Product Family Engineering and Product Management

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Table of Contents

Chapter- 1

Product Family Engineering

Product family engineering (PFE), also known as **product line engineering**, is a synonym for "domain engineering" created by the Software Engineering Institute, a term coined by James Neighbors in his 1980 dissertation at University of California, Irvine. Software product lines are quite common in our daily lives, but before a product family can be successfully established, an extensive process has to be followed. This process is known as product family engineering.

Product family engineering can be defined as a method that creates an underlying architecture of an organization's product platform. It provides an architecture that is based on commonality as well as planned variabilities. The various product variants can be derived from the basic product family, which creates the opportunity to reuse and differentiate on products in the family.

Product family engineering is a relatively new approach to the creation of new products. It focuses on the process of engineering new products in such a way that it is possible to reuse product components and apply variability with decreased costs and time. Product family engineering is all about reusing components and structures as much as possible.

Several studies have proven that using a product family engineering approach for product development can have several benefits (Carnegie Mellon (SEI), 2003). Here is a list of some of them:

- Higher productivity
- Higher quality
- Faster time-to-market
- Lower labor needs

The Nokia case mentioned below also illustrates these benefits.

Overall process

The product family engineering process consists of several phases. The three main phases are:

- Phase 1: Product management

- Phase 2: Domain engineering
- Phase 3: Product engineering

The process has been modeled on a higher abstraction level. This has the advantage that it can be applied to all kinds of product lines and families, not only software. The model can be applied to any product family. Figure 1 (below) shows a model of the entire process. Below, the process is described in detail. The process description contains elaborations of the activities and the important concepts being used. All concepts printed italic are explained in Table 1.

Phase 1: product management

The first phase is the starting up of the whole process. In this phase some important aspects are defined especially with regard to economic aspects. This phase is responsible for outlining market strategies and defining a scope, which tells what should and should not be inside the product family.

Evaluate business visioning

During this first activity all context information relevant for defining the scope of the product line is collected and evaluated. It is important to define a clear market strategy and take external market information into account, such as consumer demands. The activity should deliver a *context document* that contains guidelines, constraints and the product strategy.

Define product line scope

Scoping techniques are applied to define which aspects are within the scope. This is based upon the previous step in the process, where external factors have been taken into account. The output is a *product portfolio* description, which includes a *list of current and future products* and also a product roadmap.

It can be argued whether phase 1, product management, is part of the product family engineering process, because it could be seen as an individual business process that is more focused on the management aspects instead of the product aspect. However phase 2 needs some important input from this phase, as a large piece of the scope is defined in this phase. So from this point of view it is important to include the product management phase (phase 1) into the entire process as a base for the domain engineering process.

Phase 2: domain engineering

During the domain engineering phases the variable and common requirements are gathered for the whole product line. The goal is to establish a reusable platform. The output of this phase is a set of *common and variable requirements* for all products in the product line.

Define variable requirements

Analyze domain requirements

This activity includes all activities for analyzing the domain with regard to concept requirements. The requirements are categorized and split up into two new activities. The output is a document with the *domain analysis*.

As can be seen in Figure 1 the process of defining common requirements is a parallel process with defining variable requirements. Both activities take place at the same time.

Define common requirements

Includes all activities for eliciting and documenting the common requirements of the product line, resulting in a document with *reusable common requirements*.

Define variable requirements

Includes all activities for eliciting and documenting the variable requirements of the product line, resulting in a document with *variable variable requirements*.

Design domain

This process step consists of activities for defining the reference architecture of the product line. This generates an abstract structure for all products in the product line.

Implement domain

During this step a detailed design of the reusable components and the implementation of these components are created.

Test domain

Validates and verifies the reusability of components. Components are tested against their specifications. After successful testing of all components in different use cases and scenarios, the domain engineering phase has been completed.

Phase 3: product engineering

In the final phase a product X is being engineered. This product X uses the commonalities and variability from the domain engineering phase, so product X is being derived from the platform established in the domain engineering phase. It basically takes all common requirements and similarities from the preceding phase plus its own variable requirements. Using the base from the domain engineering phase and the individual

requirements of the product engineering phase a complete and new product can be built. After that the product has been fully tested and approved, the product X can be delivered.

Define product requirements

Developing the product requirements specification for the individual product and reuse the requirements from the preceding phase.

Design product

All activities for producing the product architecture. Makes use of the reference architecture from the step "design domain", it selects and configures the required parts of the *reference architecture* and incorporates product specific adaptations.

Build product

During this process the product is built, using selections and configurations of the *reusable components*.

Test product

During this step the product is verified and validated against its specifications. A test report gives information about all tests that were carried out, this gives an overview of possible errors in the product. If the product in the next step is not accepted, the process will loop back to "build product", in Figure 1 this is indicated as "[unsatisfied]".

Deliver and support product

The final step is the acceptance of the final product. If it has been successfully tested and approved to be complete, it can be delivered. If the product does not satisfy to the specifications, it has to be rebuilt and tested again.

The next figure shows the overall process of product family engineering as described above. It is a full process overview with all concepts attached to the different steps.

Process data diagram

On the left side the entire process from the top to bottom has been drawn. All activities on the left side are linked to the concepts on the right side through dotted lines. Every concept has a number, which reflects the association with other concepts.

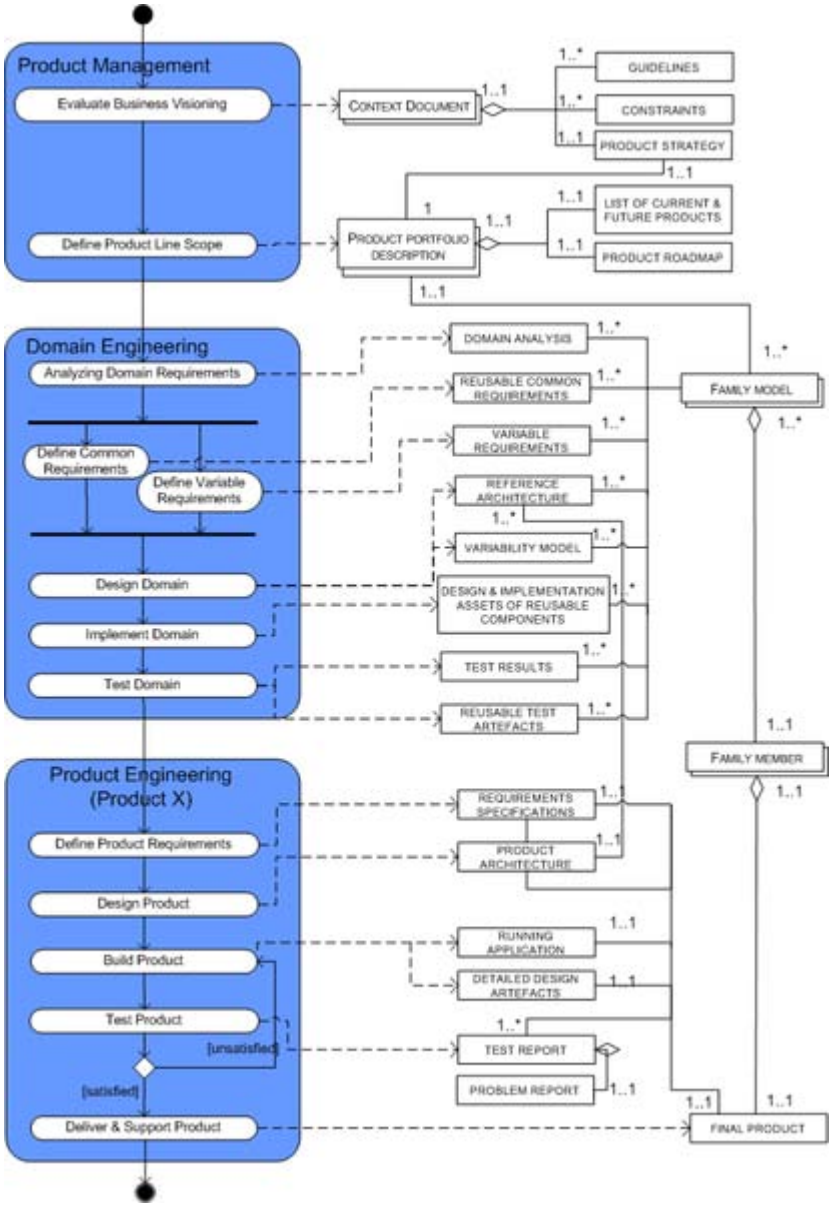


Figure 1: Process data diagram

List of concepts

Below the list with concepts will be explained. Most concept definitions are extracted from Pohl, Bockle, & Linden (2005) and also some new definitions have been added.

Concept	Definition
Domain analysis	Document contains an analysis of the domain through which common and variable requirements can be split up.
Reusable common	Document contains requirements that are

requirements	common to all products in the product line.
Variable requirements	Document contains derivation of customised requirements for different products.
Reference Architecture	Determines the static and dynamic decomposition that is valid for all products of the product line. Also the collection of common rules guiding the design, realisation of the parts, and how they are combined to form products.
Variability model	Defines the variability of the product line.
Design & implementation assets of reusable components	The major components for the design and implementation aspects, which are relevant for the whole product family.
Test results	The output of the tests performed in domain testing.
Reusable test artifacts	Test artifacts include the domain test plan, the domain test cases, and the domain test case scenarios.
Requirements specifications	The requirements for a particular product.
Product architecture	Comparable to reference architecture, but this contains the product specific architecture.
Running application	A working application that can be tested later on.
Detailed design artifacts	These include the different kinds of models that capture the static and dynamic structure of each component.
Test report	Document with all test results of the product.
Problem report	Document, which lists all problems encountered while testing the product.
Final product	The delivery of the completed product.
Family model	The overlapping concept of all family members with all sub products.
Family member	The concept of the individual product.
Context document	Document containing important information for determining the scope; containing guidelines, constraints and production strategy.

Guidelines	Market/business/product guidelines
Constraints	Market/business/product constraints
Product strategy	Product strategy with regard to markets
Product portfolio description	Portfolio containing all available products, with important properties.
List of current & future products	A list of all current products and the products that will be produced in the future.
Product roadmap	Describes the features of all products of the product line and categorises the feature into common features that are part of each product and variable features that are only part of some products.

Table 1: List of concepts

Example

There are some good examples of the use of product family engineering, which were quite successful. The abstract model of product family engineering allows different kinds of uses, most of them are related to the consumer electronics market. Below an example is given of an application of the product line engineering process, based on a real experience of Nokia.

Nokia produces different types of products. Among them is a mobile phones product family, currently containing 25 to 30 new products every year. These products are sold all over the world, which makes it necessary to support a many different languages and user interfaces. A main problem here is that several different user interfaces must be supported, and because new products succeed each other very quickly, this should be done as efficiently as possible. Product family engineering makes it possible to create software for the different products and use variability to customize the software to each different mobile phone.

The Nokia case is comparable with a normal software product line. During the first phase, product management, it is possible to define the scope of the different mobile phone series. During the second phase, domain engineering, requirements are defined for the family, and for the individual types of phones, e.g., 6100/8300 series. In this phase, the software requirements are made, which can serve as a base for the whole product family. This speeds the overall development process for the software. The last phase, product engineering, is more focused on the individual types of phones. The requirements from the preceding phase are used to create individual software for the type of phone then being developed.

The use of a product line gave Nokia the opportunity to increase their production of new mobile phone models from 5-10 to around 30. Carnegie Mellon (SEI), 2006, Clements & Northrop (2003).

Chapter- 2

Product Information Management

Product information management or PIM refers to processes and technologies focused on centrally managing information about products, with a focus on the data required to market and sell the products through one or more distribution channels. A central set of product data can be used to feed consistent, accurate and up-to-date information to multiple output media such as web sites, print catalogs, ERP systems, and electronic data feeds to trading partners. PIM systems generally need to support multiple geographic locations, multi-lingual data, and maintenance and modification of product information within a centralized catalog to provide consistently accurate information to multiple channels in a cost-effective manner.

The increasing number of channels for product data (e.g., web sites, print catalogs, electronic data feeds) emphasized the need for product information management, as information kept by businesses is frequently scattered throughout disparate departments and held by certain employees or systems instead of being available centrally. Product data often exists in ERP systems, R&D PLM systems, spreadsheets and personal databases. Data are saved in various different formats or are only available in hardcopy form. Information is utilized in varying environments and contexts such as for detailed product descriptions with pricing info in product catalogs or for size and weight data for calculating freight costs in a logistics department. PIM in this example represents a solution for centralized, media-independent data maintenance for providing purchasing, production and communications data for repeated use on/in multiple IT systems, languages, output media and publications. It also provides a solution for efficient data collection, management, refinement and output.

Synonyms and related terms

The term PIM has only just recently come into currency, thus one finds a number of other terms that are similar or synonymous in meaning, usually deriving from other fields. These include:

- PDM – Product data management derives from the concept of engineering data management (EDM), denoting systems for the effective management of product development data and the coordination of manufacturing-related processes. The term is used primarily in the field of computer-aided design (CAD).

- PRM – Product resource management is used by some software providers as a synonym for PIM (Product Information Management), as well as Product Content Management (PCM), mainly popular as a term in England and France.
- Product lifecycle management (PLM) refers more to a management strategy than to a specific IT technology, the goal of which is to optimize product life cycles through the gathering and analysis of product data generated over time.
- Media asset management (MAM) refers to the management of unstructured multimedia objects such as images, graphics and presentations as well as 'meta-information' (data about data). The term is used primarily in the media business.
- Cross media publishing (CMP) comes from the print and advertising industries, referring to the coordinated use of multiple media in complementary fashion. It also denotes the repeat usage of individual structural elements such as text, images or graphics within different media.
- product catalog management

Link with enterprise content management

Enterprise content management is a term encompassing technologies, methods and tools used for gathering, imaging, storing, archiving and providing electronic content. Distinction can be made between four separate sub-areas. Document management systems (DMS) are deployed for archiving, and PDM involves the management of structured, technical data for such applications as parts diagrams and lists. Content management systems (CMS) are more commercially oriented and provide a framework for knowledge management or informational service offerings through the management of unstructured, document-type content. PIM systems are used to manage structured data in a business context for feeding into any kind of distribution channel, from electronic catalogs to online shops to print catalogs.

Technological basis of product information management (PIM)

PIM systems consolidate all product information onto a single platform. In terms of company IT infrastructure, this means having a PIM platform running over alongside a classic Oracle or open-source database such as MySQL with a J2EE application server, and/or xml based exchange of product information (e.g., using the Open ICEcat format). This forms a foundation upon which to build sales and procurement business processes. With PIM solutions, access and user authorizations for all database information, ordering processes linked with such inventory management systems as SAP and the mechanisms for modular expansions are managed via a web-based administration interface.

Current PIM applications

Electronic catalogs

Procurement systems and platforms such as online marketplaces are based upon electronic catalogs. PIM systems can load descriptive product information as content into a catalog management solution, where products are grouped and managed for specific

target markets. Data exchange interface standards such as Open ICEcat,CNet, BMEcat and OCI allow seamless interchange of electronic catalogs between vendors on the one hand and purchasing firms and marketplace operators on the other. Procurement solutions are closely related, which automate the procurement process for purchasing goods and services. These create transparency for the product data of multiple vendors to support the centralized management of multi-supplier catalogs and facilitate price and quality research.

Website / webshop content

Centralized data management is particularly well-suited for company websites, as documents, content and media objects such as product images can be linked with other business objects such as customers or products. An e-commerce component manages the ordering process and the online presentation of dynamic content. The solution has to integrate seamlessly into inventory management and logistics systems in order to provide real cost savings.

Product catalog

Centrally maintained data can also be accessed for print or CD catalogs and websites. The publishing component of an e-business solution creates pooled data, making it possible to save and manage catalog content in a media-independent manner. The better the layout and output capabilities of the associated desktop publishing program, the more catalog production can be automated.

The market for PIM solutions

PIM is still a young market segment. It only started gaining broader attention among customers in the second half of 2004, as market analysts and the media began taking a closer look at this type of solution.

PIM solutions are most relevant for use by medium to large-sized firms in retailing, consumer goods and manufacturing. The following are the primary considerations in opting for a PIM solution:

- wide array of products
- frequently changing product characteristics
- non-uniform IT infrastructure (potentially resulting from merger activity)
- successful online business
- customer pressure to offer electronic ordering

PIM becomes strategically necessary when major customers start demanding that new data sharing standards (such as global data synchronization) be supported, in conjunction with an international expansion strategy. The effective consolidation of product information and reconfiguration of processes built thereupon is however critical for a successful strategic business outcome. A distributor of catalogs, for example, looking to

expand into five new countries without having to realign its catalog production processes will probably be unable to execute on such a strategy.

PIM becomes essential when integrating with SaaS vendors. Keeping the core product classification consistent throughout a workflow involving multiple SaaS partners supports the core SaaS proposition of rapid to market, cost effective solutions.

Chapter- 3

New Product Development

In business and engineering, **new product development** (NPD) is the term used to describe the complete process of bringing a new product or service to market. There are two parallel paths involved in the NPD process: one involves the idea generation, product design and detail engineering; the other involves market research and marketing analysis. Companies typically see new product development as the first stage in generating and commercializing new products within the overall strategic process of product life cycle management used to maintain or grow their market share.

The process

1. **Idea Generation** is often called the "fuzzy front end" of the NPD process
    - Ideas for new products can be obtained from basic research using a SWOT analysis (Strengths, Weaknesses, Opportunities & Threats), Market and consumer trends, company's R&D department, competitors, focus groups, employees, salespeople, corporate spies, trade shows, or Ethnographic discovery methods (searching for user patterns and habits) may also be used to get an insight into new product lines or product features.
    - Lots of ideas are being generated about the new product. Out of these ideas many ideas are being implemented. The ideas use to generate in many forms and their generating places are also various. Many reasons are responsible for generation of an idea.
    - Idea Generation or Brainstorming of new product, service, or store concepts - idea generation techniques can begin when you have done your OPPORTUNITY ANALYSIS to support your ideas in the **Idea Screening Phase** (shown in the next development step).
2. **Idea Screening**
    - The object is to eliminate unsound concepts prior to devoting resources to them.
    - The screeners should ask several questions:
        - Will the customer in the target market benefit from the product?
        - What is the size and growth forecasts of the market segment/target market?
        - What is the current or expected competitive pressure for the product idea?

