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# BSD 414 DESIGN THINKING

## Lecture 1 Topical Notes

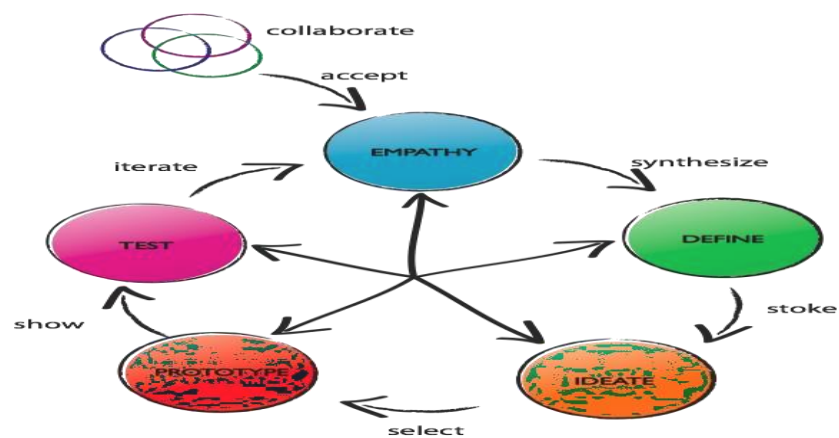
### Fundamentals of Design Thinking

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# 1 Introduction

## Introduction to Design

Depending on the industry we are talking about, design can have many different definitions. Most generally, “design” is a process for deliberately creating a product to meet a set of needs. Mobile app development requires both engineering design and product design. Engineering design focuses on physics, such as speed, mass and other performance measures while product design also considers user and consumers by asking what the user wants in a product. Thus, Design is a realization of a concept or idea into a configuration, drawing or a product.



## Characteristics of successful product development



A product is something sold by an enterprise to its customers or a product is a set of attributes offered to customers to fulfill their needs or requirements. It is obtained by conversion of raw material. The product is an entity for which clear idea of its design and development is known. The purpose of the product should be clearly visible.

### **Product Design & Development (PDD)**

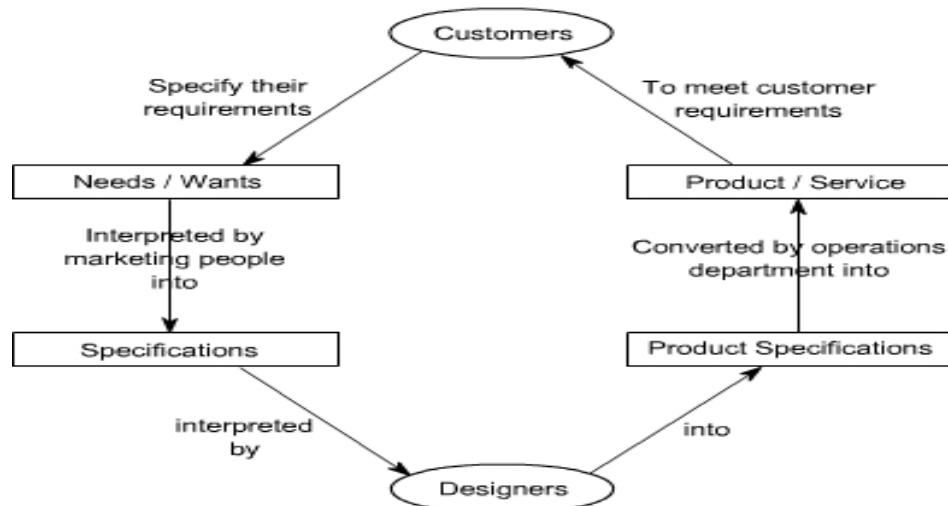
- Basic need of every manufacturing company
- Consumers want and expect new and better products
- Not to innovate approach is becoming increasingly risky
- Innovating new product is expensive and risky

### **What is product development?**

- Product Development is the set of activities, beginning with the perception of a market opportunity and ending in the production, sales and delivery of a product.
- The goal of the subject is to present a clear and detailed way a set of product development methods while focusing together the marketing, Design and manufacturing functions of the organization.



