slow, difficult terrain.		•																								
3	enables high speed descents on bumpy trails.	•		•	•																						
4	allows sensitivity adjustment.					•																					
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8	provides stiff mounting points for the brakes.										•																
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18	can be maintained with readily available tools.																						•				
19	lasts a long time.																							•	•		
20	is safe in a crash.																									•	•

Benchmark on Metrics

Metric #	Need #s	Metric	Imp	Units	ST Tritrack	Maniray 2	Rox Tahx Quadra	Rox Tahx Ti 21	Tonka Pro	Gunhill Head Shox
1	1,3	Attenuation from dropout to handlebar at 10hz	3	dB	8	15	10	15	9	13
2	2,6	Spring pre-load	3	N	550	760	500	710	480	680
3	1,3	Maximum value from the Monster	5	g	3.6	3.2	3.7	3.3	3.7	3.4
4	1,3	Minimum descent time on test track	5	s	13	11.3	12.6	11.2	13.2	11
5	4	Damping coefficient adjustment range	3	N-s/m	0	0	0	200	0	0
6	5	Maximum travel (26in wheel)	3	mm	28	48	43	46	33	38
7	5	Rake offset	3	mm	41.5	39	38	38	43.2	39
8	6	Lateral stiffness at the tip	3	kN/m	59	110	85	85	65	130
9	7	Total mass	4	kg	1.409	1.385	1.409	1.364	1.222	1.1
10	8	Lateral stiffness at brake pivots	2	kN/m	295	550	425	425	325	650
11	9	Headset sizes	5	in	1.000 1.125	1.000 1.125 1.250	1.000 1.125	1.000 1.125 1.250	1.000 1.125	NA
12	9	Steertube length	5	mm	150 180 210 230 255	140 165 190 215	150 170 190 210	150 170 190 210 230	150 190 210 220	NA
13	9	Wheel sizes	5	list	26in	26in	26in	26in 700C	26in	26in
14	9	Maximum tire width	5	in	1.5	1.75	1.5	1.75	1.5	1.5
15	10	Time to assemble to frame	1	s	35	35	45	45	35	85
16	11	Fender compatibility	1	list	Zefal	none	none	none	none	all
17	12	Instills pride	5	subj	1	4	3	5	3	5
18	13	Unit manufacturing cost	5	US$	65	105	85	115	80	100
19	14	Time in spray chamber w/o water entry	5	s	1300	2900	>3600	>3600	2300	>3600
20	15	Cycles in mud chamber w/o contamination	5	k-cycles	15	19	15	25	18	35
21	16,17	Time to disassemble/assemble for maintenance	3	s	160	245	215	245	200	425
22	17,18	Special tools required for maintenance	3	list	hex	hex	hex	hex	long hex	hex, pin wrnch
23	19	UV test duration to degrade rubber parts	5	hours	400+	250	400+	400+	400+	250
24	19	Monster cycles to failure	5	cycles	500k+	500k+	500k+	480k	500k+	330k
25	20	Japan Industrial Standards test	5	binary	pass	pass	pass	pass	pass	pass
26	20	Bending strength (frontal loading)	5	MN	55	89	75	75	62	102