        - What are the industry sales and market trends the product idea is based on?
        - Is it technically feasible to manufacture the product?
        - Will the product be profitable when manufactured and delivered to the customer at the target price?
3. **Concept Development and Testing**
    - Develop the marketing and engineering details
        - Investigate intellectual property issues and search patent data bases
        - Who is the target market and who is the decision maker in the purchasing process?
        - What product features must the product incorporate?
        - What benefits will the product provide?
        - How will consumers react to the product?
        - How will the product be produced most cost effectively?
        - Prove feasibility through virtual computer aided rendering, and rapid prototyping
        - What will it cost to produce it?
    - Testing the Concept by asking a sample of prospective customers what they think of the idea. Usually via Choice Modelling.
4. **Business Analysis**
    - Estimate likely selling price based upon competition and customer feedback
    - Estimate sales volume based upon size of market and such tools as the Fourt-Woodlock equation
    - Estimate profitability and break-even point
5. **Beta Testing and Market Testing**
    - Produce a physical prototype or mock-up
    - Test the product (and its packaging) in typical usage situations
    - Conduct focus group customer interviews or introduce at trade show
    - Make adjustments where necessary
    - Produce an initial run of the product and sell it in a test market area to determine customer acceptance
6. **Technical Implementation**
    - New program initiation
    - Finalize Quality management system
    - Resource estimation
    - Requirement publication
    - Publish technical communications such as data sheets
    - Engineering operations planning
    - Department scheduling
    - Supplier collaboration
    - Logistics plan
    - Resource plan publication
    - Program review and monitoring
    - Contingencies - what-if planning
7. **Commercialization** (often considered post-NPD)

- Launch the product
- Produce and place advertisements and other promotions
- Fill the distribution pipeline with product
- Critical path analysis is most useful at this stage

8. **New Product Pricing**
   - Impact of new product on the entire product portfolio
   - Value Analysis (internal & external)
   - Competition and alternative competitive technologies
   - Differing value segments (price, value, and need)
   - Product Costs (fixed & variable)
   - Forecast of unit volumes, revenue, and profit

These steps may be iterated as needed. Some steps may be eliminated. To reduce the time that the NPD process takes, many companies are completing several steps at the same time (referred to as **concurrent engineering** or **time to market**). Most industry leaders see new product development as a *proactive* process where resources are allocated to identify market changes and seize upon new product opportunities before they occur (in contrast to a *reactive strategy* in which nothing is done until problems occur or the competitor introduces an innovation). Many industry leaders see new product development as an ongoing process (referred to as *continuous development*) in which the entire organization is always looking for opportunities.

For the more innovative products indicated on the diagram above, great amounts of uncertainty and change may exist, which makes it difficult or impossible to plan the complete project before starting it. In this case, a more flexible approach may be advisable.

Because the NPD process typically requires both engineering and marketing expertise, cross-functional teams are a common way of organizing projects. The team is responsible for all aspects of the project, from initial idea generation to final commercialization, and they usually report to senior management (often to a vice president or Program Manager). In those industries where products are technically complex, development research is typically expensive, and product life cycles are relatively short, strategic alliances among several organizations helps to spread the costs, provide access to a wider skill set, and speeds the overall process.

Also, notice that because engineering and marketing expertise are usually both critical to the process, choosing an appropriate blend of the two is important.

People respond to new products in different ways. The adoption of a new technology can be analyzed using a variety of diffusion theories such as the Diffusion of innovations theory.

A new product pricing process is important to reduce risk and increase confidence in the pricing and marketing decisions to be made. Bernstein and Macias describe an integrated

process that breaks down the complex task of new product pricing into manageable elements.

Fuzzy Front End

The Fuzzy Front End is the messy "getting started" period of new product development processes. It is in the front end where the organization formulates a concept of the product to be developed and decides whether or not to invest resources in the further development of an idea. It is the phase between first consideration of an opportunity and when it is judged ready to enter the structured development process (Kim and Wilemon , 2002; Koen et al., 2001). It includes all activities from the search for new opportunities through the formation of a germ of an idea to the development of a precise concept. The Fuzzy Front End ends when an organization approves and begins formal development of the concept.

Although the Fuzzy Front End may not be an expensive part of product development, it can consume 50% of development time, and it is where major commitments are typically made involving time, money, and the product's nature, thus setting the course for the entire project and final end product. Consequently, this phase should be considered as an essential part of development rather than something that happens "before development," and its cycle time should be included in the total development cycle time.

Koen et al. (2001, pp. 47–51) distinguish five different front-end elements (not necessarily in a particular order):

1. Opportunity Identification
2. Opportunity Analysis
3. Idea Genesis
4. Idea Selection
5. Concept and Technology Development

The first element is the opportunity identification. In this element, large or incremental business and technological chances are identified in a more or less structured way. Using the guidelines established here, resources will eventually be allocated to new projects.... which then lead to a structured NPPD (New Product & Process Development)strategy. The second element is the opportunity analysis. It is done to translate the identified opportunities into implications for the business and technology specific context of the company. Here extensive efforts may be made to align ideas to target customer groups and do market studies and/or technical trials and research. The third element is the idea genesis, which is described as evolutionary and iterative process progressing from birth to maturation of the opportunity into a tangible idea. The process of the idea genesis can be made internally or come from outside inputs, e.g. a supplier offering a new material/technology, or from a customer with an unusual request. The fourth element is the idea selection. Its purpose is to choose whether to pursue an idea by analyzing its potential business value. The fifth element is the concept and technology development. During this part of the front-end, the business case is developed based on estimates of the

total available market, customer needs, investment requirements, competition analysis and project uncertainty. Some organizations consider this to be the first stage of the NPPD process (i.e., Stage 0).

The Fuzzy Front End is also described in literature as "Front End of Innovation", "Phase 0", "Stage 0" or "Pre-Project-Activities".

A universally acceptable definition for Fuzzy Front End or a dominant framework has not been developed so far. In a glossary of PDMA, it is mentioned that the Fuzzy Front End generally consists of three tasks: strategic planning, concept generation, and, especially, pre-technical evaluation. These activities are often chaotic, unpredictible, and unstructured. In comparison, the subsequent new product development process is typically structured, predictable, and formal. The term *Fuzzy Front End* was first popularized by Smith and Reinertsen (1991) R.G.Cooper (1988) describes the early stages of NPPD as a four step process in which ideas are generated (I),subjected to a preliminary technical and market assessment(II) and merged to coherent product concepts(III) which are finally judged for their fit with existing product strategies and portfolios (IV). In a more recent paper, Cooper and Edgett (2008) affirm that vital predevelopment activities include:

1. Preliminary market assessment.
2. Technical assessment.
3. Source-of-supply-assessment:suppliers and partners or alliances.
4. Market research : market size and segmentation analysis,VoC (voice of the customer) research.
5. Product concept testing
6. Value-to-the customer assessment
7. Product definition
8. Business and financial analysis.

These activities yield vital information to make a Go/No-Go to Development decision.

In the in-depth study by Khurana and Rosenthal front-end activities include:

- product strategy formulation and communication,
- opportunity identification and assessment,
- idea generation,
- product definition,
- project planning, and
- executive reviews.

Economical analysis, benchmarking of competitive products, and modeling and prototyping are also important activities during the front-end activities.

The outcomes of FFE are the

- mission statement
- customer needs
- details of the selected concept
- product definition and specifications
- economic analysis of the product
- the development schedule
- project staffing and the budget, and a
- business plan aligned with corporate strategy.

In a paper by Husig, Kohn and Huskela (2005) was proposed a conceptual model of Front-End Process which includes early Phases of Innovation Process. This model is structured in three phases and three gates:

- Phase 1: Environmental screening or opportunity identification stage in which external changes will be analysed and translated into potential business opportunities.
- Phase 2: Preliminary definition of an idea or concept.
- Phase 3: Detailed product, project or concept definition, and Business planning.

The gates are:

- Opportunity screening;
- Idea evaluation;
- Go/No-Go for development.

The final gate leads to a dedicated new product development project . Many professionals and academics consider that the general features of Fuzzy Front End (fuzziness,,ambiguity, and uncertainty) make difficult to see the FFE as a structured process, but rather as a set of interdependent activities (e.g.Kim and Wilemon ,2002). However, Husig et al.,2005 argue that front-end not need to be fuzzy,but can be handled in a structured manner. Peter Koen argue that in the FFE for incremental,platform and radical projects,three separate strategies and processes are typically involved. The traditional Stage Gate (TM) process was designed for incremental product development,namely for a single product.The FFE for developing a new platform must start out with a strategic vision of where the company wants to develop products and this will lead to a family of products. Projects for breakthrough products start out with a similar strategic vision,but are associated with technologies which require new discoveries.It is worth mentioning what are incremental,platform and breakthrough products. *Incremental products* are considered to be cost reductions, improvements to existing product lines,additions to existing platforms and repositioning of existing products introduced in markets. *Breakthrough products* are new to the company or new to the world and offer a 5-10 times or greater improvement in performance combined with a 30-50% or greater reduction in costs. *Platform products* establish a basic

architecture for a next generation product or process and are substantially larger in scope and resources than incremental projects.

NPD organizations

- Product Development and Management Association (PDMA)
- Association of International Product Marketing & Management

NPD strategies

- Design for six sigma
- Stage-Gate model
- Quality function deployment
- Flexible product development

Chapter- 4

Packaging and Labeling

Tablets in a blister pack, which was itself packaged in a folding carton made of paperboard.

Packaging is the science, art, and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the *process* of design, evaluation, and production of packages. Packaging can be described as a *coordinated system* of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal use.

Package labelling (en-GB) or **labeling** (en-US) is any written, electronic, or graphic communications on the packaging or on a separate but associated label.

History

The first packages used the natural materials available at the time: Baskets of reeds, wineskins (Bota bags), wooden boxes, pottery vases, ceramic amphorae, wooden barrels, woven bags, etc. Processed materials were used to form packages as they were developed: for example, early glass and bronze vessels. The study of old packages is an important aspect of archaeology.

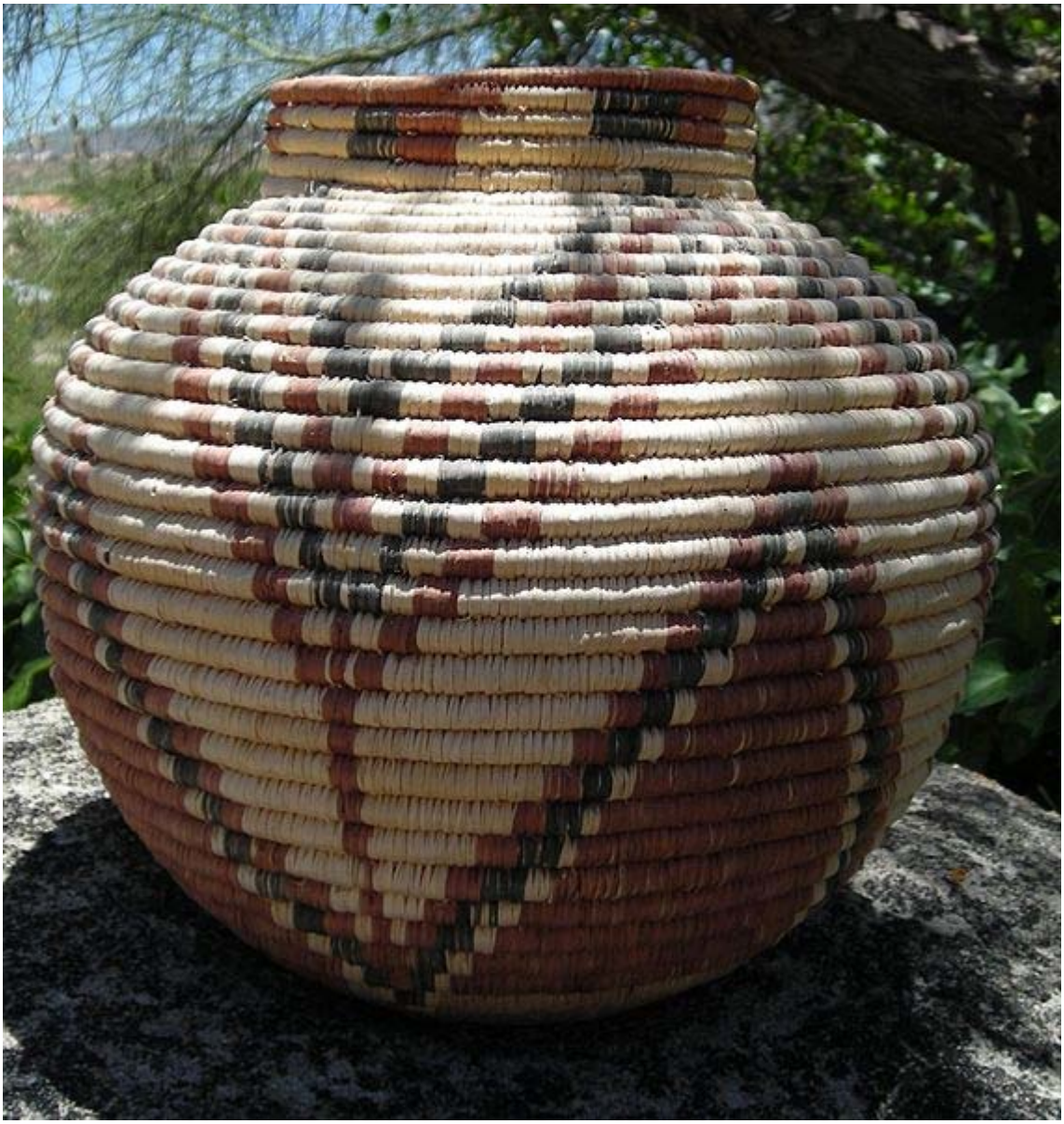
The earliest recorded use of paper for packaging dates back to 1035, when a Persian traveler visiting markets in Cairo noted that vegetables, spices and hardware were wrapped in paper for the customers after they were sold.

Iron and tin plated steel were used to make cans in the early 19th century. Paperboard cartons and corrugated fiberboard boxes were first introduced in the late 19th century.

Packaging advancements in the early 20th century included Bakelite closures on bottles, transparent cellophane overwraps and panels on cartons, increased processing efficiency and improved food safety. As additional materials such as aluminum and several types of plastic were developed, they were incorporated into packages to improve performance and functionality.

In-plant recycling has long been common for production of packaging materials. Post-consumer recycling of aluminum and paper based products has been economical for many years: since the 1980s, post-consumer recycling has increased due to curbside recycling, consumer awareness, and regulatory pressure.

As of 2003, the packaging sector accounted for about two percent of the gross national product in developed countries. About half of this market was related to food packaging.



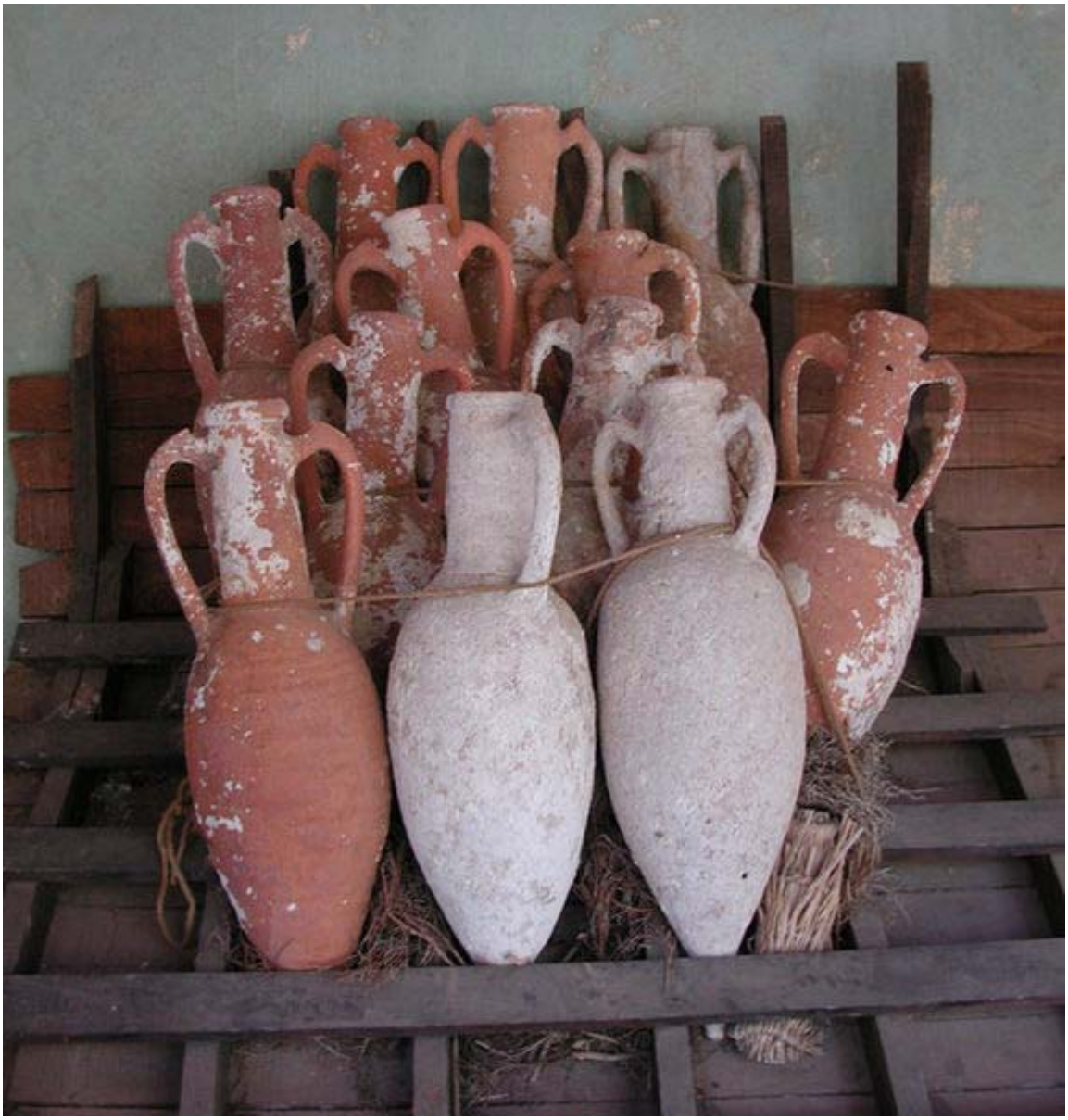
Traditional pot-shaped basket, Mexico

Early wooden wine barrel

Blown glass bottle, 3rd century CE

Bronze wine container, 9th century BCE

Heroin bottle and carton, 1914



Amphorae, Turkey

Packing folding cartons of salt, 1930 - 1940

Prototype Coca-Cola bottle, 1915. Later revised for better stability

The purposes of packaging and package labels

Diced pork in tray and film overwrap. Label indicates net weight, composition, preparation, etc. The Union Flag, British Farm Standard tractor logo, and British Meat Quality Standard logo are also present.