## Product Development Process



Product development is an interdisciplinary activity requiring contribution from the following three functions.

### Marketing

### Design



### Manufacturing



**Marketing:** The marketing function mediates the interactions between the firm and its customers. Marketing also typically arranges for communication between the firm and its customers, sets target prices and oversees the launch and promotion of the

product.

**Design:** The design function plays the lead role in defining the physical form of the product to best meet customer needs. In this context, the design function includes engineering design (mechanical, electrical, software etc.) and industrial design (aesthetics, ergonomics, user interfaces).

**Manufacturing:** The manufacturing function is primarily responsible for designing and operating the production system in order to produce the product. Broadly defined, the manufacturing function also often includes purchasing, distribution and installation. This collection of activities is sometimes called the supply chain.

## **Elements of a Product Development Team**

### **Project team**

Few products are developed by a single individual. The collection of individuals developing a product forms the project team. This team usually has a single team leader who could be drawn from any of functions of the firm. The team can be thought of as consisting of a core team and an extended team.

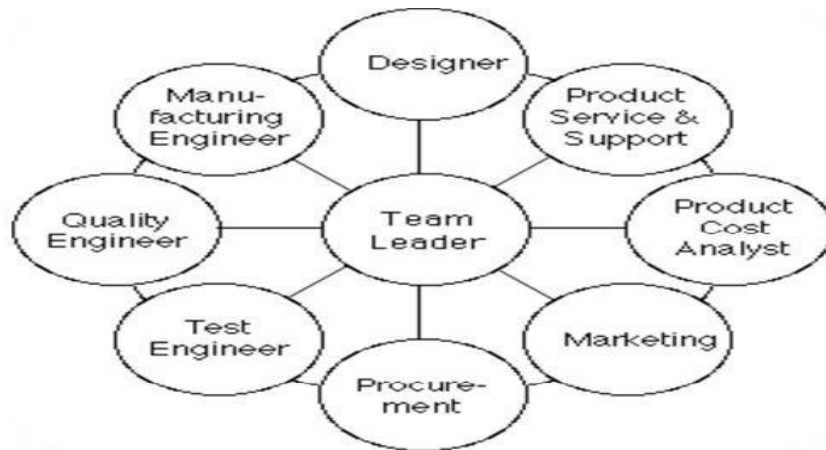
### **Core team**

In order to work together effectively, the core team usually remains small enough to meet in a conference room.

### **Extended team**

While the extended team may consist of dozens, hundreds or even thousands of other members.

### **Development Team**



### **Reasons for expensive and risky:**

- Most of the product ideas which go to product development stage never reach the market due to non availability of money, technology, manpower or due to change in demand.

- Many products that do reach the market are not successful mainly due to inferior quality, high product cost, poor functionality, poor marketing skills or change in demand.
- Successful products tend to have a shorter life due to change in demand, stiff competition or rapid technological changes.

Thus, management finds itself in a dilemma, it must develop new product, yet the odds weight heavily against their success.

### **Product identification related factors:**

- Gap in demand i.e. Demand > Supply
- Under-utilized resources-contract manufacturing– lending of facilities
- Diversification- limited customer base
- New product ideas- friends, co-workers, environment.

### **Product Analysis**

- Performed before actual design starts
- It is based on the information collected about the customer's requirements and the level of competition.
- Its objective should be to satisfy as many functions as possible.
- Its objective should be to keep the product cost as low as possible.
- It is a trade off b/w product cost and functionality.
- It focuses on multiple product concepts

### **Why Product Analysis is So Imp.?**

- Design modifications are more expensive at later stage of product life.
- Design modifications are unwelcomed, once the product is launched
- Design modifications at later stage also delay the launch of a new product.