Assign Marginal and Ideal Values

	Metric	Units	Marginal Value	Ideal Value
1	Attenuation from dropout to handlebar at 10hz	dB	>10	>15
2	Spring pre-load	N	480 - 800	650 - 700
3	Maximum value from the Monster	g	<3.5	<3.2
4	Minimum descent time on test track	s	<13.0	<11.0
5	Damping coefficient adjustment range	N-s/m	0	>200
6	Maximum travel (26in wheel)	mm	33 - 50	45
7	Rake offset	mm	37 - 45	38
8	Lateral stiffness at the tip	kN/m	>65	>130
9	Total mass	kg	<1.4	<1.1
10	Lateral stiffness at brake pivots	kN/m	>325	>650
11	Headset sizes	in	1.000 1.125	1.000 1.125 1.250
12	Steertube length	mm	150 170 190 210	150 170 190 210 230
13	Wheel sizes	list	26in	26in 700c
14	Maximum tire width	in	>1.5	>1.75
15	Time to assemble to frame	s	<60	<35
16	Fender compatibility	list	none	all
17	Instills pride	subj	>3	>5
18	Unit manufacturing cost	US$	<85	<65
19	Time in spray chamber w/o water entry	s	>2300	>3600
20	Cycles in mud chamber w/o contamination	k-cycles	>15	>35
21	Time to disassemble/assemble for maintenance	s	<300	<160
22	Special tools required for maintenance	list	hex	hex
23	UV test duration to degrade rubber parts	hours	>250	>450
24	Monster cycles to failure	cycles	>300k	>500k
25	Japan Industrial Standards test	binary	pass	pass
26	Bending strength (frontal loading)	MN	>70	>100

Process for setting the final specifications

1. Develop technical models to assess technical feasibility. The input is design variable and the output is a measurement using a metric.
2. Develop a cost model of the product.
3. Refine the specifications, making tradeoffs, where necessary to form a competitive map.
4. "Flow down" the final overall specs to specs for each subsystem (component and part).
5. Reflect on the results to see
   - ❖ Whether the product is a winner, and/or
   - ❖ How much uncertainty there is in the technical and cost model, or
   - ❖ Whether there is a need to develop a better technical model.