Packaging and package labeling have several objectives

- **Physical protection** - The objects enclosed in the package may require protection from, among other things, mechanical shock, vibration, electrostatic discharge, compression, temperature, etc.
- **Barrier protection** - A barrier from oxygen, water vapor, dust, etc., is often required. Permeation is a critical factor in design. Some packages contain desiccants or Oxygen absorbers to help extend shelf life. Modified atmospheres or controlled atmospheres are also maintained in some food packages. Keeping the contents clean, fresh, sterile and safe for the intended shelf life is a primary function.
- **Containment or agglomeration** - Small objects are typically grouped together in one package for reasons of efficiency. For example, a single box of 1000 pencils requires less physical handling than 1000 single pencils. Liquids, powders, and granular materials need containment.

- **Information transmission** - Packages and labels communicate how to use, transport, recycle, or dispose of the package or product. With pharmaceuticals, food, medical, and chemical products, some types of information are required by governments. Some packages and labels also are used for track and trace purposes.
- **Marketing** - The packaging and labels can be used by marketers to encourage potential buyers to purchase the product. Package graphic design and physical design have been important and constantly evolving phenomenon for several decades. Marketing communications and graphic design are applied to the surface of the package and (in many cases) the point of sale display.
- **Security** - Packaging can play an important role in reducing the security risks of shipment. Packages can be made with improved tamper resistance to deter tampering and also can have tamper-evident features to help indicate tampering. Packages can be engineered to help reduce the risks of package pilferage: Some package constructions are more resistant to pilferage and some have pilfer indicating seals. Packages may include authentication seals and use security printing to help indicate that the package and contents are not counterfeit. Packages also can include anti-theft devices, such as dye-packs, RFID tags, or electronic article surveillance tags that can be activated or detected by devices at exit points and require specialized tools to deactivate. Using packaging in this way is a means of loss prevention.
- **Convenience** - Packages can have features that add convenience in distribution, handling, stacking, display, sale, opening, reclosing, use, dispensing, and reuse.
- **Portion control** - Single serving or single dosage packaging has a precise amount of contents to control usage. Bulk commodities (such as salt) can be divided into packages that are a more suitable size for individual households. It is also aids the control of inventory: selling sealed one-liter-bottles of milk, rather than having people bring their own bottles to fill themselves.

Packaging types

Various household packaging types for foods

Packaging may be looked at as being of several different types. For example a **transport package** or **distribution package** can be the shipping container used to ship, store, and handle the product or inner packages. Some identify a **consumer package** as one which is directed toward a consumer or household.

Packaging may be described in relation to the type of product being packaged: medical device packaging, bulk chemical packaging, over-the-counter drug packaging, retail food packaging, military materiel packaging, pharmaceutical packaging, etc.

Aluminum can with an easy open lid

It is sometimes convenient to categorize packages by layer or function: "primary", "secondary", etc.

- Primary packaging is the material that first envelops the product and holds it. This usually is the smallest unit of distribution or use and is the package which is in direct contact with the contents.
- Secondary packaging is outside the primary packaging, perhaps used to group primary packages together.
- Tertiary packaging is used for bulk handling, warehouse storage and transport shipping. The most common form is a palletized unit load that packs tightly into containers.

These broad categories can be somewhat arbitrary. For example, depending on the use, a shrink wrap can be primary packaging when applied directly to the product, secondary packaging when combining smaller packages, and tertiary packaging on some distribution packs.

Symbols used on packages and labels

Many types of symbols for package labeling are nationally and internationally standardized. For consumer packaging, symbols exist for product certifications, trademarks, proof of purchase, etc. Some requirements and symbols exist to communicate aspects of consumer use and safety, for example the estimated sign that notes conformance to EU weights and measures accuracy regulations. Examples of environmental and recycling symbols include the recycling symbol, the resin identification code and the "Green Dot".

Bar codes , Universal Product Codes, and RFID labels are common to allow automated information management in logistics and retailing. Country of Origin Labeling is often used.

Shipping container labeling

"Print & Apply" corner wrap UCC (GS1-128) label application to a pallet load

Technologies related to shipping containers are identification codes, bar codes, and electronic data interchange (EDI). These three core technologies serve to enable the

business functions in the process of shipping containers throughout the distribution channel. Each has an essential function: identification codes either relate product information or serve as keys to other data, bar codes allow for the automated input of identification codes and other data, and EDI moves data between trading partners within the distribution channel.

Elements of these core technologies include UPC and EAN item identification codes, the SCC-14 (UPC shipping container code), the SSCC-18 (Serial Shipping Container Codes), Interleaved 2-of-5 and UCC/EAN-128 (newly designated GS1-128) bar code symbologies, and ANSI ASC X12 and UN/EDIFACT EDI standards.

Small parcel carriers often have their own formats. For example, United Parcel Service has a MaxiCode 2-D code for parcel tracking.

RFID labels for shipping containers are also increasing in usage. A Wal-Mart division, Sam's Club, has also moved in this direction and is putting pressure on its suppliers for compliance.

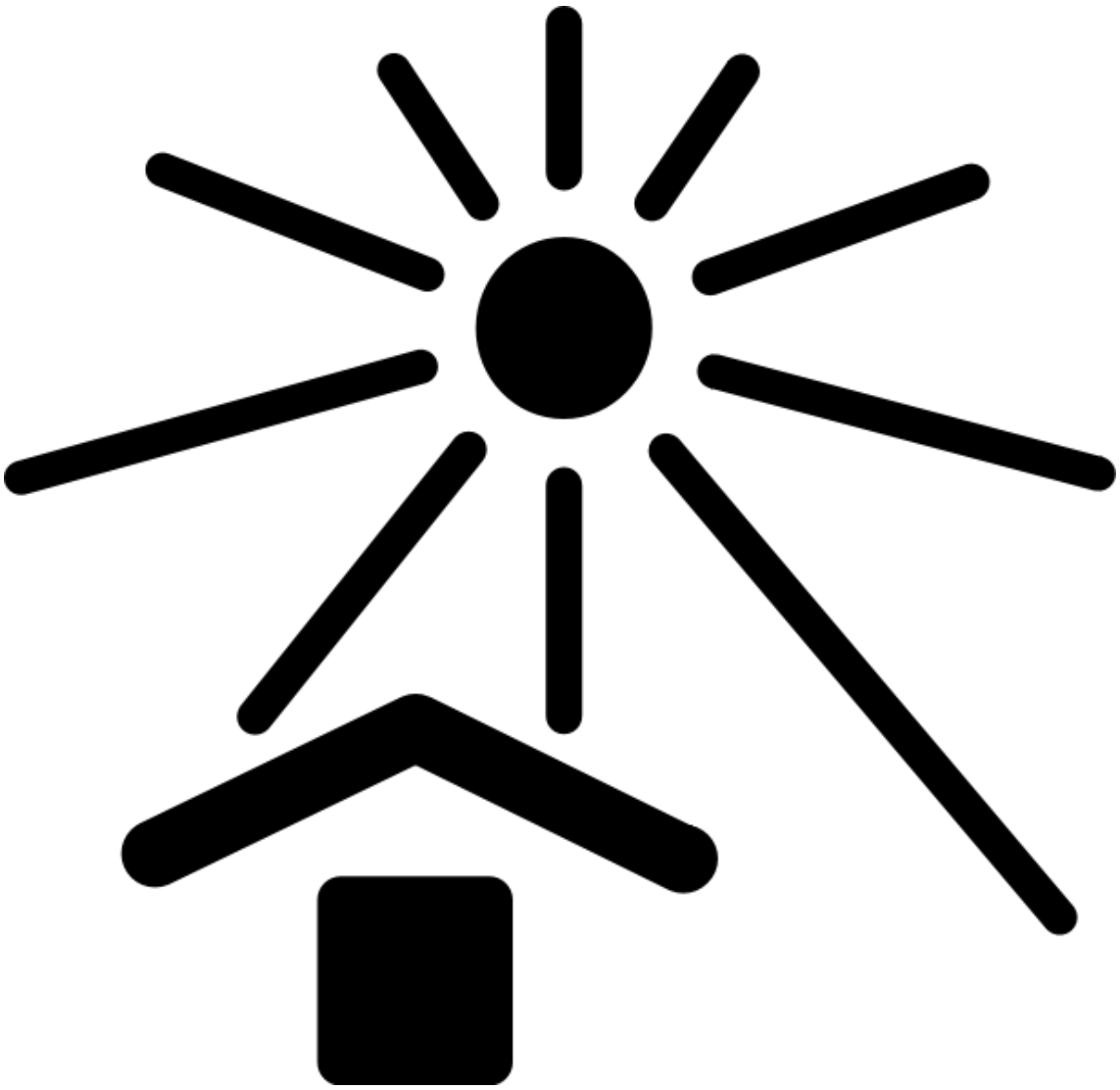
Shipments of hazardous materials or dangerous goods have special information and symbols (labels, plackards, etc.) as required by UN, country, and specific carrier requirements. Two examples are below:

With transport packages, standardised symbols are also used to communicate handling needs. Some common ones are shown below while others are listed in ASTM D5445 "Standard Practice for Pictorial Markings for Handling of Goods" and ISO 780 "Pictorial marking for handling of goods".

Fragile

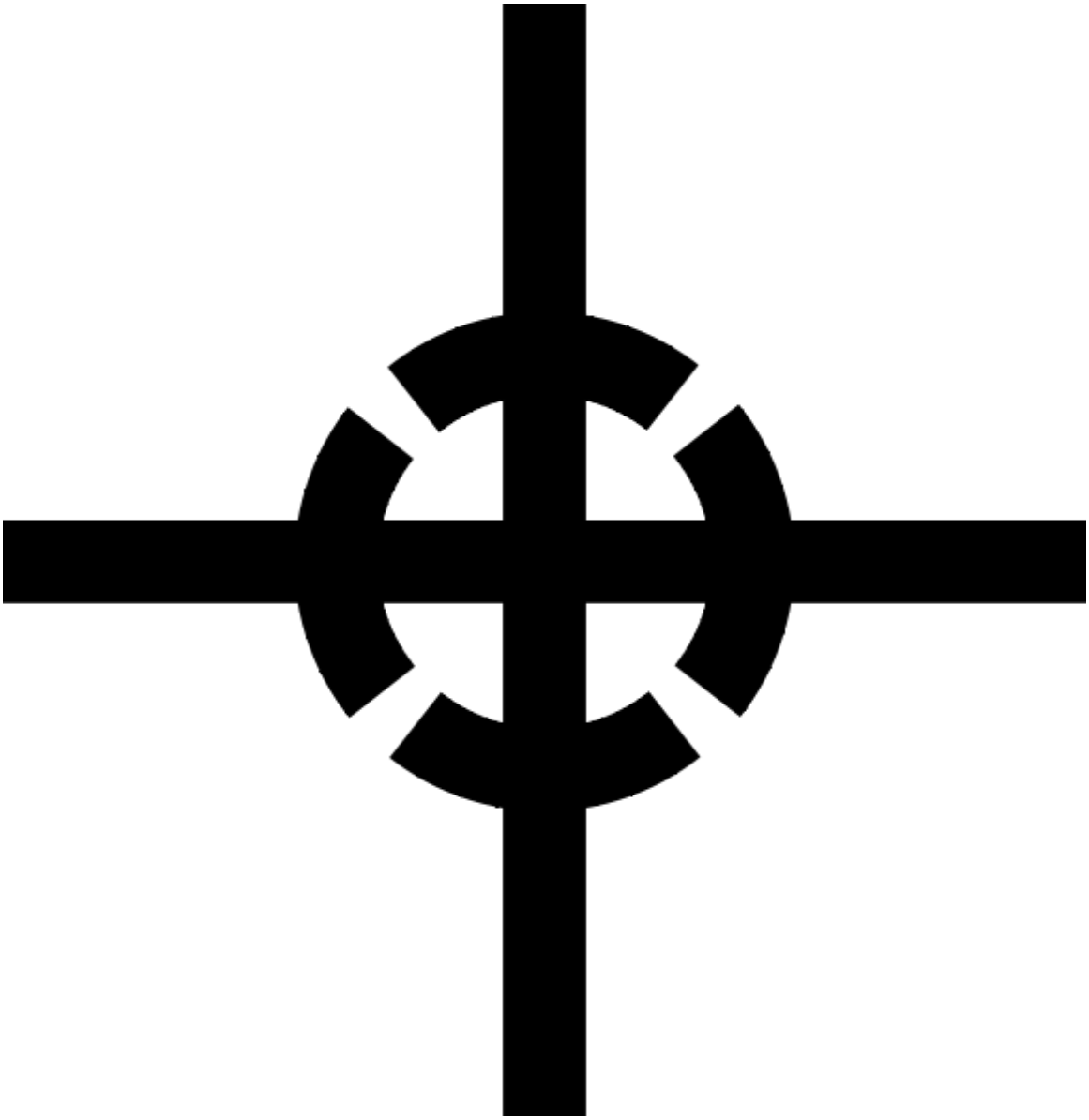
Do not use hand hooks

This way up



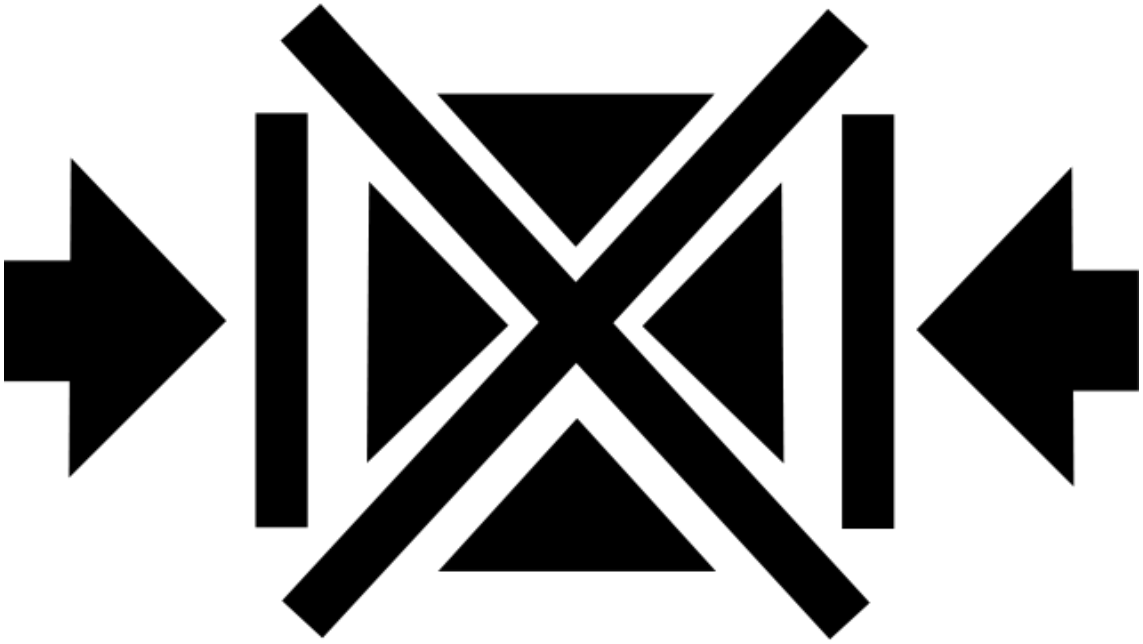
Keep away from sunlight

Keep away from water



Centre of gravity

Clamp as indicated



Do not clamp as indicated

Package development considerations

Package design and development are often thought of as an integral part of the new product development process. Alternatively, development of a package (or component) can be a separate process, but must be linked closely with the product to be packaged. Package design starts with the identification of all the requirements: structural design, marketing, shelf life, quality assurance, logistics, legal, regulatory, graphic design, end-use, environmental, etc. The design criteria, performance (specified by package testing),

completion time targets, resources, and cost constraints need to be established and agreed upon.

Palletized and unitized load

Express air shipment of mixed parcels

Transport packaging needs to be matched to its logistics system. Packages designed for controlled shipments of uniform pallet loads may not be suited to mixed shipments with express carriers.

An example of how package design is affected by other factors is the relationship to logistics. When the distribution system includes individual shipments by a small parcel carrier, the sortation, handling, and mixed stacking make severe demands on the strength and protective ability of the transport package. If the logistics system consists of uniform palletized unit loads, the structural design of the package can be designed to those specific needs: vertical stacking, perhaps for a longer time frame. A package designed for one mode of shipment may not be suited for another.

With some types of products, the design process involves detailed regulatory requirements for the package. For example with packaging foods, any package components that may contact the food are food contact materials. Toxicologists and food scientists need to verify that the packaging materials are allowed by applicable regulations. Packaging engineers need to verify that the completed package will keep the product safe for its intended shelf life with normal usage. Packaging processes, labeling, distribution, and sale need to be validated to comply with regulations and have the well being of the consumer in mind.