### **Several aspects are considered for product analysis:**

- Functionality aspect
- Operational aspect
- Quality aspect
- Reliability aspect
- Durability aspect
- Maintainability aspect
- Aesthetic aspect

### **Factors to study for PDD**

- **Marketing related factors**
- Prestige of the company
- Technologically sound products
- Customer's requirements
- Market potential
- Product life
- Competition

### **Stages in Product life Cycle**

- Introduction
- Growth
- Maturity
- Decline

### **Legal Factors**

- Environment pollution
- Import restriction on capital goods
- Restriction on finance

### **Finance related factors**





- Capital investment-manufacturing resources, plant and machinery
- Cash generation
  - Govt. support
  - Shares
  - Fixed Deposits

### **Manufacturing related factors**

- Availability of technological know-how- its cost, related equipments
- Cost of Manufacturing facilities
- Quality of manufactured products – customer requirement
- Rate of production – market demand

### **Distribution related factors**

- Availability of distributors- reputation, facilities and manpower
- Availability of ware houses- space requirement, cost and facilities
- After sale service- maintenance, repair, spares, cost
- Sales personnel – marketing skills, implementation of sale promotional schemes etc.

### **Organization related factors**

- Skill requirement both workers and managers
- Availability of manager, labor etc.
- Salary and wages of workers – cost implications

### **Characteristics**

Successful product development means “Development of a product that can be produced and sold profitably.(Very difficult to achieve quickly and directly). Generally there are five specific dimensions used to measure the performance of product development effort.

**1. Product Quality:** Product quality is ultimately reflected in market share and the price that customers are willing to pay.

- How good is the product resulting from the development effort team.
- Does it satisfy customer needs?
- Is it robust and reliable?

## **2. Product Cost:**

- Product cost determines how much profit accrues to the firm for a particular sales volume and a particular sales price.
- Capital equipment + Tooling + Incremental cost

## **3. Development Time:**

- How quickly did the team complete the development effort .
- It determines how responsive the firm can be to competitive forces and to technological development

## **4. Development Cost:**

- It is usually a fraction of investment required to achieve profit.

## **5. Development Capability:**

- Development capability is an asset the firm can use to develop products more effectively and economically in the future.
- Future Scope

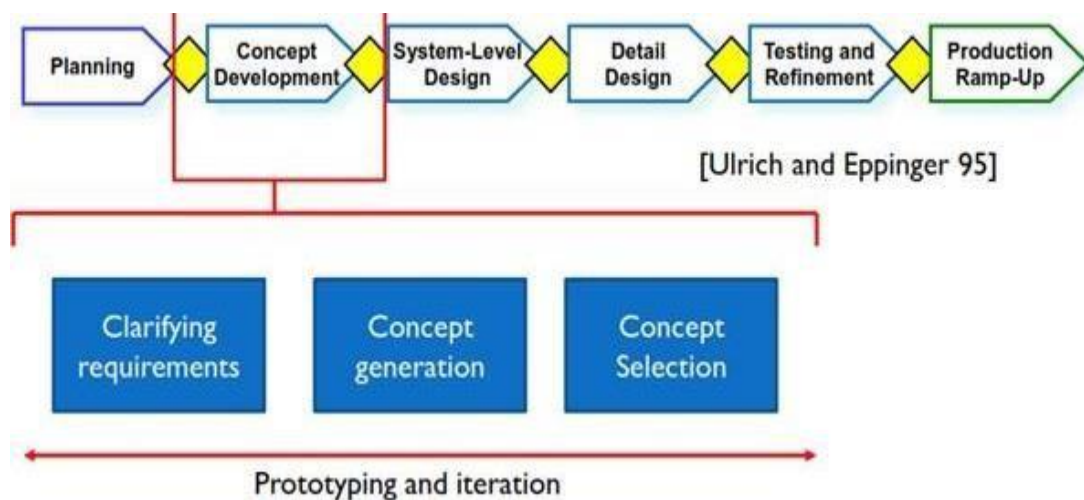
## **3. Product development process**

Product development is the process of creating a new product to be sold by a business or enterprise to its customers. Development refers collectively to the entire process of identifying a market opportunity, creating a product to appeal to the identified market, and finally, testing, modifying and refining the product until it is ready for production.