Set Final Specifications

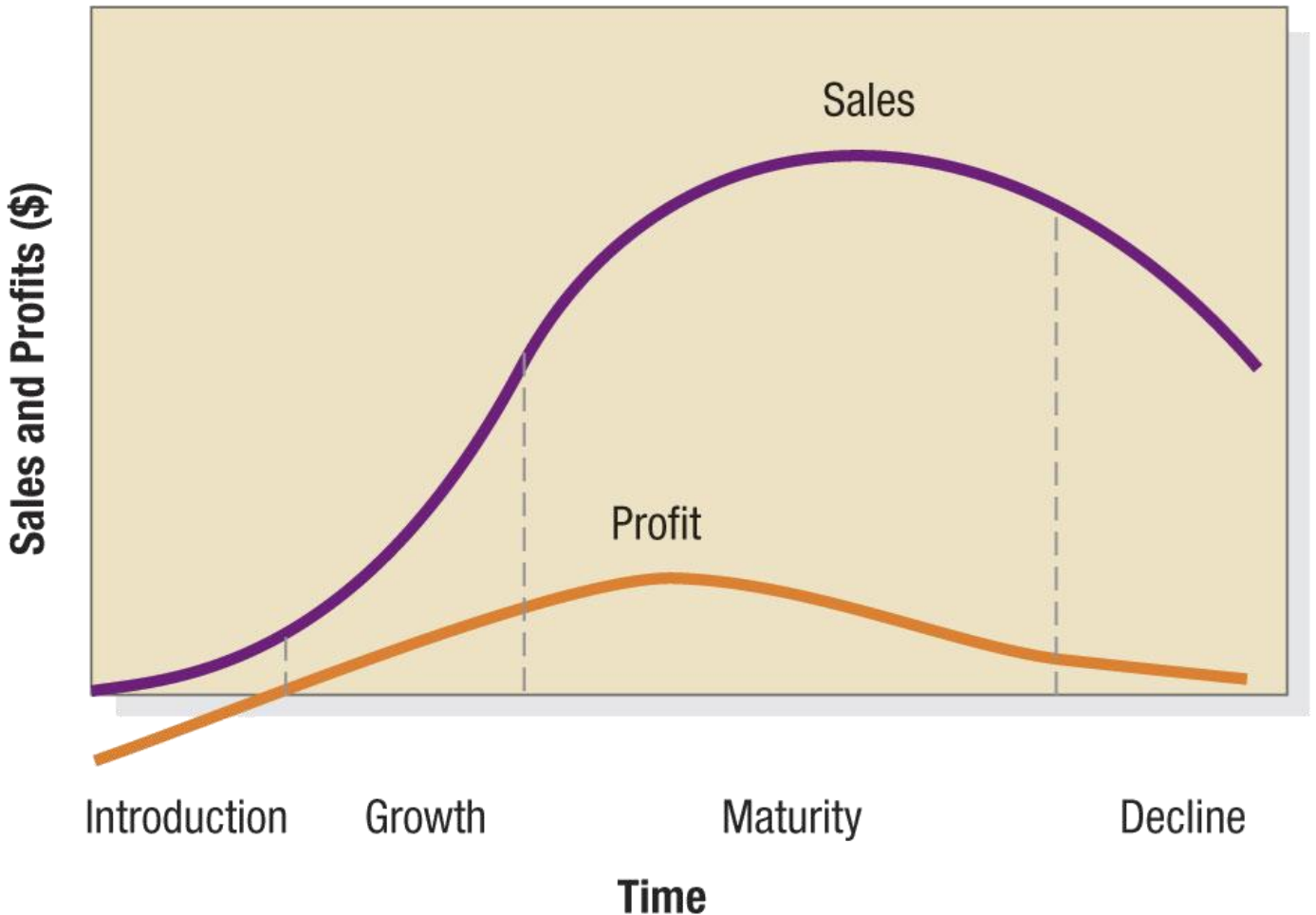
	METRIC	Units	Value
1	Attenuation from dropout to handlebar at 10hz	dB	>12
2	Spring pre-load	N	650
3	Maximum value from the Monster	g	<3.4
4	Minimum descent time on test track	s	<11.5
5	Damping coefficient adjustment range	N-s/m	>100
6	Maximum travel (26in wheel)	mm	43
7	Rake offset	mm	38
8	Lateral stiffness at the tip	kN/m	>75
9	Total mass	kg	<1.4
10	Lateral stiffness at brake pivots	kN/m	>425
11	Headset sizes	in	1.000 1.125
12	Steertube length	mm	150 170 190 210 230
13	Wheel sizes	list	26in
14	Maximum tire width	in	>1.75
15	Time to assemble to frame	s	<45
16	Fender compatibility	list	Zefal
17	Instills pride	subj	>4
18	Unit manufacturing cost	US$	<80
19	Time in spray chamber w/o water entry	s	>3600
20	Cycles in mud chamber w/o contamination	k-cycles	>25
21	Time to disassemble/assemble for maintenance	s	<200
22	Special tools required for maintenance	list	hex
23	UV test duration to degrade rubber parts	hours	>450
24	Monster cycles to failure	cycles	>500k
25	Japan Industrial Standards test	binary	pass
26	Bending strength (frontal loading)	MN	>100

PRODUCT LIFE CYCLE

- Describes the advancement of products through identifiable stages of their existence.
- Product passes through the series of stages-their life cycle from the time they introduce in the market untill they are withdrawn
- The Product Life Cycle Concept is Based on Four Premises
  - Products have a limited life
  - Product sales pass through distinct stages each with different challenges and opportunities
  - Profits rise and fall at different stages
  - Products require different strategies in each life cycle stage

PRODUCT LIFE CYCLE

- The product will typically passes through four major stages in its life



PRODUCT LIFE CYCLE:INTRODUCTION

- Here the product is introduced in the market.
- The objective of this stage to create awarness and trial of the product launched
- Features of this stage are
  - Costs are high
  - Few competitiors
  - Sales and Profits are low
  - Relatively high prize
  - More money spend for promotion
  - Covers less market

PRODUCT LIFE CYCLE:GROWTH

- Product gets into more customers
- Objective is to maximize market share
- Features of this stage are
  - Sales rise rapidly
  - Profit at peak level
  - Price decreases
  - Increasing competitions
  - Unit cost decline
  - Mass market approach
  - Better revenue generation