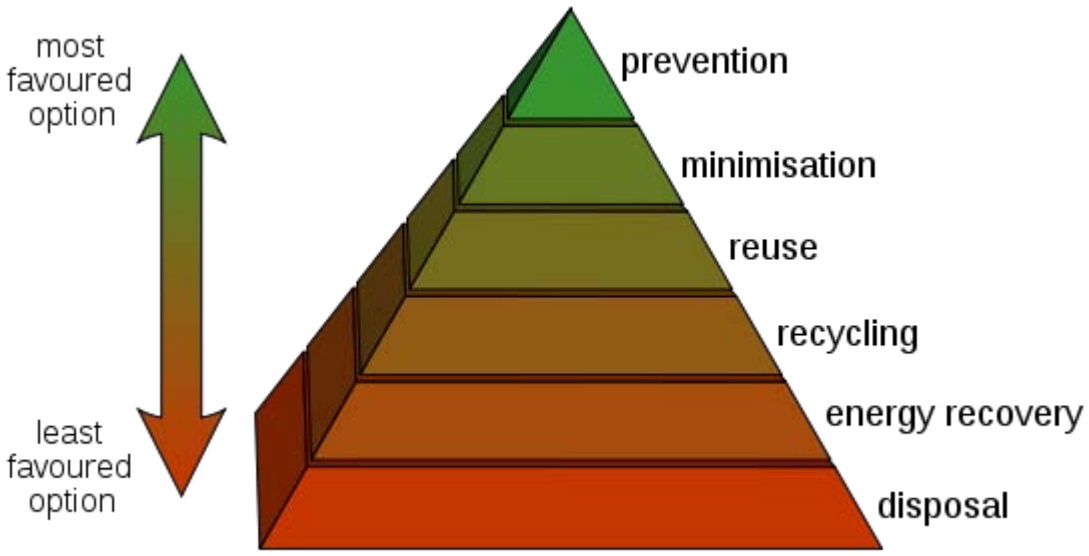
Sometimes the objectives of package development seem contradictory. For example, regulations for an over-the-counter drug might require the package to be tamper-evident and child resistant: These intentionally make the package difficult to open. The intended consumer, however, might be handicapped or elderly and be unable to readily open the package. Meeting all goals is a challenge.

Package design may take place within a company or with various degrees of external packaging engineering: independent contractors, consultants, vendor evaluations, independent laboratories, contract packagers, total outsourcing, etc. Some sort of formal Project planning and Project management methodology is required for all but the simplest package design and development programs. An effective quality management system and Verification and Validation protocols are mandatory for some types of packaging and recommended for all.

Environmental considerations

Package development involves considerations for sustainability, environmental responsibility, and applicable environmental and recycling regulations. It may involve a life cycle assessment which considers the material and energy inputs and outputs to the package, the packaged product (contents), the packaging process, the logistics system, waste management, etc. It is necessary to know the relevant regulatory requirements for point of manufacture, sale, and use.

The traditional "three R's" of reduce, reuse, and recycle are part of a waste hierarchy which may be considered in product and package development.



The waste hierarchy

- Prevention – Waste prevention is a primary goal. Packaging should be used only where needed. Proper packaging can also help prevent waste. Packaging plays an important part in preventing loss or damage to the packaged-product (contents). Usually, the energy content and material usage of the product being packaged are much greater than that of the package. A vital function of the package is to protect the product for its intended use: if the product is damaged or degraded, its entire energy and material content may be lost.

- Minimization – (also "source reduction") The mass and volume of packaging (per unit of contents) can be measured and used as one of the criteria to minimize during the package design process. Usually “reduced” packaging also helps minimize costs. Packaging engineers continue to work toward reduced packaging.
- Reuse – The reuse of a package or component for other purposes is encouraged. Returnable packaging has long been useful (and economically viable) for closed loop logistics systems. Inspection, cleaning, repair and recouperage are often needed. Some manufacturers re-use the packaging of the incoming parts for a product, either as packaging for the outgoing product or as part of the product itself.
- Recycling – Recycling is the reprocessing of materials (pre- and post-consumer) into new products. Emphasis is focused on recycling the largest primary components of a package: steel, aluminum, papers, plastics, etc. Small components can be chosen which are not difficult to separate and do not contaminate recycling operations.
- Energy recovery – Waste-to-energy and Refuse-derived fuel in approved facilities are able to make use of the heat available from the packaging components.
- Disposal – Incineration, and placement in a sanitary landfill are needed for some materials. Certain states within the US regulate packages for toxic contents, which have the potential to contaminate emissions and ash from incineration and leachate from landfill. Packages should not be littered.

Development of sustainable packaging is an area of considerable interest by standards organizations, government, consumers, packagers, and retailers.

Packaging machines

Beer bottling lines

A choice of packaging machinery includes: technical capabilities, labor requirements, worker safety, maintainability, serviceability, reliability, ability to integrate into the packaging line, capital cost, floorspace, flexibility (change-over, materials, etc.), energy usage, quality of outgoing packages, qualifications (for food, pharmaceuticals, etc.), throughput, efficiency, productivity, ergonomics, return on investment, etc.

Packaging machinery can be:

1. purchased as standard, off-the-shelf
2. purchased custom-made or custom-tailored to specific operations
3. manufactured or modified by in-house engineers and maintenance staff

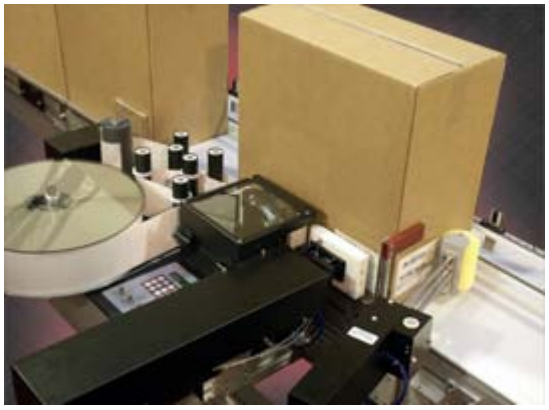
Packaging machines may be of the following general types:

- Accumulating and Collating Machines
- Blister packs, skin packs and Vacuum Packaging Machines
- Bottle caps equipment, Over-Capping, Lidding, Closing, Seaming and Sealing Machines
- Box, Case and Tray Forming, Packing, Unpacking, Closing and Sealing Machines

- Cartoning machines
- Cleaning, Sterilizing, Cooling and Drying Machines
- Coding, Printing, Marking, Stamping, and Imprinting Machines
- Converting Machines
- Conveyor belts, Accumulating and Related Machines
- Feeding, Orienting, Placing and Related Machines
- Filling Machines: Handling dry, powered, solid, liquid, gas, or viscous products
- Inspecting, Detecting and Check weigher Machines
- Label dispenser
- Orienting, Unscrambling Machines
- Package Filling and Closing Machines
- Palletizing, Depalletizing, Unit load assembly
- Product Identification: labeling, marking, etc.
- Wrapping machines: Shrink wrap, Banding
- Form, Fill and Seal Machines
- Other speciality machinery: slitters, perforating, laser cutters, parts attachment, etc.
- Process Machinery (Product Preparation): Chopper, Crusher, Cutter, Molder, Peeler, etc.
- Process Machinery (Special Product): Coating, Enrobing, Seasoning
- Process Machinery (Product Cooking, Heating, and Cooling): Aseptic

Bakery goods shrinkwrapped by shrink film, heat sealer and heat tunnel on roller conveyer

High speed conveyor with bar code scanner for sorting transport packages



Label printer applicator applying a label to adjacent panels of a corrugated box.

Robotics used to palletize bread

Equipment used for making molded pulp components and molding packaging from straw

A semi-automatic Rotary Arm Stretch Wrapper

Automated labeling line for wine bottles

Chapter- 5

Brand Extension

Brand extension or **brand stretching** is a marketing strategy in which a firm marketing a product with a well-developed image uses the same brand name in a different product category. The new product is called a **spin-off**. Organizations use this strategy to increase and leverage brand equity (definition: the net worth and long-term sustainability just from the renowned name). An example of a brand extension is Jello-gelatin creating Jello pudding pops. It increases awareness of the brand name and increases profitability from offerings in more than one product category.

A brand's "extendibility" depends on how strong consumer's associations are to the brand's values and goals. Ralph Lauren's Polo brand successfully extended from clothing to home furnishings such as bedding and towels. Both clothing and bedding are made of linen and fulfill a similar consumer function of comfort and hominess. Arm & Hammer leveraged its brand equity from basic baking soda into the oral care and laundry care categories. By emphasizing its key attributes, the cleaning and deodorizing properties of its core product, Arm & Hammer was able to leverage those attributes into new categories with success. Another example is Virgin Group, which was initially a record label that has extended its brand successfully many times; from transportation (aeroplanes, trains) to games stores and video stores such a Virgin Megastores.

In the 1990s, 81% of new products used brand extension to introduce new brands and to create sales. Launching a new product, is not only time consuming but also needs a big budget to create awareness and to promote a product's benefits. Brand extension is one of the new product development strategies which can reduce financial risk by using the parent brand name to enhance consumers' perception due to the core brand equity.

While there can be significant benefits in brand extension strategies, there can also be significant risks, resulting in a diluted or severely damaged brand image. Poor choices for brand extension may dilute and deteriorate the core brand and damage the brand equity. Most of the literature focuses on the consumer evaluation and positive impact on parent brand. In practical cases, the failures of brand extension are at higher rate than the successes. Some studies show that negative impact may dilute brand image and equity. In spite of the positive impact of brand extension, negative association and wrong communication strategy do harm to the parent brand even brand family.

Product extensions are versions of the same parent product that serve a segment of the target market and increase the variety of an offering. An example of a product extension is Coke vs. Diet Coke in same product category of soft drinks. This tactic is undertaken due to the brand loyalty and brand awareness they enjoy consumers are more likely to buy a new product that has a tried and trusted brand name on it. This means the market is catered for as they are receiving a product from a brand they trust and Coca Cola is catered for as they can increase their product portfolio and they have a larger hold over the market in which they are performing in.

Types of product extension

Brand extension research mainly focuses on the consumer evaluation of extension and attitude of the parent brand. Following the Aaker and Keller's (1990) model, they provide a sufficient depth and breadth proposition to examine consumer behaviour and conceptual framework. They use three dimensions to measure the fit of extension. First of all, the "Complement" is that consumer takes two product (extension and parent brand product) classes as complement to satisfy their specific needs. Secondly, the "Substitute" indicates two products have same user situation and satisfy their same needs which means the products class is very similar so that can replace each other. At last, the "Transfer" is the relationship between extension product and manufacturer which "reflects the perceived ability of any firm operating in the first product class to make a product in the second class". The first two measures focus on the consumer's demand and the last one focuses on firm's ability.

From the line extension to brand extension, however, there are many different way of extension such as "brand alliance", co-branding or "brand franchise extension". Tauber (1988) suggests seven strategies to identify extension cases such as product with parent brand's benefit, same product with different price or quality, etc. In his suggestion, it can be classified into two category of extension; extension of product-related association and non-product related association. Another form of brand extension, is a licensed brand extension. Where the brand-owner partners (sometimes with a competitor) who takes on the responsibility of manufacturer and sales of the new products, paying a royalty every time a product is sold.

Categorisation theory

Researchers tend to use "categorisation theory" as their fundamental theory to explore the links about the brand extension. When consumers face thousands of products, they not only are initially confused and disorderly in mind, but also try to categorise the brand association or image with their existing memory. When two or more products exit in front of consumers, they might reposition memories to frame a brand image and concept toward new introduction. A consumer can judge or evaluate the extension by their category memory. They categorise new information into specific brand or product class label and store it. This process is not only related to consumer's experience and knowledge, but also involvement and choice of brand. If the brand association is highly related to extension, consumer can perceive the fit among brand extension. Some studies

suggest that consumer may ignore or overcome the dissonance from extension especially flagship product which means the low perceived of fit does not dilute the flagship's equity.

Brand extension failure

Literature related to negative effect of brand extension is limited and the findings are revealed as incongruent. The early works of Aaker and Keller (1990) find no significant evidence that brand name can be diluted by unsuccessful brand extensions. Conversely, Loken and Roedder-John (1993) indicate that dilution effect do occur when the extension across inconsistency of product category and brand beliefs. The failure of extension may come from difficulty of connecting with parent brand, a lack of similarity and familiarity and inconsistent IMC messages.

"Equity of an integrated oriented brand can be diluted significantly from both functional and non-functional attributes-base variables", which means dilution does occur across the brand extension to the parent brand. These failures of extension make consumers create a negative or new association relate to parent brand even brand family or to disturb and confuse the original brand identity and meaning.

In addition, Martinez and de Chernatony (2004) classify the brand image in two types: the general brand image and the product brand image. They suggest that if the brand name is strong enough as Nike or Sony, the negative impact has no specific damage on general brand image and "the dilution effect is greater on product brand image than on general brand image". Consequently, consumers may maintain their belief about the attributes and feelings about parent brand, however their study does show that "brand extension dilutes the brand image, changing the beliefs and association in consumers' mind".

The flagship product is a money-spinner to a firm. Marketer spends budget and time to create maximum exposure and awareness for the product. Theoretically speaking, flagship product is usually had the top sales and highest awareness in its product category. In spite of Aaker and Keller's (1990) research which reports that prestigious brands are not harmed from failure of extensions, some evidence shows that the dilution effect has great and instant damage to the flagship product and brand family. Still, some studies suggest that even though overall parent belief is diluted; the flagship product would not be harmed. In addition, brand extension also "diminish[es] consumer's feelings and beliefs about brand name." To establish a strong brand, it is necessary to build up a "brand ladder".

Marketers may follow the order and model created by Aaker and Keller who are authorities on brand management, but branding does not always follow a rational line. One mistake can damage all brand equity. A classic extension failure example would be Coca Cola launching "New Coke" in 1985. Although initially accepted a backlash against "New Coke" soon emerged among consumers. Not only did Coca Cola not succeed in

developing a new brand but sales of the original flavour also decreased. Coca Cola had to make considerable efforts to regain customers who had turned to Pepsi cola.

Although there are few works about the failure of extensions, literature still provides sufficient in depth research around this issue. Studies also suggest that brand extension is a risky strategy to increase sales or brand equity. It should consider the damage of parent brand no matter what types of extension are used. Example. BIC Pens tried to produce BIC pantyhose. You can read some more here

Brand equity

Brand equity is defined as the main concern in brand management and IMC campaign. Every marketer should pursue the long term equity and pay attention to every strategy in detail. Because a small message dissonance would cause great failure of brand extension. On the other hand, consumer has his psychology process in mind. The moderating variable is a useful indication to evaluate consumer evaluation of brand extension.

Throughout the categorisation theory and associative network theory, consumer does have the ability to process information into useful knowledge for them. They would measure and compares the difference between core brand and extension product through quality of core brand, fit in category, former experience and knowledge, and difficulty of making. Consequently, here we, may conclude some points about consumer evaluation of brand extension:

1. Quality of core brand creates a strong position for brand and low the impact of fit in consumer evaluation.
2. Similarity between core brand and extension is the main concern of consumer perception of fit. The higher the similarity is the higher perception of fit.
3. Consumer's knowledge and experience affect the evaluation before extension product trail.
4. The more innovation of extension product is, the greater positive fit can perceive.

A successful brand message strategy relies on a congruent communication and a clear brand image. The negative impact of brand extension would cause a great damage to parent brand and brand family. From a manager and marketer's perspective, an operation of branding should maintain brand messages and associations within a consistency and continuum in the long way. Because the effects of negative impact from brand extension are tremendous and permanently. Every messages or brand extension can dilute the brand in nature.

Chapter- 6

Conjoint Analysis (Marketing)

Conjoint analysis is a statistical technique used in market research to determine how people value different features that make up an individual product or service.

The objective of conjoint analysis is to determine what combination of a limited number of attributes is most influential on respondent choice or decision making. A controlled set of potential products or services is shown to respondents and by analyzing how they make preferences between these products, the implicit valuation of the individual elements making up the product or service can be determined. These implicit valuations (utilities or part-worths) can be used to create market models that estimate market share, revenue and even profitability of new designs.

Conjoint originated in mathematical psychology and was developed by marketing professor Paul Green at the University of Pennsylvania and Data Chan. Other prominent conjoint analysis pioneers include professor V. “Seenu” Srinivasan of Stanford University who developed a linear programming (LINMAP) procedure for rank ordered data as well as a self-explicated approach, Richard Johnson (founder of Sawtooth Software) who developed the Adaptive Conjoint Analysis technique in the 1980s and Jordan Louviere (Ph.D., University of Iowa) who invented and developed Choice-based approaches to conjoint analysis and related techniques such as MaxDiff.

Today it is used in many of the social sciences and applied sciences including marketing, product management, and operations research. It is used frequently in testing customer acceptance of new product designs, in assessing the appeal of advertisements and in service design. It has been used in product positioning, but there are some who raise problems with this application of conjoint analysis.

Conjoint analysis techniques may also be referred to as multiattribute compositional modelling, discrete choice modelling, or stated preference research, and is part of a broader set of trade-off analysis tools used for systematic analysis of decisions. These tools include Brand-Price Trade-Off, Simalto, and mathematical approaches such as evolutionary algorithms or Rule Developing Experimentation.

Conjoint Design

A product or service area is described in terms of a number of attributes. For example, a television may have attributes of screen size, screen format, brand, price and so on. Each attribute can then be broken down into a number of levels. For instance, levels for screen format may be LED, LCD, or Plasma.

Respondents would be shown a set of products, prototypes, mock-ups, or pictures created from a combination of levels from all or some of the constituent attributes and asked to choose from, rank or rate the products they are shown. Each example is similar enough that consumers will see them as close substitutes, but dissimilar enough that respondents can clearly determine a preference. Each example is composed of a unique combination of product features. The data may consist of individual ratings, rank orders, or preferences among alternative combinations.

As the number of combinations of attributes and levels increases the number of potential profiles increases exponentially. Consequently, fractional factorial design is commonly used to reduce the number of profiles that have to be evaluated, while ensuring enough data is available for statistical analysis, resulting in a carefully controlled set of "profiles" for the respondent to consider

Types of conjoint analysis

The earliest forms of conjoint analysis were what are known as Full Profile studies, in which a small set of attributes (typically 4 to 5) are used to create profiles that are shown to respondents, often on individual cards. Respondents then rank or rate these profiles. Using relatively simple dummy variable regression analysis the implicit utilities for the levels can be calculated.