A development process can be understood as a risk management system .In the early phase of product development, various risks are identified. As the process progresses, risks are reduced as the key uncertainties are eliminated and the functions of the product are validated . When the process is completed, the team should have

substantial confidence that the product will work correctly and be well received by the market.

The initial concept development process is important because a better design process leads to a better design outcome. Decisions made during the early stages of design tightly constrain future options. It is estimated that 70% cost of a product is determined in the first 30% of the design cycle.



### **Planning:**

- This is also called as the “zero phase” since it precedes the project approval and launch of the actual product development process.
- The output of this phase is the project mission statement, which specifies the target market for the product, business goals, key assumptions, and constraints.

### **Concept development:**

- Good concept development is crucial, during this stage the needs of the target market are identified, competitive products are reviewed, product specifications are defined, a product concept is elected, an economic analysis is done, and the development project is outlined.
- This stage provides the foundation for the development effort, and if poorly done can undermine the entire effort.

**System level design:**

- Includes the definition of the product architecture and the decomposition of the product into subsystem and components.
- The o/p of this phase usually includes a geometric layout of the product, a functional specification of each of the products subsystem and preliminary process flow diagram for final assembly process.

**Detail design:**

- Detail design, or design-for-manufacture, is the stage wherein the necessary engineering is done for every component of the product.
- During this phase, each part is identified and engineered. Tolerances, materials, and finishes and specification of standard parts to be purchased from suppliers are defined, and the design is documented with drawings or computer files.
- Process plan and tooling for each part is The output of this phase is the control documentation for the product.

**Testing and refinement:**

- During the testing and refinement stage, a number of prototypes are built and tested. Early alpha prototypes are built with prodn.
- Intent parts but not necessarily fabricated with actual processes. It is necessary to determine whether the performance of the product matches the specifications, and to uncover design shortfalls and gain in-the-field experience with the product in use.
- Later, beta prototypes are built from the first production components received from suppliers.

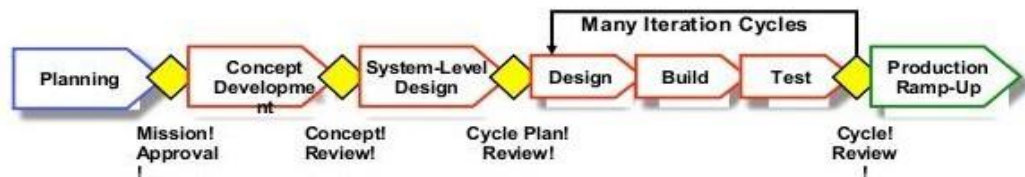
**Production ramp-up:**

- During production ramp-up, the work force is trained as the first products are being assembled.
- The comparatively slow product build provides time to work out any remaining problems with supplier components, fabrication, and assembly procedures.

- The staff and supervisory team is organized, beginning with a core team, and line workers are trained by assembling production units.