PRODUCT LIFE CYCLE:MATURITY

- Here the sales continue to rise but more slowly
- The objective is to maximize profits defending market share.
- Features are
  - Profit gets stable
  - Competition at its peak
  - Price reduces further
  - Mass market
  - Product is established and promotion expenditures are less
  - Little growth potential for the product
  - Converting customers product to your own is a major challenge in maturity stage

PRODUCT LIFE CYCLE:DECLINE

- Here the sales decline permanently
- Objective is to reduce expenditure and sell the brand
- In this stage the expenditure begin to equal the profits or worse
- Features are
  - Market is saturated
  - Sales and profit decline
  - Company become cost conscious
  - Resources are blocked
  - Three options left
    - Repositioning or Rebranding
    - Amintain the product and reduces its cost
    - Take the product off the market

SUMMARY OF PRODUCT LIFE CYCLE FEATURES

Stages	**Introduction**	**Growth**	**Maturity**	**Decline**
Objectives	Create Product Awareness and Trial	Maximize Market Share	Maximize Profit when defending market share	Reduce expenditure and dilute the brand
Sales	Low Sales	Rapidly Increasing Sales	Peak Sales	Sales decline
Costs	High Cost Per Customer	Average cost per customer	Low cost per customer	High Cost
Profits	Negative	More Profit	High Profit	No profit
Customer	Innovators	Early Adopters	Early Majority +Late Majority	
Competitor	Few	More in Number	Stable Number, Beginning to decline	New comers

SUMMARY OF PRODUCT LIFE CYCLE STRATEGIES

Stages	**Introduction**	**Growth**	**Maturity**	**Decline**
Product	Basic product	Offer Product Extensions, Warranty	Diversify Brand and Models	Phase out weak items
Prize	Use cost plus	Price to penetrate market	Price to match or beat competitors	Cut price
Distribution	Build Selective Distribution	Build Intensive Distribution	Build More intensive Distribution	Go Selective :Phase out unprofitable outlets
Advertising	Build product awareness among early adopters and desires	Build awareness and interest in the mass market	Brand Differences and benefits	Reduce to retain hard core loyal
Sales promotion	Use heavy sales promotion	Reduce to take advantage of heavy consumer demand	Increase to encourage brand switching	Reduce to minimum level

New-Product Failures

- Why do new products fail?
  - Overestimation of market size.
  - Product design problems.
  - Incorrectly positioned, priced, or advertised.
  - Pushed by high level executives despite poor marketing research findings.
  - Excessive development costs.
  - Competitive reaction.

Product Development Process

- 0. Planning
- 1. Concept development
- 2. System level design
- 3. Detail design
- 4. Testing and refining
- 5. Production ramp-up
- 6.Marketing strategy development
- 7.Business analysis
- 8.Test marketing
- 9.Commercialization

Product Development Process

- **0. *Planning***
- The planning activity is often referred to as "phase zero" because it precedes the project approval and launch of the actual product development process.
- This phase begins with opportunity identification and assessment of technology developments
- The output of the planning phase is the project mission statement, which specifies the target market for the product, business goals, key assumptions and constraints.