Two drawbacks were seen in these early designs. Firstly, the number of attributes in use was heavily restricted. With large numbers of attributes, the consideration task for respondents becomes too large and even with fractional factorial designs the number of profiles for evaluation can increase rapidly.

In order to use more attributes (up to 30), hybrid conjoint techniques were developed. The main alternative was to do some form of self-explication before the conjoint tasks and some form of adaptive computer-aided choice over the profiles to be shown.

The second drawback was that the task itself was unrealistic and did not link directly to behavioural theory. In real-life situations, the task would be some form of actual choice between alternatives rather than the more artificial ranking and rating originally used. Jordan Louviere pioneered an approach that used only a choice task which became the basic of choice-based conjoint and discrete choice analysis. This stated preference research is linked to econometric modeling and can be linked revealed preference where choice models are calibrated on the basis of real rather than survey data. Originally choice-based conjoint analysis was unable to provide individual level utilities as it

aggregated choices across a market. This made it unsuitable for market segmentation studies. With newer hierarchical Bayesian analysis techniques, individual level utilities can be imputed back to provide individual level data.

Information collection

Data for conjoint analysis is most commonly gathered through a market research survey, although conjoint analysis can also be applied to a carefully designed configurator or data from an appropriately design test market experiment. Market research rules of thumb apply with regard to statistical sample size and accuracy when designing conjoint analysis interviews.

The length of the research questionnaire depends on the number of attributes to be assessed and the method of conjoint analysis in use. A typical Adaptive Conjoint questionnaire with 20-25 attributes may take more than 30 minutes to complete. Choice based conjoint, by using a smaller profile set distributed across the sample as a whole may be completed in less than 15 minutes. Choice exercises may be displayed as a store front type layout or in some other simulated shopping environment.

Analysis

Any number of algorithms may be used to estimate utility functions. These utility functions indicate the perceived value of the feature and how sensitive consumer perceptions and preferences are to changes in product features. The actual mode of analysis will depend on the design of the task and profiles for respondents. For full profile tasks, linear regression may be appropriate, for choice based tasks, maximum likelihood estimation, usually with logistic regression are typically used. The original methods were monotonic analysis of variance or linear programming techniques, but these are largely obsolete in contemporary marketing research practice.

In addition, hierarchical Bayesian procedures that operate on choice data may be used to estimate individual level utilities from more limited choice-based designs.

Advantages

- estimates psychological tradeoffs that consumers make when evaluating several attributes together
- measures preferences at the individual level
- uncovers real or hidden drivers which may not be apparent to the respondent themselves
- realistic choice or shopping task
- able to use physical objects
- if appropriately designed, the ability to model interactions between attributes can be used to develop needs based segmentation

Disadvantages

- designing conjoint studies can be complex
- with too many options, respondents resort to simplification strategies
- difficult to use for product positioning research because there is no procedure for converting perceptions about actual features to perceptions about a reduced set of underlying features
- respondents are unable to articulate attitudes toward new categories, or may feel forced to think about issues they would otherwise not give much thought to
- poorly designed studies may over-value emotional/preference variables and undervalue concrete variables
- does not take into account the number items per purchase so it can give a poor reading of market share

Chapter- 7

Disruptive Technology

A **disruptive innovation** is an innovation that disrupts an existing market. The term is used in business and technology literature to describe innovations that improve a product or service in ways that the market does not expect, typically by lowering price or designing for a different set of consumers.

In contrast to "disruptive" innovation, a "sustaining" innovation does not have an effect on existing markets. Sustaining innovations may be either "discontinuous" (i.e. "transformational") or "continuous" (i.e. "evolutionary"). Transformational innovations are not always disruptive. Although the automobile was a transformational innovation, it was not a disruptive innovation, because early automobiles were expensive luxury items that did not disrupt the market for horse-drawn vehicles. The market for transportation essentially remained intact until the debut of the lower priced Ford Model T in 1908 by making higher speed, motorized transportation available to the masses.

History and usage of the term

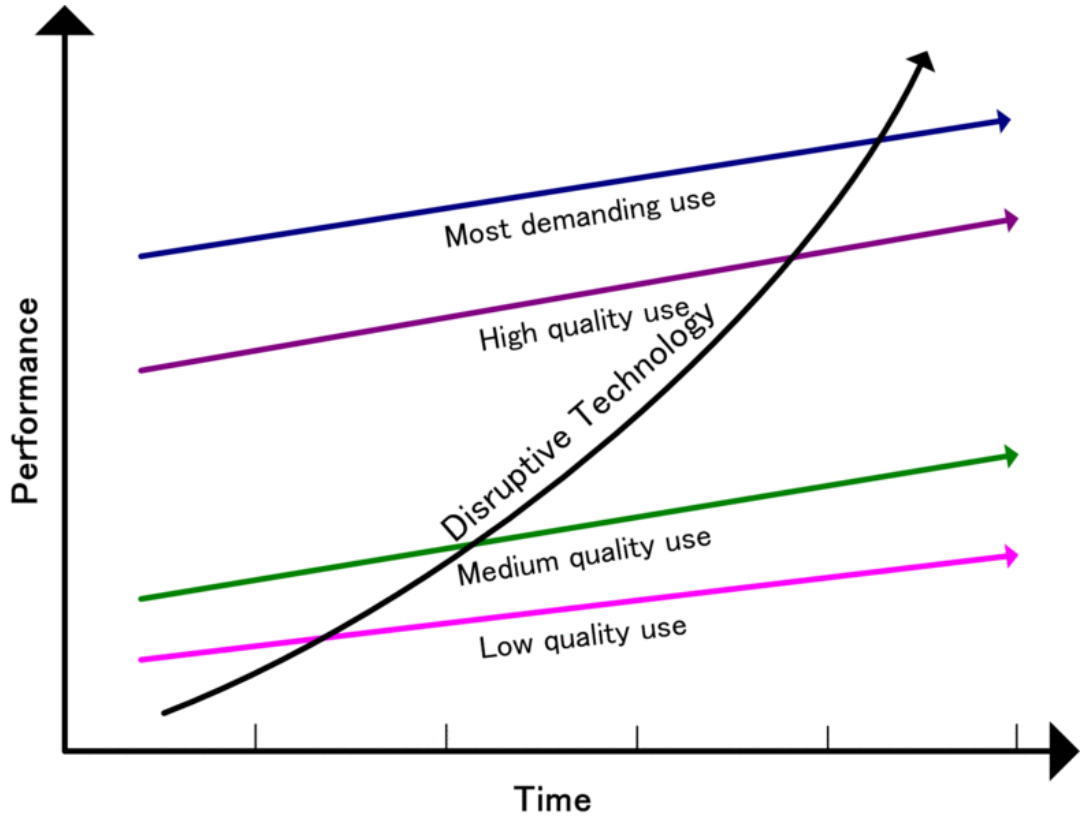
The term *disruptive technologies* was coined by Clayton M. Christensen and introduced in his 1995 article *Disruptive Technologies: Catching the Wave*, which he co-wrote with Joseph Bower. The article is aimed at managing executives who make the funding/purchasing decisions in companies rather than the research community. He describes the term further in his book *The Innovator's Dilemma*. (1997) In his sequel, *The Innovator's Solution*, (2003) Christensen replaced *disruptive technology* with the term *disruptive innovation* because he recognized that few technologies are intrinsically disruptive or sustaining in character. It is the strategy or business model that the technology enables that creates the disruptive impact. The concept of disruptive technology continues a long tradition of the identification of radical technical change in the study of innovation by economists, and the development of tools for its management at a firm or policy level. However, Christensen's evolution from a technological focus to a business modelling focus is central to understanding the evolution of business at the market or industry level. For example, Christensen's contemporary emphasis on the applied business model rather than the technology itself was developed by Henry Chesbrough's pioneering notion of Open Innovation.

The theory

Christensen defines a disruptive innovation as a product or service designed for a new set of customers.

"Generally, disruptive innovations were technologically straightforward, consisting of off-the-shelf components put together in a product architecture that was often simpler than prior approaches. They offered less of what customers in established markets wanted and so could rarely be initially employed there. They offered a different package of attributes valued only in emerging markets remote from, and unimportant to, the mainstream."

Christensen argues that disruptive innovations can hurt successful, well managed companies that are responsive to their customers and have excellent research and development. These companies tend to ignore the markets most susceptible to disruptive innovations, because the markets have very tight profit margins and are too small to represent significant growth.



How low-end disruption occurs over time.

Christensen distinguishes between "low-end disruption" which targets customers who do not need the full performance valued by customers at the high end of the market and

"new-market disruption" which targets customers who have needs that were previously unserved by existing incumbents.

"Low-end disruption" occurs when the rate at which products improve exceeds the rate at which customers can adopt the new performance. Therefore, at some point the performance of the product overshoots the needs of certain customer segments. At this point, a disruptive technology may enter the market and provide a product which has lower performance than the incumbent but which exceeds the requirements of certain segments, thereby gaining a foothold in the market.

In low-end disruption, the disruptor is focused initially on serving the least profitable customer, who is happy with a good enough product. This type of customer is not willing to pay premium for enhancements in product functionality. Once the disruptor has gained foot hold in this customer segment, it seeks to improve its profit margin. To get higher profit margins, the disruptor needs to enter the segment where the customer is willing to pay a little more for higher quality. To ensure this quality in its product, the disruptor needs to innovate. The incumbent will not do much to retain its share in a not so profitable segment, and will move up-market and focus on its more attractive customers. After a number of such encounters, the incumbent is squeezed into smaller markets than it was previously serving. And then finally the disruptive technology meets the demands of the most profitable segment and drives the established company out of the market.

"New market disruption" occurs when a product fits a new or emerging market segment that is not being served by existing incumbents in the industry.

Examples of disruptive innovations

Innovation	Disrupted market	Notes
8 inch floppy disk drive	14 inch floppy disk drive	The floppy disk drive market has had unusually large changes in market share over the past fifty years. According to Clayton M. Christensen's research, the cause of this instability was a repeating pattern of disruptive innovations. For example, in 1981, 8 inch drives (used in mini computers) were "vastly superior" to 5.25 inch drives (used in desktop computers). However, 8 inch drives were not affordable for the new desktop machines. The simple 5.25 inch drive, assembled from technologically inferior "off-the-shelf" components, was an "innovation" only in the sense that it was new. However, as this market grew and the drives improved, the companies that manufactured them eventually triumphed while many of the existing manufacturers of eight inch drives fell behind.
5.25 inch floppy disk drive	8 inch floppy disk drive	
3.5 inch floppy disk drive	5.25 inch floppy disk drive	

Downloadable Digital Media	CDs, DVDs	In the 1990s, the music industry phased out the single. This left consumers with no means to purchase individual songs. This market was filled by peer-to-peer file sharing technologies, which were initially free, and then by online retailers such as the iTunes music store and Amazon.com. This low end disruption eventually undermined the sales of physical, high-cost CDs.
Hydraulic excavators	Cable-operated excavators	Hydraulic excavators were clearly innovative at the time of introduction but they gain widespread use only decades after. However, cable-operated excavators are still used in some cases, mainly for large excavations.
Mini steel mills	vertically integrated steel mills	By using mostly locally available scrap and power sources these mills can be cost effective even though not large.
Minicomputers	Mainframes	Minicomputers were originally presented as an inexpensive alternative to mainframes and mainframe manufacturers did not consider them a serious threat in their market. Eventually, the market for minicomputers became much larger than the market for mainframes. Similarly, the market for main frames and mini-computers was seriously disrupted by personal computers. Although they were not at all competitive at the time of their introduction in the 1970s, by the mid 1980s they had improved exponentially and could compete directly with the more expensive machines.
Personal computers	Minicomputers, Workstations. Word processors, Lisp machines	
Desktop publishing	Traditional publishing	Early desktop-publishing systems could not match high-end professional systems in either features or quality. Nevertheless, they lowered the cost of entry to the publishing business, and economies of scale eventually enabled them to match, and then surpass, the functionality of the older dedicated publishing systems.
Computer printers	Offset printing	Offset printing has a high overhead cost, but very low unit cost compared to computer printers, and superior quality. But as printers, especially laser printers, have improved in speed and quality, they have become increasingly useful for creating documents in

		limited issues.
Digital photography	Chemical photography	Early digital cameras suffered from low picture quality and resolution and long shutter lag. Quality and resolution are no longer major issues and shutter lag is much less than it used to be. The convenience of small memory cards and portable hard drives that hold hundreds or thousands of pictures, as well as the lack of the need to develop these pictures, also helped. Digital cameras have a high power consumption (but several lightweight battery packs can provide enough power for thousands of pictures). Cameras for classic photography are stand-alone devices. In the same manner, high-resolution digital video recording has replaced film stock, except for high-budget motion pictures.
High speed CMOS video sensors	Photographic film	When first introduced, high speed CMOS sensors were less sensitive, had lower resolution, and cameras based on them had less duration (record time). The advantage of rapid setup time, editing in the camera, and nearly-instantaneous review quickly eliminated 16 mm high speed film systems. CMOS-based cameras also require less power (single phase 110 V AC and a few amps for CMOS, vs. 240 V single- or three-phase at 20-50 A for film cameras). Continuing advances have overtaken 35 mm film and are challenging 70 mm film applications.
Steamships	Sailing ships	The first steamships were deployed on inland waters where sailing ships were less effective, instead of on the higher profit margin seagoing routes. Hence steamships originally only competed in traditional shipping lines' "worst" markets.
Telephones	Telegraphy	When Western Union infamously declined to purchase Alexander Graham Bell's telephone patents for $100,000, their highest-profit market was long-distance telegraphy. Telephones were only useful for very local calls. Short-distance telegraphy barely existed as a market segment, which explains

		Western Union's decision.
Automobiles	Rail transport	At the beginning of the 20th century, rail (including streetcars) was the fastest and most cost-efficient means of land transportation for goods and passengers in industrialized countries. The first cars, buses and trucks were used for local transportation in suburban areas, where they often replaced streetcars and industrial tracks. As highways expanded, medium- and later long-distance transports were relocated to road traffic, and some railways closed down. As rail traffic has a lower ton-kilometer cost, but a higher investment and operating cost than road traffic, rail is still preferred for large-scale bulk cargo (such as minerals). Since rail has always been faster than contemporary road vehicles, it is viable for passengers in populated regions like Western Europe, south and east Asia and the Northeast Corridor. When urban density increases, rail systems often become more attractive and make a comeback.
Private jet	Supersonic transport	The Concorde aircraft has so far been the only supersonic airliner in extensive commercial traffic. However, it catered to a small customer segment, which could later afford small private sub-sonic jets. The loss of speed was compensated by flexibility and a more direct routing (i.e. no need to go through a hub. Supersonic flight is also banned above inhabited land, due to sonic booms. The Concorde service was withdrawn in 2003.
Plastic	Metal, wood, glass etc	Bakelite and other early plastics had very limited use - their main advantages were electric insulation and low cost. New forms had advantages such as transparency, elasticity and combustibility. In the early 21st century, plastics can be used for nearly all household items previously made of metal, wood and glass.

Light-emitting diodes	Light bulbs	A LED is significantly smaller and less power-consuming than a light bulb. The first optical LEDs were weak, and only useful as indicator lights. Later models could be used for indoor lighting, and future ones will probably be strong enough to serve as street lights. Classical light bulbs for lower light indoor use remain, possible mainly because of sentimental and aesthetic value, although some lamps using other technologies have designs resembling light bulbs. Incandescent light bulbs are being phased out in many countries.
Digital synthesizer	Electronic organ and piano	Synthesizers were initially low-cost, low-weight alternatives to electronic organs and acoustic pianos. Today's synthesizers feature many automated functions and have replaced them for home and hobby users.
Mobile Telephony	Mobile Discount Operators	Mobile Discount / No Frills Operators (MDOs aka. MVNOs) first focused on a low-distribution-cost-through-internet sales model. In later times, innovations like low-priced mobile-internet tariffs were brought to market. This tripped the development of a new discount category in the market which was later entered by the large discount retail chains with own branded offerings leveraging their distribution power in the lower tier of the market.
LCD	CRT	The first liquid crystal displays (LCD) were monochromatic and had low resolution. They were used in watches and other handheld devices, but during the early 2000s these (and other planar technologies) largely replaced the dominant cathode ray tube (CRT) technology for computer displays and television sets, although CRT technologies have improved with advances like true-flat panels and digital controls only recently.
Digital calculator	Mechanical calculator	Facit AB used to dominate the European market for calculators, but did not adapt digital technology, and failed to compete with digital competitors.

Podcasting	Broadcast Radio & TV	With the advent of podcasting, broadcast radio and television have seen a decline in their listeners/viewers. Broadcasting companies have had to look for innovative ways to "time-shift" their content so that consumers can watch or view media when and where they desire.

Business implications

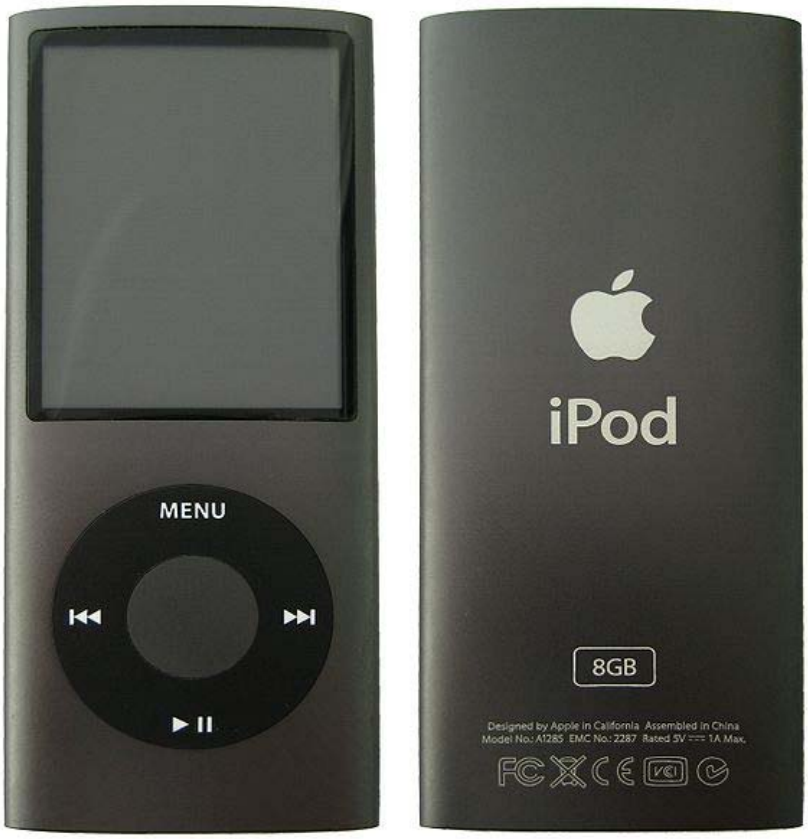
Disruptive technologies are not always disruptive to customers, and often take a long time before they are significantly disruptive to established companies. They are often difficult to recognize. Indeed, as Christensen points out and studies have shown, it is often entirely rational for incumbent companies to ignore disruptive innovations, since they compare so badly with existing technologies or products, and the deceptively small market available for a disruptive innovation is often very small compared to the market for the established technology.