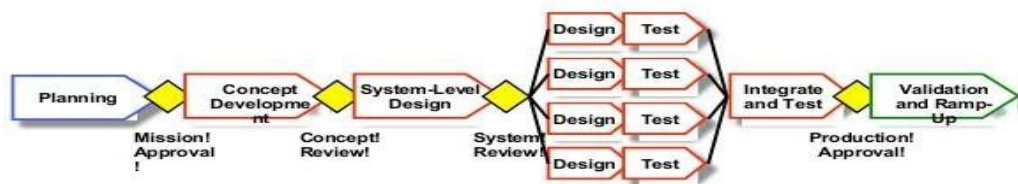
## ELOPMENT PROCESS PHASES A GENERIC DEV

### Rapid Iteration/spiral PD Process



## A GENERIC DEVELOPMENT PROCESS PHASES

### Complex System PD Process



### Identification of opportunities

Design Thinking is a design methodology that provides a solution-based approach to solving problems. It's extremely useful in tackling complex problems that are ill-defined or unknown, by understanding the human needs involved, by re-framing the problem in human-centric ways, by creating many ideas in brainstorming sessions, and by adopting a hands-on approach in prototyping and testing.

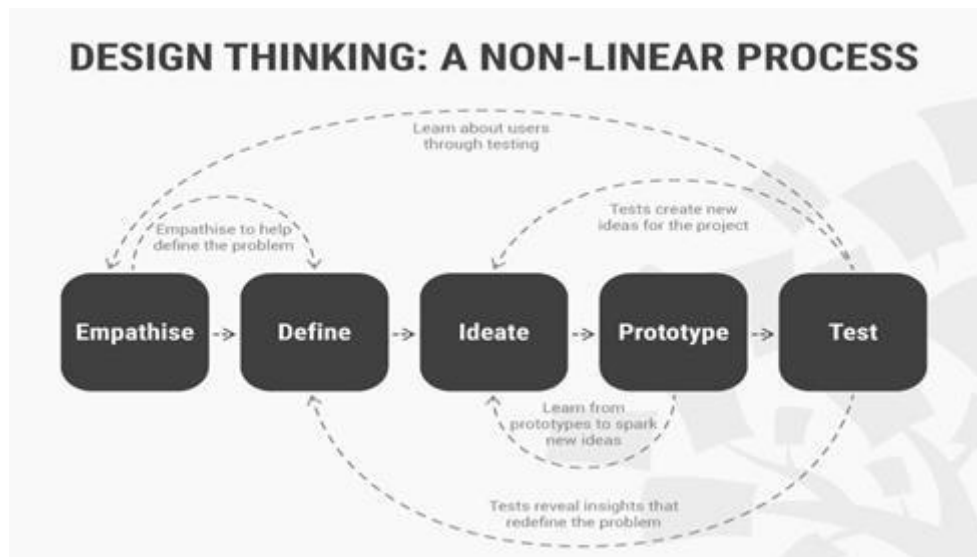
**Empathizing:** Understanding the human needs involved.

**Defining:** Re-framing and defining the problem in human-centric ways.

**Ideating:** Creating many ideas in ideation sessions.

**Prototyping:** Adopting a hands-on approach in prototyping.

**Testing:** Developing a prototype/ solution to the problem.



### **Empathizing:**

The first stage of the Design Thinking process is to gain an empathic understanding of the problem you are trying to solve. This involves consulting experts to find out more about the area of concern through observing, engaging and empathizing with people to understand their experiences and motivations, as well as immersing yourself in the physical environment so you can gain a deeper personal understanding of the issues involved. Empathy is crucial to a human-centered design process such as Design Thinking, and empathy allows design thinkers to set aside their own assumptions about the world in order to gain insight into users and their needs.

### **Defining:**

During the Define stage, you put together the information you have created and gathered during the Empathize stage. This is where you will analyze your observations and synthesize them in order to define the core problems that you and your team have identified up to this point. You should seek to define the problem as a problem statement in a human - centered manner.

### **Ideating:**

During the third stage of the Design Thinking process, designers are ready to start generating ideas. You've grown to understand your users and their needs in the Empathize stage, and you've analyzed and synthesized your observations in the Define stage, and ended up with a human-centered problem statement.

With this solid background, you and your team members can start to "think outside the box" to identify new solutions to the problem statement you've created, and you can start to look for alternative ways of viewing the problem.