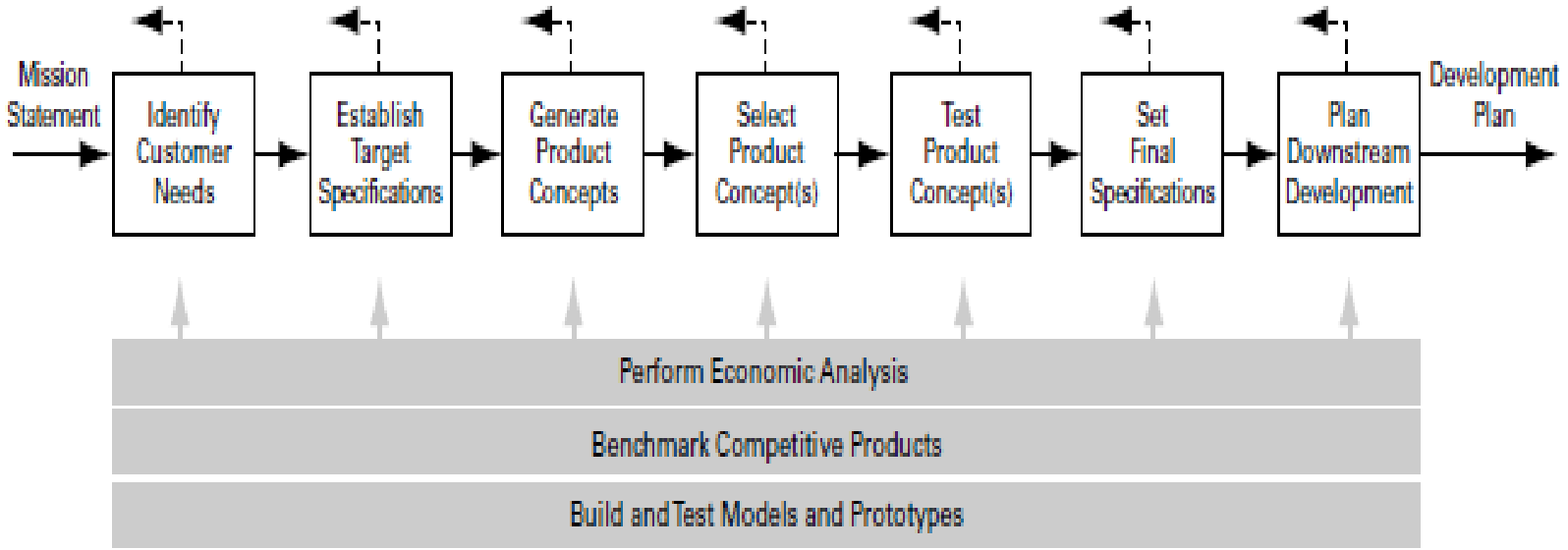
Concept Development

- The needs of the target market are identified, alternative product concepts are generated and evaluated, and a single concept is selected for further development.
- A concept is a description of the form, function and features of a product and is usually accompanied by a set of specifications, an analysis of competitive products, and an economic justification of the project.

Concept Development Steps

- Identify customer needs
- Establish target specification
- Analyze competing products
- Generate design concepts
- Select best design concept
- Refine specifications
- Economic analysis
- Project Planning

Concept Development Steps



System-level design:

- The system-level design phase includes the definition of the product architecture, decomposition of the product into subsystems and components, and preliminary design of key components.
- Initial plans for the production system and final assembly are usually defined during this phase as well.
- The output of this phase usually includes a geometric layout of the product, a functional specification of each of the product's subsystems, and a preliminary process flow diagram for the final assembly process.

Detail design:

- The output of this phase is the control documentation for the product—the drawings or computer files describing the geometry of each part and its production tooling, the specifications of the purchased parts, and the process plans for the fabrication and assembly of the product.
- In the detail design phase, are: materials selection, production cost, and robust performance are finalized

Testing and refinement:

- The testing and refinement phase involves the construction and evaluation of multiple preproduction versions of the product.
- Early(alpha) prototypes are usually built parts with the same geometry and material properties but not necessarily fabricated with the actual processes to be used in production.
- Alpha prototypes are tested to determine whether the product will work as designed
- Later (beta) prototypes are usually built with parts supplied by the intended production processes but may not be assembled using the intended final assembly process.
- Beta prototypes are extensively evaluated internally and are also typically tested by customers in their own use environment.

Production ramp-up:

- In the production ramp-up phase, the product is made using the intended production system.
- Products produced during production ramp-up are sometimes supplied to preferred customers and are carefully evaluated to identify any remaining flaws.
- A post launch project review may occur shortly after the launch.
- This review includes an assessment of the project from both commercial and technical perspectives and is intended to identify ways to improve the development process for future projects.

Marketing strategy development:

- Part One:
  - Describes the target market, planned value proposition, sales, market share, and profit goals.
- Part Two:
  - Outlines the product's planned price, distribution, and marketing budget.
- Part Three:
  - Describes the planned long-run sales and profit goals, marketing mix strategy.