Even if a disruptive innovation is recognized, existing businesses are often reluctant to take advantage of it, since it would involve competing with their existing (and more profitable) technological approach. Christensen recommends that existing firms watch for these innovations, invest in small firms that might adopt these innovations, and continue to push technological demands in their core market so that performance stays above what disruptive technologies can achieve.

Disruptive technologies, too, can be subtly disruptive, rather than prominently so. Examples include digital photography (the sharp decline in consumer demand for common 35 mm print film has had a deleterious effect on free-riders such as slide and infrared film stocks, which are now more expensive to produce) and IP/Internet telephony, where the replacement technology does not, and sometimes cannot practically replace all of the non-obvious attributes of the older system (sustained operation through municipal power outages, national security priority access, the higher degree of obviousness that the service may be life-safety critical or deserving of higher restoration priority in catastrophes, etc).

Chapter- 8

Industrial Design



An iPod, an industrially designed product

KitchenAid 5 qt. Stand Mixer, designed in 1937 by Egmont Arens, remains very successful today

Industrial design is a combination of applied art and applied science, whereby the aesthetics, ergonomics and usability of products may be improved for marketability and production. The role of an industrial designer is to create and execute design solutions towards problems of form, usability, physical ergonomics, marketing, brand development and sales.

The term "industrial design" is often attributed to the designer Joseph Claude Sinel in 1919 (although he himself denied it in later interviews) but the discipline predates that by at least a decade. Its origins lay in the industrialization of consumer products. For instance the Deutscher Werkbund, founded in 1907 and a precursor to the Bauhaus, was a state-sponsored effort to integrate traditional crafts and industrial mass-production techniques, to put Germany on a competitive footing with England and the United States.

Definition of industrial design

Western Electric model 302 Telephone, found almost universally in the United States from 1937 until the introduction of touch-tone dialing, as the Family's life was extended into the 1960s

General

The objective of this area is to study both function and form, and the connection between product and the user - product as it happens in any other architecture area, being the only difference, that here the professionals that participate in the process are all specialized in small scale design, rather than in other massive colossal equipments like buildings or ships. Architects do not design the gears or motors that make machines move, or the circuits that control the movement (that task is usually attributed to engineers), but they can affect technical aspects through usability design and form relationships. And usually, they partner a whole of other professionals like marketers, to identify and fulfill needs, wants and expectations.

In Depth

"Industrial Design (ID) is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer".

Design, itself, is often difficult to define to non-designers because the meaning accepted by the design community is not one made of words. Instead, the definition is created as a result of acquiring a critical framework for the analysis and creation of artifacts. One of the many accepted (but intentionally unspecific) definitions of design originates from Carnegie Mellon's School of Design, "Design is the process of taking something from its existing state and moving it to a preferred state." This applies to new artifacts, whose existing state is undefined, and previously created artifacts, whose state stands to be improved.

According to the Chartered Society of Designers, design is a force that delivers innovation that in turn has exploited creativity. Their design framework known as the Design Genetic Matrix determines a set of competences in 4 key genes that are identified to define the make up of designers and communicate to a wide audience what they do. Within these genes the designer demonstrates the core competences of a designer and specific competences determine the designer as an 'industrial designer'. This is normally within the context of delivering innovation in the form of a three dimensional product that is produced in quantity. However the definition also extends to products that have been produced using an industrial process.

According to the ICSID (International Council of Societies of Industrial Design), "Design is a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life-cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange."

It is critical to the product development process that the industrial design and engineering aspects of a product are considered simultaneously. This can occur via two methods. The most streamlined method is for the product designer to have an education and/or background that encompasses both industrial design and engineering. Unfortunately, there are very few educational establishments (especially in the United States) that embrace this educational ideology. A survey of engineering and industrial design curricula clearly demonstrates this fault. The other method, which is utilized by most U.S. companies, is to employ or contract with separate teams that focus somewhat independently, with occasional meetings to ensure the primary goals of each team are met or exceeded. The difficulty with the latter process is that there is sometimes a vast disconnect behind the skills, education, and understanding of the two groups. This disconnect can sometimes become extremely cumbersome to the design process, and possibly fatal to the ultimate success of the product.

Process of design

A Fender Stratocaster with sunburst finish, one of the most widely recognized electric guitars in the world.

Model 1300 Volkswagen Beetle

Although the process of design may be considered 'creative', many analytical processes also take place. In fact, many industrial designers often use various design methodologies in their creative process. Some of the processes that are commonly used are user research, sketching, comparative product research, model making, prototyping and testing. These processes can be chronological, or as best defined by the designers and/or other team members. Industrial designers often utilize 3D software, computer-aided industrial design and CAD programs to move from concept to production. Product characteristics specified by the industrial designer may include the overall form of the object, the location of details with respect to one another, colors, texture, sounds, and aspects concerning the use of the product ergonomics. Additionally the industrial designer may specify aspects concerning the production process, choice of materials and the way the product is presented to the consumer at the point of sale. The use of industrial designers in a product development process may lead to added values by improved usability, lowered production costs and more appealing products. However, some classic industrial designs are considered as much works of art as works of engineering: the iPod, the Jeep, the Fender Stratocaster, the Coke bottle, and the VW Beetle are frequently cited examples.

Industrial design also has a focus on technical concepts, products and processes. In addition to considering aesthetics, usability, and ergonomics, it can also encompass the engineering of objects, usefulness as well as usability, market placement, and other concerns such as seduction, psychology, desire, and the emotional attachment of the user to the object. These values and accompanying aspects on which industrial design is based can vary, both between different schools of thought and among practicing designers.

Product design and industrial design can overlap into the fields of user interface design, information design and interaction design. Various schools of industrial design and/or product design may specialize in one of these aspects, ranging from pure art colleges (product styling) to mixed programs of engineering and design, to related disciplines like

exhibit design and interior design, to schools where aesthetic design is almost completely subordinated to concerns of function and ergonomics of use (the so-called *functionalist* school).

Also used to describe a technically competent product designer or industrial designer is the term *Industrial Design Engineer*. The Cyclone vacuum cleaner inventor James Dyson for example could be considered to be in this category[A].

Industrial design rights

Industrial design rights are intellectual property rights that make exclusive the visual design of objects that are not purely utilitarian. An industrial design consists of the creation of a shape, configuration or composition of pattern or color, or combination of pattern and color in three dimensional form containing aesthetic value. An industrial design can be a two- or three-dimensional pattern used to produce a product, industrial commodity or handicraft. Under the Hague Agreement Concerning the International Deposit of Industrial Designs, a WIPO-administered treaty, a procedure for an international registration exists. An applicant can file for a single international deposit with WIPO or with the national office in a country party to the treaty. The design will then be protected in as many member countries of the treaty as desired.

Notable industrial designers

A number of industrial designers have made such a significant impact on culture and daily life that they have attained a level of notability beyond that of an average designer. Alvar Aalto, renowned as an architect, also designed a significant number of household items, such as chairs, stools, lamps, a tea-cart, and vases. Raymond Loewy was a prolific American designer who is responsible for the Royal Dutch Shell corporate logo, the original BP logo (in use until 2000), the PRR S1 steam locomotive, the Studebaker Starlight (including the later iconic bulletnose), as well as Schick electric razors, Electrolux refrigerators, short-wave radios, Le Creuset French ovens, and a complete line of modern furniture, among many other items. Richard A. Teague, who spent most of his career with the American Motor Company, originated the concept of using interchangeable body panels so as to create a wide array of different vehicles using the same stampings. He was responsible for such unique automotive designs as the Pacer, Gremlin, Matador coupe, Jeep Cherokee, and the complete interior of the Eagle Premier. Viktor Schreckengost designed bicycles manufactured by Murray bicycles for Murray and Sears, Roebuck and Company. With engineer Ray Spiller, he designed the first truck with a cab-over-engine configuration, a design in use to this day. Schreckengost also founded The Cleveland Institute of Art's school of industrial design. Charles and Ray Eames were most famous for their unique furniture design, such as the Eames Lounge Chair Wood and Eames Lounge Chair.

Another example is German industrial designer Dieter Rams, who is closely associated with the consumer products company Braun (where he worked until 1995) and the Functionalist school of industrial design. He is famous for his "ten principles to good

design", in addition to designing many iconic products at Braun. More recently, Jonathan Ive, the Senior Vice President of Design at Apple Inc., is credited for designing products for the company, which has a strong philosophy in aesthetics. His designs include the iPod and iPhone.

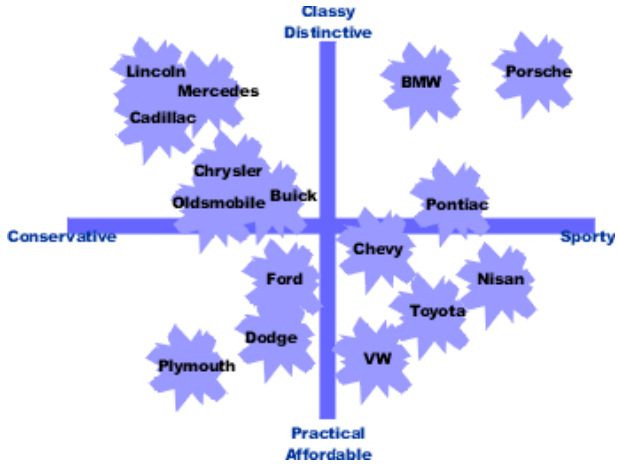
Chapter- 9

Perceptual Mapping and Brand Equity

Perceptual mapping

Perceptual mapping is a graphics technique used by asset marketers that attempts to visually display the perceptions of customers or potential customers. Typically the position of a product, product line, brand, or company is displayed relative to their competition.

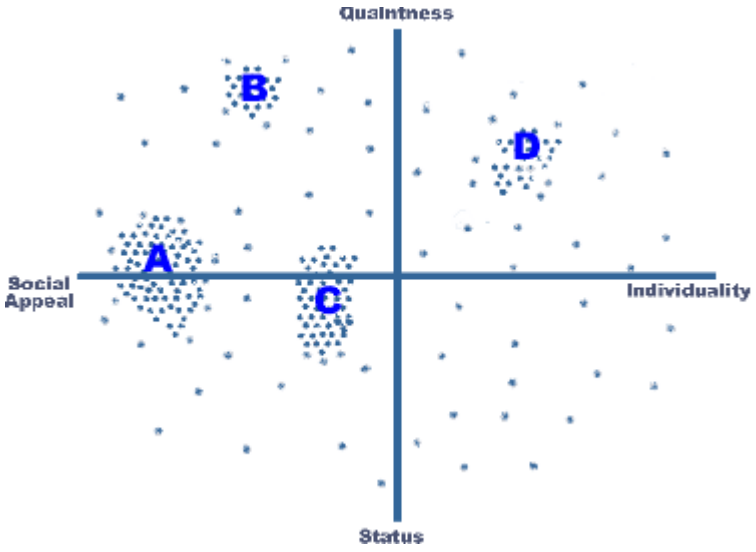
Perceptual maps can have any number of dimensions but the most common is two dimensions. Any more is a challenge to draw and confusing to interpret. The first perceptual map below shows consumer perceptions of various automobiles on the two dimensions of sportiness/conservative and classy/affordable. This sample of consumers felt Porsche was the sportiest and classiest of the cars in the study (top right corner). They felt Plymouth was most practical and conservative (bottom left corner).



Perceptual Map of Competing Products

Cars that are positioned close to each other are seen as similar on the relevant dimensions by the consumer. They are close competitors and form a competitive grouping. A company considering the introduction of a new model will look for an area on the map free from competitors. Some perceptual maps use different size circles to indicate the sales volume or market share of the various competing products.

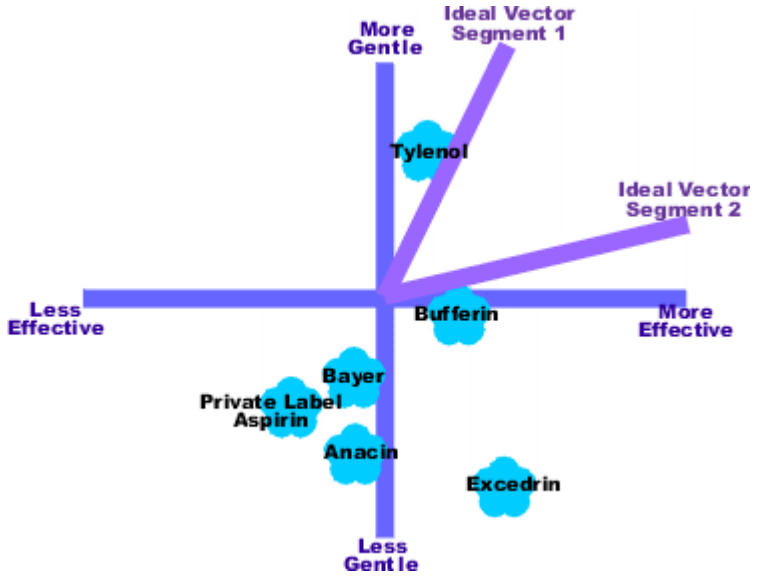
Displaying consumers' perceptions of related products is only half the story. Many perceptual maps also display consumers' ideal points. These points reflect ideal combinations of the two dimensions as seen by a consumer. The next diagram shows a study of consumers' ideal points in the **alcohol/spirits product space**. Each dot represents one respondent's ideal combination of the two dimensions. Areas where there is a cluster of ideal points (such as A) indicates a market segment. Areas without ideal points are sometimes referred to as demand voids.



Perceptual Map of Ideal Points and Clusters

A company considering introducing a new product will look for areas with a high density of ideal points. They will also look for areas without competitive rivals. This is best done by placing both the ideal points and the competing products on the same map.

Some maps plot ideal vectors instead of ideal points. The map below, displays various aspirin products as seen on the dimensions of effectiveness and gentleness. It also shows two ideal vectors. The slope of the ideal vector indicates the preferred ratio of the two dimensions by those consumers within that segment. This study indicates there is one segment that is more concerned with effectiveness than harshness, and another segment that is more interested in gentleness than strength.



Perceptual Map of Competing Products with Ideal Vectors

Perceptual maps need not come from a detailed study. There are also intuitive maps (also called judgmental maps or consensus maps) that are created by marketers based on their understanding of their industry. Management uses its best judgment. It is questionable how valuable this type of map is. Often they just give the appearance of credibility to management's preconceptions.

When detailed marketing research studies are done methodological problems can arise, but at least the information is coming directly from the consumer. There is an assortment of statistical procedures that can be used to convert the raw data collected in a survey into a perceptual map. Preference regression will produce ideal vectors. Multi dimensional scaling will produce either ideal points or competitor positions. Factor analysis, discriminant analysis, cluster analysis, and logit analysis can also be used. Some techniques are constructed from perceived differences between products, others are constructed from perceived similarities. Still others are constructed from cross price elasticity of demand data from electronic scanners.

Brand equity

Brand equity refers to the marketing effects and outcomes that accrue to a product with its brand name compared with those that *would* accrue if the same product did not have the brand name. Because of the well known brand name the company some time charges premium prices from the consumer . And, at the root of these marketing effects is consumers' knowledge. In other words, consumers' knowledge about a brand makes manufacturers/advertisers respond differently or adopt appropriately adept measures for the marketing of the brand. The study of brand equity is increasingly popular as some

marketing researchers have concluded that brands are one of the most valuable assets that a company has. Brand equity is one of the factors which can increase the financial value of a brand to the brand owner, although not the only one. Elements that can be included in the valuation of brand equity include (but not limited to): changing market share, profit margins, consumer recognition of logos and other visual elements, brand language associations made by consumers, consumers' perceptions of quality and other relevant brand values.

Measurement

There are many ways to measure a brand. Some measurements approaches are at the firm level, some at the product level, and still others are at the consumer level.

Firm Level: Firm level approaches measure the brand as a financial asset. In short, a calculation is made regarding how much the brand is worth as an intangible asset. For example, if you were to take the value of the firm, as derived by its market capitalization - and then subtract tangible assets and "measurable" intangible assets- the residual would be the brand equity. One high profile firm level approach is by the consulting firm Interbrand. To do its calculation, Interbrand estimates brand value on the basis of projected profits discounted to a present value. The discount rate is a subjective rate determined by Interbrand and Wall Street equity specialists and reflects the risk profile, market leadership, stability and global reach of the brand.

Product Level*:* The classic product level brand measurement example is to compare the price of a no-name or private label product to an "equivalent" branded product. The difference in price, assuming all things equal, is due to the brand. More recently a revenue premium approach has been advocated.

Consumer Level*:* This approach seeks to map the mind of the consumer to find out what associations with the brand the consumer has. This approach seeks to measure the awareness (recall and recognition) and brand image (the overall associations that the brand has). Free association tests and projective techniques are commonly used to uncover the tangible and intangible attributes, attitudes, and intentions about a brand. Brands with high levels of awareness and strong, favorable and unique associations are high equity brands.

All of these calculations are, at best, approximations. A more complete understanding of the brand can occur if multiple measures are used.