### **Prototyping:**

- The design team will now produce a number of inexpensive, scaled down versions of the product or specific features found within the product, so they can investigate the problem solutions generated in the previous stage.
- Prototypes may be shared and tested within the team itself, in other departments, or on a small group of people outside the design team. This is an experimental phase, and the aim is to identify the best possible solution for each of the problems identified during the first three stages.
- The solutions are implemented within the prototypes, and, one by one, they are investigated and either accepted, improved and re-examined, or rejected on the basis of the users' experiences.

### **Testing:**

Designers or evaluators rigorously test the complete product using the best solutions identified during the prototyping phase. This is the final stage of the 5 stage-model, but in an iterative process, the results generated during the testing phase are often used to redefine one or more problems and inform the understanding of the users, the conditions of use, how people think, behave, and feel, and to empathize.

## **PRODUCT PLANNING**

### **1. Developing the product concept:**

- The first phase of product planning is developing the product concept. Marketing managers usually create ideas for new products by identifying certain problems that consumers face or various customers need.

### **2. Studying the market:**

- The next step in the product planning process is studying the competition. Secondary research usually provides details on key competitors and their market share, which is the percent of total sales that they hold in the marketplace.
- The business can then determine places in which it has an advantage over the



competition to identify areas of opportunity. Market research is a complex task. It must include an analysis of products that are indirect competitors products manufactured by the company observed.

### **3. Market research:**

- A small company should consider doing both **qualitative** and **quantitative marketing research** for its new product. **Focus groups** are an example of qualitative information. Focus groups allow companies to ask their consumers about their likes and dislike of a product in small groups.
- A focus group allows the company to tweak the product concept before testing it through phone surveys a more quantitative marketing research function.
- Market research is the one stage of product planning and it can be regarded as the way to accomplish the activity though designing questions, preparing the samples, collecting data and analyzing.
- Market researchers always use quantitative and qualitative research to differentiate the methods of investigation into those which are cared about getting an understanding of a subject and those which are involved in measuring things.
- Quantitative research is about understanding aspects of a market or what kinds of customers making up the market. And it can be split into soft and hard parts. Soft part means phenomena like customer attitudes and hard part is market size, brand shares and so on.
- The differences between quantitative and qualitative research can be summarized that qualitative research is always open-ended, more flexible, gives consumers more creativity, pays more attention to deeper understanding so that they can get deeper data and richer ideas and quantitative research are usually statistical and numerical measurement and people will be divided into groups to get sampling or comparisons.

### **4. Product introduction:**

- If the survey results prove favorable, the company may decide to sell the new product on a small scale or regional basis.
- During this time, the company will distribute the products in one or more cities.

- The company will run advertisements and sales promotions for the product, tracking sales results to determine the products potential success.
- If sales figures are favorable, the company will then expand distribution even further. Eventually, the company may be able to sell the product on a national basis.

## **5. Product life cycle:**

- Product planning must also include managing the product through various stages of its [product life cycle](#).
- These stages include the introduction, growth, maturity and decline stages. Sales are usually strong during the growth phase, while competition is low.
- The first stage is introduction which means it is time for a company or brand to promote its new products.
- The goal of introduction is to attract customers' attention as much as possible and confirm the products' initial distribution, the company does not need to worry about the competition generally as the products are new.
- In this stage, there will have the first communication between marketers and customers as it will be the first time for consumers to know about the new products.
- In addition, the cost of the things will be high like research, testing and development and the sales are low as the new products' market is small.
- The second stage is growth. In this stage, the new products have been accepted in the market and their sales and profits has begun to increase, the competition has happened so that the company will promote their quality to stay competitive.
- The products also have basic consumers' attention and can develop their loyal customers. There will have second communication as marketers can start to receive customers' feedback and then make improvements.
- The third stage is maturity where the sales and profit have grown slowly and will reach their peak.
- The competitions between companies and brands will be fierce so that the companies will go out of their ways like providing higher quality products with a lower price or thinking about any improvements to survive in the competitions and make profits

maximum.