Business analysis:

- Involves a review of the sales, costs, and profit projections to assess fit with company objectives.
- If results are positive, project moves to the product development phase.

Test marketing:

- Product and marketing program are introduced in a more realistic market setting.
- Not needed for all products.
- Can be expensive and time consuming, but better than making a major marketing mistake.

Commercialization:

- Must decide on **timing** (i.e., when to introduce the product).
- Must decide on **where** to introduce the product (e.g., single location, state, region, nationally, internationally).
- Must develop a **market rollout** plan.

Morphology of Design

- Morphology of design is a study of the chronological structure of the design project.
- It is defined by phases and their constituent steps.
- Consist of Seven Phases
- Of the seven phases, the first three phases belong to design, and the remaining four phases belong to production ,distribution consumption and retirement.

Morphology of Design

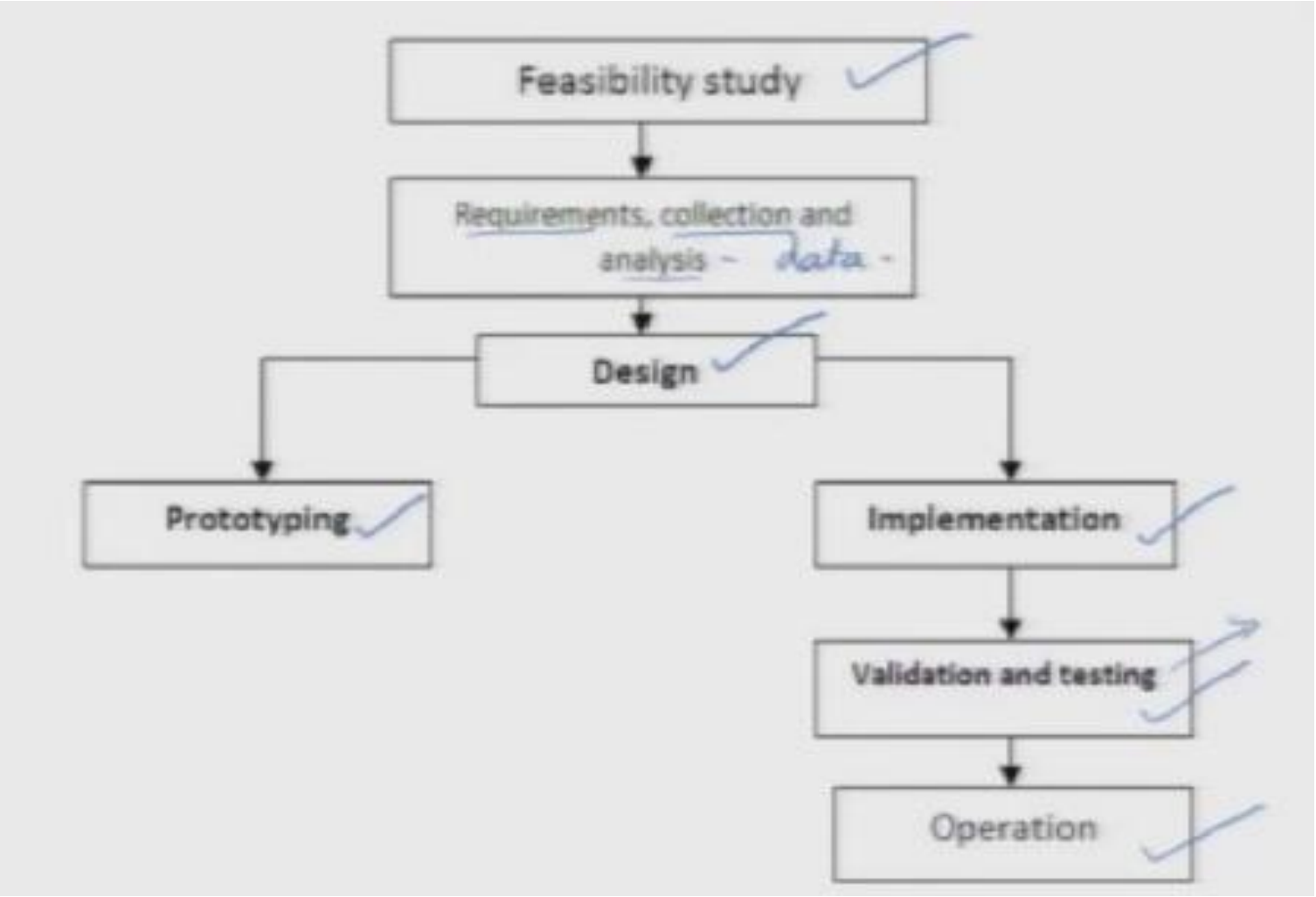
- Design process begins with the realization of unfulfilled needs of the society and ends with satisfying them.
- Engineering product design is concerned only with what is feasible.
- Necessary requirements are physical reliability and utility.