Positive brand equity vs. negative brand equity

A brand equity is the positive effect of the brand on the difference between the prices that the consumer accepts to pay when the brand known compared to the value of the benefit received.

There are two schools of thought regarding the existence of negative brand equity. One perspective states brand equity cannot be negative, hypothesizing only positive brand equity is created by marketing activities such as advertising, PR, and promotion. A second perspective is that negative equity can exist, due to catastrophic events to the brand, such as a wide product recall or continued negative press attention (Blackwater or Halliburton, for example).

Colloquially, the term "negative brand equity" may be used to describe a product or service where a brand has a negligible effect on a product level when compared to a no-name or private label product.

Family branding vs. individual branding strategies

The greater a company's brand equity, the greater the probability that the company will use a family branding strategy rather than an individual branding strategy. This is because family branding allows them to leverage the equity accumulated in the core brand. Aspects of brand equity includes: brand loyalty, awareness, association, and perception of quality .

Examples

In the early 2000s in North America, the Ford Motor Company made a strategic decision to brand all new or redesigned cars with names starting with "F". This aligned with the previous tradition of naming all sport utility vehicles since the Ford Explorer with the letter "E". The Toronto Star quoted an analyst who warned that changing the name of the well known Windstar to the Freestar would cause confusion and discard brand equity built up, while a marketing manager believed that a name change would highlight the new redesign. The aging Taurus, which became one of the most significant cars in American auto history, would be abandoned in favor of three entirely new names, all starting with "F", the Five Hundred, Freestar and Fusion. By 2007, the Freestar was discontinued without a replacement. The Five Hundred name was thrown out and Taurus was brought back for the next generation of that car in a surprise move by Alan Mulally. "Five Hundred" was recognized by less than half of most people, but an overwhelming majority was familiar with the "Ford Taurus".

Chapter- 10

Trademark Distinctiveness

Trademark distinctiveness is an important concept in the law governing trademarks and service marks. A trademark may be eligible for registration, or **registrable**, if amongst other things it performs the essential trademark function, and has **distinctive character**. Registrability can be understood as a continuum, with "inherently distinctive" marks at one end, "generic" and "descriptive" marks with no distinctive character at the other end, and "suggestive" and "arbitrary" marks lying between these two points. This part of registration is known as Section 3 of the trademark act in the UK as opposed to Section 5 which is concerned with prior rights of others. A mark must satisfy both sections to become registered.

The spectrum of distinctiveness

Courts often speak of marks falling along the following "**spectrum of distinctiveness"**:

Fanciful marks

A **fanciful** / **inherently distinctive** trademark is prima facie registrable, and comprises an entirely invented or "fanciful" sign. For example, "Kodak" had no meaning before it was adopted and used as a trademark in relation to goods, whether photographic goods or otherwise. Invented marks are neologisms which will not previously have been found in any dictionary.

Arbitrary marks

An **arbitrary** trademark is usually a common word which is used in a meaningless context (e.g. "Apple" for computers). Such marks consist of words or images which have some dictionary meaning before being adopted as trademarks, but which are used in connection with products or services unrelated to that dictionary meaning. Arbitrary marks are also immediately eligible for registration. *Salty* would be an arbitrary mark if it used in connection with e.g. telephones such as in *Salty Telephones*, as the term "salt" has no particular connection with such products.

Suggestive marks

A **suggestive** trademark tends to indicate the nature, quality, or a characteristic of the products or services in relation to which it is used, but does not describe this characteristic, and requires imagination on the part of the consumer to identify the characteristic. Suggestive marks invoke the consumer's perceptive imagination. An example of a suggestive mark is Blu-ray, a new technology of high-capacity data storage.

Descriptive marks

A **descriptive** mark is a term with a dictionary meaning which is used in connection with products or services directly related to that meaning. An example might be *Salty* used in connection with saltine crackers or anchovies. Such terms are not registrable unless it can be shown that distinctive character has been established in the term through extensive use in the marketplace. Lektronic was famously refused protection by the USPTO on ground of being descriptive for electronic goods.

Generic marks

A **generic** term is the common name for the products or services in connection with which it is used, such as "salt" when used in connection with sodium chloride. A generic term is not capable of serving the essential trademark function of distinguishing the products or services of a business from the products or services of other businesses, and therefore cannot be afforded any legal protection. This is because there has to be some term which may generally be used by anyone—including other manufacturers—to refer to a product without using some organization's proprietary trademark. Marks which become generic after losing distinctive character are known as genericized trademarks.

Assessing distinctiveness

In trademark litigation, courts are most frequently asked to parse between *suggestive* and *descriptive* marks on the one hand, and between *descriptive* and *generic* marks on the other. This is because suggestive marks, like fanciful and arbitrary marks, are presumed to be entitled to trademark protection, while descriptive marks are entitled to protection if they have become known as representing the producer of the goods, and generic marks can never receive protection. It can be seen from the examples above that the distinctive character of a term is closely related to the products or services in relation to which the term is used.

A general method for assessing the distinctive character of a mark is to consider a consumer's reaction to a mark. The mark may only be inherently registrable if the consumer has never encountered the mark before. On the other hand, the mark is unlikely to be inherently registrable if it informs him about any characteristic of the relevant products or services (e.g. whether they are delicious, large, spicy, black or sweet, in the case of fruit). In any other case the mark may not be registrable.

Another example of a descriptive mark would be a geographical word or phrase that merely indicates the origin of the product or service. For example, Houston based ice cream might find that the name "Houston ice cream" is denied trademark protection on the grounds that the word Houston is merely descriptive. However, they might have better luck with the name "North Pole ice cream". In the latter case, although North Pole is a geographical location, the ice cream is not actually made at the North Pole, and no reasonable person would assume that the phrase North Pole is literally descriptive.

Therefore marks that identify or describe a product or service, or that are in common use, or that are used as geographical indications, generally cannot be registered as trademarks, and remain in the public domain for use by anyone. For example, a generic term such as "apple", or descriptive terms such as "red" or "juicy" could not be registered in relation to apples.

Primary consideration in the selection and use of trademarks should be given to marks which are inherently distinctive, as they possess the strongest distinctive character and do not require evidence of use to establish acquired distinctiveness. A fanciful, arbitrary, or suggestive term can be inherently distinctive and registrable without proof of acquired distinctiveness. Although these categories are most easily applied in relation to trademarks comprising words, the same general principles are applied in relation to all kinds of trademarks. For example, a pine tree shape is descriptive when used on pine-scented products.

Acquired distinctiveness

A trademark with no distinctive character (i.e. a mark which is not inherently distinctive) is prima facie unregistrable. However, most jurisdictions may still allow such marks to be registered if the trademark owner can demonstrate, typically by reference to **evidence of use**, that consumers in the marketplace exclusively associate the mark, as used on the identified goods or in connection with the identified services, with a particular commercial origin or source (i.e. the trademark owner). "Use" may include authorized use by a licensee or other party. If the trade marks office is satisfied that the evidence demonstrates that a mark has "acquired" distinctive character *as a matter of fact*, then the mark may be accepted for registration on the basis of **acquired distinctiveness**.

The nature and extent of acceptable evidence of use varies between jurisdictions, although the most useful evidence usually includes sales figures, details of advertising and promotional expenditure, and examples of promotional material. Consumer surveys may also help establish that consumers chiefly associate an otherwise non-distinctive mark with the trademark owner and its products or services. Generally, evidence of use may only be acceptable or relevant if it covers a certain period of time (e.g. three years prior to the filing date of the trademark application) and originates from within the jurisdiction where registration is sought.

The terminology of acquired distinctiveness is accepted in the European Union and Commonwealth jurisdictions such as Australia, Hong Kong and the United Kingdom, and

the common law jurisdiction of the United States (which also uses the term **secondary meaning**). In the U.S., if a trademark has been used for a continuous period of at least five years after the date of registration, the right to use the mark and the registration may become "incontestable" (e.g. invulnerable to cancellation for non-use, but not for becoming generic). In such cases the USPTO checks and confirm whether the request for incontestability meets formality requirements, but whether a registration is incontestable at law can only be determined during legal proceedings involving the registration.

The essential function of a trademark is to exclusively identify the commercial source or origin of products or services, such that a trademark, properly called, indicates source or serves as a badge of origin. The use of a trademark in this way is known as trademark use. Certain exclusive rights attach to a registered mark, which can be enforced by way of an action for trademark infringement, while unregistered trademark rights may be enforced pursuant to the common law tort of passing off.

It should be noted that trademark rights generally arise out of the use and/or registration (see below) of a mark in connection only with a specific type or range of products or services. Although it may sometimes be possible to take legal action to prevent the use of a mark in relation to products or services outside this range (e.g. for passing off), this does not mean that trademark law prevents the use of that mark by the general public. A common word, phrase, or other sign can only be removed from the public domain to the extent that a trademark owner is able to maintain exclusive rights over that sign in relation to certain products or services, assuming there are no other trademark objections.

Maintaining distinctiveness

If a court rules that a trademark has become "generic" through common use (such that the mark no longer performs the essential trademark function and the average consumer no longer considers that exclusive rights attach to it), the corresponding registration may also be ruled invalid.

For example, the Bayer company's trademark "Aspirin" has been ruled generic in the United States, so other companies may use that name for acetylsalicylic acid as well (although it is still a trademark in Canada). Xerox for photocopiers and Band-Aid for adhesive bandages are both trademarks which are at risk of succumbing to death by becoming declared generic in certain countries, something that the respective trademark owners actively seek to prevent. In order to prevent marks becoming generic, trademark owners often contact those who appear to be using the trademark incorrectly, from web page authors to dictionary editors, and request that they cease the improper usage.

The proper use of a trademark means using the mark as an adjective, not as a noun or a verb, though for certain trademarks, use as nouns and, less commonly, verbs is common. For example, Adobe sent e-mails to many web authors using the term "photoshopped" telling them that they should only use the term "modified by Adobe® Photoshop® software." Xerox has also purchased print advertisements declaring that "you cannot 'xerox' a document, but you can copy it on a Xerox Brand copying machine." Another

popular example is the use of the word "frappuccino" by Starbucks customers to mean any blended coffee beverage, though employees are instructed to only say "frappuccino blended coffee" or "frappuccino blended cream" when referring to such drinks. This rule is not hard-and-fast, however; for example, Lexis-Nexis has a U.S. trademark registration for "Shepardize," Reg. No. 1743711, and defines "Shepardizing on a web page as "the process of looking up citations" in "a series of books called Shepard's Citations." Such efforts may or may not be successful in preventing genericism in the long run, which depends less on the mark owner's efforts and more on how the public actually perceives and uses the mark. In fact, legally it is more important that the trademark holder visibly and actively seems to attempt to prevent its trademark from becoming generic, regardless of real success.

Chapter- 11

Product Management & Product Life Cycle Management

Product Management

Product management is an organizational lifecycle function within a company dealing with the planning or forecasting or marketing of a product or products at all stages of the product lifecycle.

Product management (inbound focused) and product marketing (outbound focused) are different yet complementary efforts with the objective of maximizing sales revenues, market share, and profit margins. The role of product management spans many activities from strategic to tactical and varies based on the organizational structure of the company. Product management can be a function separate on its own and a member of marketing or engineering.

While involved with the entire product lifecycle, product management's main focus is on driving new product development. According to the Product Development and Management Association (PDMA), superior and differentiated new products — ones that deliver unique benefits and superior value to the customer — is the number one driver of success and product profitability.

Aspects of product management

Depending on the company size and history, product management has a variety of functions and roles. Sometimes there is a product manager, and sometimes the role of product manager is held by others. Frequently there is Profit and Loss (P&L) responsibility as a key metric for evaluating product manager performance. In some companies, the product management function is the hub of many other activities around the product. In others, it is one of many things that need to happen to bring a product to market.

Product management often serves an inter-disciplinary role, bridging gaps within the company between teams of different expertise, most notably between engineering-oriented teams and business-oriented teams. For example product managers often translate business objectives set for a product by Marketing or Sales into engineering

requirements. Conversely they may work to explain the capabilities and limitations of the finished product back to Marketing and Sales. Product Managers may also have one or more direct reports such as a Product Executive who can manage operational tasks or a Change Manager who can oversee new initiatives.

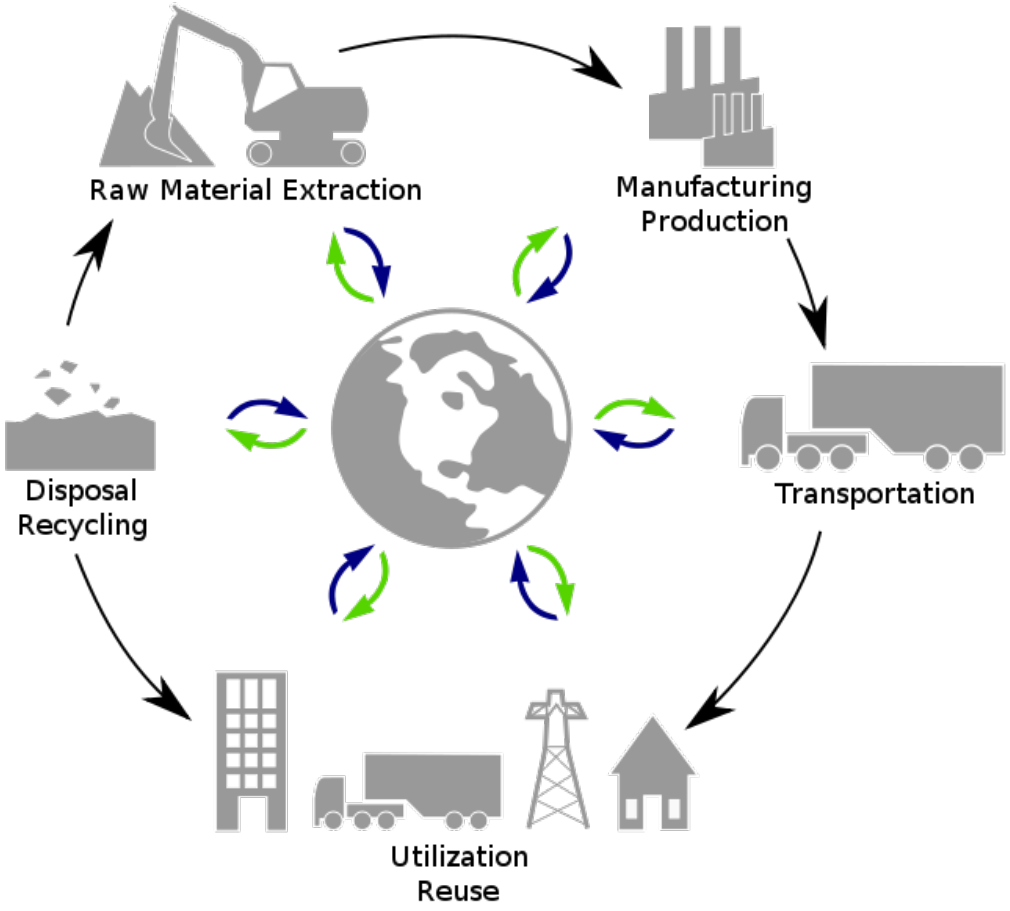
Product planning

- Identifying new product candidates
- Gathering market requirements
- Defining product requirements
- Determine business-case and feasibility
- Scoping and defining new products at high level
- Evangelizing new products within the company
- Building product roadmaps, particularly Technology roadmaps
- Working to a critical path and ensuring all products are produced on schedule
- Ensuring products are within optimal price margins and up to specifications
- Product Life Cycle considerations
- Product differentiation
- Detailed Product planning
- 7 functions of marketing

Product marketing

- Product positioning and outbound messaging
- Promoting the product externally with press, customers, and partners
- Conduct customer feedback and enabling (pre-production, beta software)
- Bringing new products to market
- Monitoring the competition
- more detail on Product marketing

Product Life Cycle Management



A generic lifecycle of products

In industry, **product lifecycle management** (**PLM**) is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. PLM integrates people, data, processes and business systems and provides a product information backbone for companies and their extended enterprise.

'Product lifecycle management' (PLM) should be distinguished from 'Product life cycle management (marketing)' (PLCM). PLM describes the engineering aspect of a product, from managing descriptions and properties of a product through its development and useful life; whereas, PLCM refers to the commercial management of life of a product in the business market with respect to costs and sales measures.

Product lifecycle management is one of the four cornerstones of a corporation's information technology structure. All companies need to manage communications and information with their customers (CRM-Customer Relationship Management), their suppliers (SCM-Supply Chain Management), their resources within the enterprise (ERP-

Enterprise Resource Planning) and their planning (SDLC-Systems Development Life Cycle). In addition, manufacturing engineering companies must also develop, describe, manage and communicate information about their products.

A form of PLM called people-centric PLM. While traditional PLM tools have been deployed only on release or during the release phase, people-centric PLM targets the design phase.

Recent (as of 2009) ICT development (EU funded PROMISE project 2004-2008) has allowed PLM to extend beyond traditional PLM and integrate sensor data and real time 'lifecycle event data' into PLM, as well as allowing this information to be made available to different players in the total lifecycle of an individual product (closing the information loop). This has resulted in the extension of PLM into Closed Loop Lifecycle Management (CL_2M).