- The last one is decline which means the product is going to end and be discontinued.
- The sales of product will decrease until it is no longer in demand as it has become saturated, all the customers who want to buy this product has already got that.
- Then the company or brand will cut down the old products and pays attention to designing and developing the new products to gain back the customer base, stay in the markets and make profits.

### **Product Planning**

**Product planning** is a process that involves all the activities, right from the conception of the product idea to the introduction of the product in the market.

It includes product engineering and product design. Product planning basically represents the core of the process of manufacturing.

Its main purpose is to organize resources in such a manner so as to manage costs, time, staff, and other resources.

Any manufacturing process reaches its full potential if the product planning operation is efficient at its best.

#### **Product Planning may take either of the two forms:**

- A. Creating an entirely new product or adding an existing product line.
- B. Modifying an existing product suitable to latest changes.

Development of new products is important to meet the ever-changing 'needs and wants' of consumers. Businesses may also introduce new products or update existing versions if products have reached the end of their lifecycle.

Product planning is also important to counter competitors and environmental changes that the company wishes to capitalize on. Once a decision is made to undertake product planning, the following steps are followed:

#### **1.Idea Generation:**

- The process of product planning typically commences with idea generation.
- A brainstorming session may be held to decide on types of products that need to

be manufactured.

- Product concepts are devised to fill the void in the marketplace or to meet customer expectations.
- For this reason, it is important to undertake market research, SWOT (Strength, Weaknesses, Opportunities and Threat) analysis of the company, and analysis of competitors' products, while encouraging product ideas from employees and partners.

## **2. Idea Screening:**

- This stage is crucial as it helps to eliminate ideas that are not feasible.
- Ideas are short-listed and finally, the most preferred product is zeroed in on. Idea screening is an essential process of filtering.
- Factors like return on investment, market potential, company objectives, and affordability are taken into consideration while selecting the final idea.
- These factors are considered carefully, so as to avoid product failure down the line.

## **3. Concept Development:**

- Customers are regarded as central to any business.
- Hence, it is important that their feedback is taken into consideration. It helps to develop a better understanding of customer needs and to identify the marketing message of the product.
- Businesses may also hire external market research teams to conduct surveys via the internet, phone or mail.
- These professionals conduct surveys and the information is then tabulated into bar graphs, pie diagrams, line bars, and other analytical tools for the ease of understanding.

#### **4. Product Development:**

- Once the product concept gets a go-ahead, it is then passed to the marketing stage for the creation of a limited production model in which companies develop their products on a small scale in the beginning to see if the response is favorable.

This helps to reduce costs in case the product fails to take off. Companies also run advertisements and sales promotions, while tracking sales to determine the potential for success.

#### **5. Product Lifecycle:**

- Product planning does not stop with the introduction of the product.
- It also includes managing the product at various stages in the lifecycle. In the initial phase, sales may show a steady increase.
- Over time, competitors will introduce similar products that will result in a decrease in sales or a diminished market share.
- At this stage, various strategies need to be implemented, such as reduction of product prices, mass production, promotions and offers, product modifications, and the formulation of different marketing and distribution approaches.
- The process of **product planning** should be seen as a form of continuous development, with limitless opportunities.
- Though it requires heavy commitment of technology, finance and staff, it helps in preventing a product failure.

## **Innovation in Product Development**

### **Product Innovation: Product Planning in a Nutshell:**

- Innovate or die is the stark message for businesses, but it is no less true, as no business can sell the same product in its existing form for an indefinite period.
- Along with dynamic changes in the business environment, businesses need to respond to these changes through their products and services.
- If products offered are not tailored according to the needs and requirements of consumers, they will switch to competitor products.
- This in turn would reduce sales and profits. Hence, product innovation means product planning is a crucial function in any business.