Morphology of Design

Phase 1:Feasibility Study

- Verify current existence of needs
- Explore design problems with constraints.
- Effort to seek number of feasible solutions
- Sorting of potential useful solutions from feasible set.
- In feasibility study ,the requirements, collection and analysis have to be done.
- Then what we do is we try to develop a design.
- If it is a product then we try to develop a prototype or if it is a solution software, we try to do implementation, validation and test our results and then we put into operation.

Phase 1:Feasibility Study



Phase 2:Preliminary Design

- Preliminary design phase starts with a set of useful solutions which were developed in the feasibility study.
- The purpose of the preliminary study is to find the best design alternatives.
- The purpose of this preliminary study is to establish which of the preferred alternative is the best design solutions.
- Surveying solution is tentatively accepted for closer examination
- Methods like FEA,CFD are used

Phase 2:Preliminary Design

- It involves
  - Formulation of mathematical models
  - Sensitivity Analysis
  - Formal optimisation
  - Simplification

Phase 3:Detailed Design

- After preliminary design, other studies examine the extent to which forces from surrounding or internal forces which affect the stability of the system
- The goal here is to furnish the engineering description of the examined design.
- The great flexibility is to show up to them at this point in designing.
- The preliminary design is developed as a master layout with this as a basis the detailed design or the specification of the component is carried out
- After the detailed design is done, now people look forward to local vendors, people look for international vendors, they try to pass on the design and then they ask them can you give the costing for it.

Phase 4:Planning for Production

- Fixed engineering specification, engineering design constraints are set in earlier phases now we think about manufacturing processes.
- As mentioned in the three phases are in the field of engineering design, but the fourth phase and further are related towards management.
- Every part requires a detail process plan.
- There is a process sheet which will be developed for each individual product, and then there will be more information about what is to be what all changes have to happen to the part such that it becomes a product ok.
- So, then the operation analysis is also performed.

Phase 5:Planning for Distribution

- Transportation cost can affect the outer design of the product.
- To facilitate handling special strapping and palletizing may be needed.(Eg:Cot)
- Major activities are
  - Planning the packaging system
  - Planning the warehouse facility
  - Planning the promotional activity
  - Designing the product for conditions arising in distribution

Phase 6:Planning for consumption

- The consumption in is the third process in the production-consumption cycle.
- It influences on the designs design.
- So, design for consumption includes the following factors.
  - Design for operation,
  - design for reliability,
  - design for convenience in use.
  - Design for safety
  - Design for aesthetic features
  - Design for maintenance
  - Design for adequate duration of services

Phase 7:Planning for retirement

- Last phase in the sequence of design of morphology.
- For large and semi permanent installation the removal may pose difficult engineering problems.
- Often goods are retired more frequently because of technical obsolescence than for physical deterioration.
- It may consider following aspects
  - Designing to reduce the rate of obsolescence
  - Designing the physical life to match anticipated service life.