Benefits

Documented benefits of product lifecycle management include:

- Reduced time to market
- Improved product quality
- Reduced prototyping costs
- More accurate and timely Request For Quote generation
- Ability to quickly identify potential sales opportunities and revenue contributions
- Savings through the re-use of original data
- A framework for product optimization
- Reduced waste
- Savings through the complete integration of engineering workflows
- Documentation that can assist in proving Compliance for RoHS or Title 21 CFR Part 11
- Ability to provide Contract Manufacturers with access to a centralized product record

Areas of PLM

Within PLM there are five primary areas;

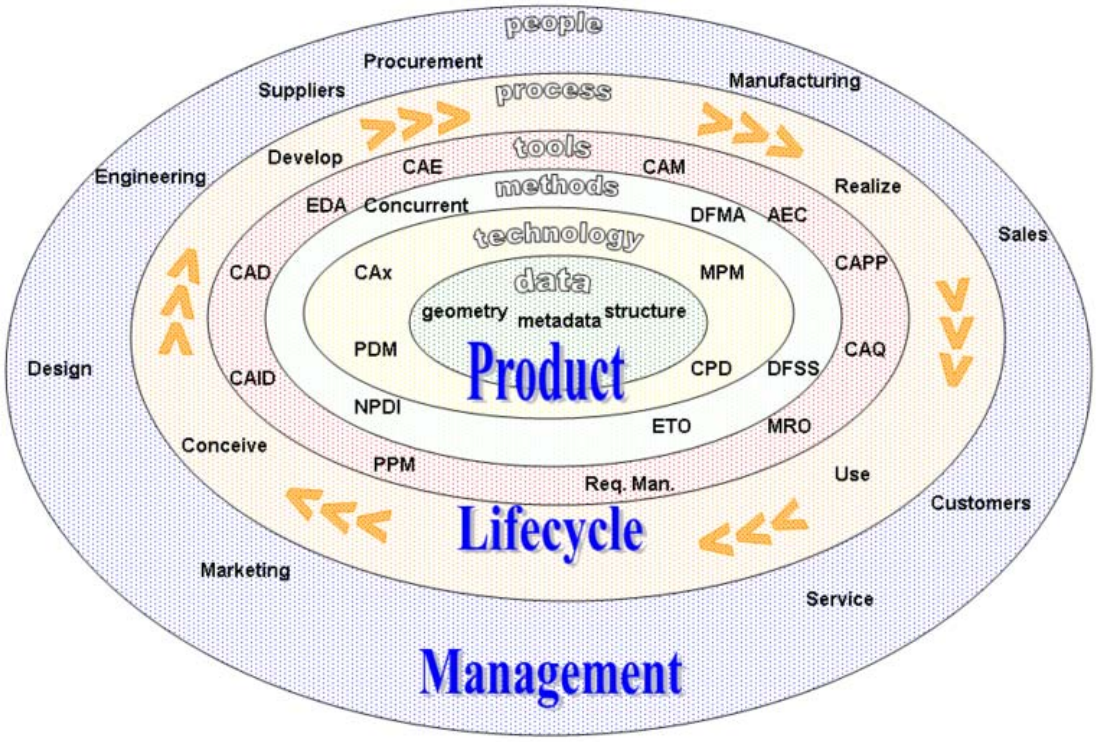
1. Systems Engineering (SE)
2. Product and Portfolio Management (PPM)
3. Product Design (CAx)
4. Manufacturing Process Management (MPM)
5. Product Data Management (PDM)

Note: While application software is not required for PLM processes, the business complexity and rate of change requires organizations execute as rapidly as possible.

Systems Engineering is focused on meeting all requirements, primary meeting customer needs, and coordinating the Systems Design process by involving all relevant disciplines. Product and Portfolio Management is focused on managing resource allocation, tracking progress vs. plan for projects in the new product development projects that are in process (or in a holding status). Portfolio management is a tool that assists management in tracking progress on new products and making trade-off decisions when allocating scarce resources. Product Data Management is focused on capturing and maintaining information on products and/or services through their development and useful life.

Introduction to development process

The core of PLM (product lifecycle management) is in the creations and central management of all product data and the technology used to access this information and knowledge. PLM as a discipline emerged from tools such as CAD, CAM and PDM, but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life. It is not just about software technology but is also a business strategy.



For simplicity the stages described are shown in a traditional sequential engineering workflow. The exact order of event and tasks will vary according to the product and industry in question but the main processes are:

- Conceive
  - Specification
  - Concept design
- Design
  - Detailed design
  - Validation and analysis (simulation)
  - Tool design
- Realize
  - Plan manufacturing
  - Manufacture
  - Build/Assemble
  - Test (quality check)
- Service
  - Sell and Deliver
  - Use
  - Maintain and Support
  - Dispose

The major key point events are:

- Order
- Idea
- Kick-off
- Design freeze
- Launch

The reality is however more complex, people and departments cannot perform their tasks in isolation and one activity cannot simply finish and the next activity start. Design is an iterative process, often designs need to be modified due to manufacturing constraints or conflicting requirements. Where exactly a customer order fits into the time line depends on the industry type, whether the products are for example Build to Order, Engineer to Order, or Assemble to Order.

History

Inspiration for the burgeoning business process now known as PLM came when American Motors Corporation (AMC) was looking for a way to speed up its product development process to compete better against its larger competitors in 1985, according to François Castaing, Vice President for Product Engineering and Development. After introducing its compact Jeep Cherokee (XJ), the vehicle that launched the modern sport utility vehicle (SUV) market, AMC began development of a new model, that later came out as the Jeep Grand Cherokee. The first part in its quest for faster product development was computer-aided design (CAD) software system that make engineers more productive. The second part in this effort was the new communication system that allowed conflicts to be resolved faster, as well as reducing costly engineering changes because all drawings and documents were in a central database. The product data

management was so effective, that after AMC was purchased by Chrysler, the system was expanded throughout the enterprise connecting everyone involved in designing and building products. While an early adopter of PLM technology, Chrysler was able to become the auto industry's lowest-cost producer, recording development costs that were half of the industry average by the mid-1990s.

Phases of product lifecycle and corresponding technologies

Many software solutions have developed to organize and integrate the different phases of a product's lifecycle. PLM should not be seen as a single software product but a collection of software tools and working methods integrated together to address either single stages of the lifecycle or connect different tasks or manage the whole process. Some software providers cover the whole PLM range while others a single niche application. Some applications can span many fields of PLM with different modules within the same data model. An overview of the fields within PLM is covered here. It should be noted however that the simple classifications do not always fit exactly, many areas overlap and many software products cover more than one area or do not fit easily into one category. It should also not be forgotten that one of the main goals of PLM is to collect knowledge that can be reused for other projects and to coordinate simultaneous concurrent development of many products. It is about business processes, people and methods as much as software application solutions. Although PLM is mainly associated with engineering tasks it also involves marketing activities such as Product Portfolio Management (PPM), particularly with regards to New product introduction (NPI).

Phase 1: Conceive

Imagine, specify, plan, innovate

The first stage in idea is the definition of its requirements based on customer, company, market and regulatory bodies' viewpoints. From this specification of the products major technical parameters can be defined. Parallel to the requirements specification the initial concept design work is carried out defining the visual aesthetics of the product together with its main functional aspects. For the Industrial Design, Styling, work many different media are used from pencil and paper, clay models to 3D CAID Computer-aided industrial design software.

Phase 2: Design

Describe, define, develop, test, analyze and validate

This is where the detailed design and development of the product's form starts, progressing to prototype testing, through pilot release to full product launch. It can also involve redesign and ramp for improvement to existing products as well as planned obsolescence. The main tool used for design and development is CAD Computer-aided design. This can be simple 2D Drawing / Drafting or 3D Parametric Feature Based Solid/Surface Modeling. Such software includes technology such as Hybrid Modeling,

Reverse Engineering, KBE (Knowledge-Based Engineering), NDT (Nondestructive testing), Assembly construction.

This step covers many engineering disciplines including: Mechanical, Electrical, Electronic, Software (embedded), and domain-specific, such as Architectural, Aerospace, Automotive, ... Along with the actual creation of geometry there is the analysis of the components and product assemblies. Simulation, validation and optimization tasks are carried out using CAE (Computer-aided engineering) software either integrated in the CAD package or stand-alone. These are used to perform tasks such as:- Stress analysis, FEA (Finite Element Analysis); Kinematics; Computational fluid dynamics (CFD); and mechanical event simulation (MES). CAQ (Computer-aided quality) is used for tasks such as Dimensional Tolerance (engineering) Analysis. Another task performed at this stage is the sourcing of bought out components, possibly with the aid of Procurement systems.

Phase 3: Realize

Manufacture, make, build, procure, produce, sell and deliver

Once the design of the product's components is complete the method of manufacturing is defined. This includes CAD tasks such as tool design; creation of CNC Machining instructions for the product's parts as well as tools to manufacture those parts, using integrated or separate CAM Computer-aided manufacturing software. This will also involve analysis tools for process simulation for operations such as casting, molding, and die press forming. Once the manufacturing method has been identified CPM comes into play. This involves CAPE (Computer-aided Production Engineering) or CAP/CAPP – (Production Planning) tools for carrying out Factory, Plant and Facility Layout and Production Simulation. For example: Press-Line Simulation; and Industrial Ergonomics; as well as tool selection management. Once components are manufactured their geometrical form and size can be checked against the original CAD data with the use of Computer Aided Inspection equipment and software. Parallel to the engineering tasks, sales product configuration and marketing documentation work will be taking place. This could include transferring engineering data (geometry and part list data) to a web based sales configurator and other Desktop Publishing systems.

Phase 4: Service

Use, operate, maintain, support, sustain, phase-out, retire, recycle and disposal

The final phase of the lifecycle involves managing of in service information. Providing customers and service engineers with support information for repair and maintenance, as well as waste management/recycling information. This involves using such tools as Maintenance, Repair and Operations Management (MRO) software.

All phases: product lifecycle

Communicate, manage and collaborate

None of the above phases can be seen in isolation. In reality a project does not run sequentially or in isolation of other product development projects. Information is flowing between different people and systems. A major part of PLM is the co-ordination of and management of product definition data. This includes managing engineering changes and release status of components; configuration product variations; document management; planning project resources and timescale and risk assessment.

For these tasks graphical, text and metadata such as product bills of materials (BOMs) needs to be managed. At the engineering departments level this is the domain of PDM – (Product Data Management) software, at the corporate level EDM (Enterprise Data Management) software, these two definitions tend to blur however but it is typical to see two or more data management systems within an organization. These systems are also linked to other corporate systems such as SCM, CRM, and ERP. Associated with these system are Project Management Systems for Project/Program Planning.

This central role is covered by numerous Collaborative Product Development tools which run throughout the whole lifecycle and across organizations. This requires many technology tools in the areas of Conferencing, Data Sharing and Data Translation. The field being Product visualization which includes technologies such as DMU (Digital Mock-Up), Immersive Virtual Digital Prototyping (virtual reality) and Photo realistic Imaging.

User skills

The broad array of solutions that make up the tools used within a PLM solution-set (e.g., CAD, CAM, CAx...) were initially used by dedicated practitioners who invested time and effort to gain the required skills. Designers and engineers worked wonders with CAD systems, manufacturing engineers became highly skilled CAM users while analysts, administrators and managers fully mastered their support technologies. However, achieving the full advantages of PLM requires the participation of many people of various skills from throughout an extended enterprise, each requiring the ability to access and operate on the inputs and output of other participants.

Despite the increased ease of use of PLM tools, cross-training all personnel on the entire PLM tool-set has not proven to be practical. Now, however, advances are being made to address ease of use for all participants within the PLM arena. One such advance is the availability of “role” specific user interfaces. Through Tailorable UIs, the commands that are presented to users are appropriate to their function and expertise.

Product development processes and methodologies

A number of established methodologies have been adopted by PLM and been further advanced. Together with PLM digital engineering techniques, they have been advanced to meet company goals such as reduced time to market and lower production costs. Reducing lead times is a major factor as getting a product to market quicker than the competition will help with higher revenue and profit margins and increase market share.

These techniques include:-

- Concurrent engineering workflow
- Industrial Design
- Bottom-up design
- Top-down design
- Front loading design workflow
- Design in context
- Modular design
- NPD New product development
- DFSS Design for Six Sigma
- DFMA Design for manufacture / assembly
- Digital simulation engineering
- Requirement driven design
- Specification managed validation
- Configuration Management

Concurrent engineering workflow

Concurrent engineering (British English: **simultaneous engineering**) is a workflow that, instead of working sequentially through stages, carries out a number of tasks in parallel. For example: starting tool design before the detailed designs of the product are finished, or starting on detail design solid models before the concept design surfaces models are complete. Although this does not necessarily reduce the amount of manpower required for a project, it does drastically reduce lead times and thus time to market. Feature-based CAD systems have for many years allowed the simultaneous work on 3D solid model and the 2D drawing by means of two separate files, with the drawing looking at the data in the model; when the model changes the drawing will associatively update. Some CAD packages also allow associative copying of geometry between files. This allows, for example, the copying of a part design into the files used by the tooling designer. The manufacturing engineer can then start work on tools before the final design freeze; when a design changes size or shape the tool geometry will then update. Concurrent engineering also has the added benefit of providing better and more immediate communication between departments, reducing the chance of costly, late design changes. It adopts a problem prevention method as compared to the problem solving and re-designing method of traditional sequential engineering.

Bottom-up design

Bottom-up design (CAD Centric) occurs where the definition of 3D models of a product starts with the construction of individual components. These are then virtually brought together in sub-assemblies of more than one level until the full product is digitally defined. This is sometimes known as the review structure showing what the product will look like. The BOM contains all of the physical (solid) components; it may (but not also) contain other items required for the final product BOM such as paint, glue, oil and other materials commonly described as 'bulk items'. Bulk items typically have mass and quantities but are not usually modelled with geometry.

Bottom-up design tends to focus on the capabilities of available real-world physical technology, implementing those solutions which this technology is most suited to. When these bottom-up solutions have real-world value, bottom-up design can be much more efficient than top-down design. The risk of bottom-up design is that it very efficiently provides solutions to low-value problems. The focus of Bottom-Up design is "what can we most efficiently do with this technology?" rather than the focus of Top-Down which is "What is the most valuable thing to do?"

Top-down design

Top-Down design is focused on high-level functional requirements, with relatively less focus on existing implementation technology. A top level spec is decomposed into lower and lower level structures and specifications, until the physical implementation layer is reached. The risk of a top-down design is that it will not take advantage of the most efficient applications of current physical technology, especially with respect to hardware implementation. Top-Down design sometimes results in excessive layers of lower-level abstraction and inefficient performance when the Top-Down model has followed an abstraction path which does not efficiently fit available physical-level technology. The positive value of Top-Down design is that it preserves a focus on the optimum solution requirements.

A Part-Centric Top-down design may eliminate some of the risks of Top-Down design. This starts with a layout model, often a simple 2D sketch defining basic sizes and some major defining parameters. Industrial Design, brings creative ideas to product development. Geometry from this is associatively copied down to the next level, which represents different sub-systems of the product. The geometry in the sub-systems is then used to define more detail in levels below. Depending on the complexity of the product, a number of levels of this assembly are created until the basic definition of components can be identified, such as position and principal dimensions. This information is then associatively copied to component files. In these files the components are detailed; this is where the classic bottom-up assembly starts.

The top down assembly is sometime known as a control structure. If a single file is used to define the layout and parameters for the review structure it is often known as a skeleton file.

Defense engineering traditionally develops the product structure from the top down. The system engineering process prescribes a functional decomposition of requirements and then physical allocation of product structure to the functions. This top down approach would normally have lower levels of the product structure developed from CAD data as a bottom up structure or design.

Both-Ends-Against-The-Middle design

Both-Ends-Against-The-Middle (BEATM) design is a design process that endeavors to combine the best features of Top-Down design, and Bottom-Up design into one process. A BEATM design process flow may begin with an emergent technology which suggests solutions which may have value, or it may begin with a top-down view of an important problem which needs a solution. In either case the key attribute of BEATM design methodology is to immediately focus at both ends of the design process flow: a top-down view of the solution requirements, and a bottom-up view of the available technology which may offer promise of an efficient solution. The BEATM design process proceeds from both ends in search of an optimum merging somewhere between the top-down requirements, and bottom-up efficient implementation. In this fashion, BEATM has been shown to genuinely offer the best of both methodologies. Indeed some of the best success stories from either top-down or bottom-up have been successful because of an intuitive, yet unconscious use of the BEATM methodology. When employed consciously, BEATM offers even more powerful advantages.

Front loading design and workflow

Front loading is taking top-down design to the next stage. The complete control structure and review structure, as well as downstream data such as drawings, tooling development and CAM models, are constructed before the product has been defined or a project kick-off has been authorized. These assemblies of files constitute a template from which a family of products can be constructed. When the decision has been made to go with a new product, the parameters of the product are entered into the template model and all the associated data is updated. Obviously predefined associative models will not be able to predict all possibilities and will require additional work. The main principle is that a lot of the experimental/investigative work has already been completed. A lot of knowledge is built into these templates to be reused on new products. This does require additional resources “up front” but can drastically reduce the time between project kick-off and launch. Such methods do however require organizational changes, as considerable engineering efforts are moved into “offline” development departments. It can be seen as an analogy to creating a concept car to test new technology for future products, but in this case the work is directly used for the next product generation.

Design in context

Individual components cannot be constructed in isolation. CAD; CAiD models of components are designed within the context of part or all of the product being developed. This is achieved using assembly modelling techniques. Other components’ geometry can

be seen and referenced within the CAD tool being used. The other components within the sub-assembly, may or may not have been constructed in the same system, their geometry being translated from other CPD formats. Some assembly checking such as DMU is also carried out using Product visualization software.

Product and process lifecycle management (PPLM)

Product and process lifecycle management **(PPLM)** is an alternate genre of PLM in which the process by which the product is made is just as important as the product itself. Typically, this is the life sciences and advanced specialty chemicals markets. The process behind the manufacture of a given compound is a key element of the regulatory filing for a new drug application. As such, PPLM seeks to manage information around the development of the process in a similar fashion that baseline PLM talks about managing information around development of the product.

Market size

Total spending on PLM software and services was estimated in 2006 to be above $15 billion a year, but it is difficult to find any two market analysis reports that agree on figures. Market growth estimates are in the 10% area.

Diffusion

Diffusion is the process by which a new idea or new product is accepted by the market. The **rate of diffusion** is the speed that the new idea spreads from one consumer to the next. **Adoption** is similar to diffusion except that it deals with the psychological processes an individual goes through, rather than an aggregate market process. In economics it is more often named "technological change".

Theories

There are several theories that purport to explain the mechanics of diffusion:

1. **The two-step hypothesis** - information and acceptance flows, via the media, first to opinion leaders, then to the general population
2. the **trickle-down effect** - products tend to be expensive at first, and therefore only accessible to the wealthy social strata - in time they become less expensive and are diffused to lower and lower strata
3. **The Everett Rogers Diffusion of innovations theory** - for any given product category, there are five categories of product adopters:
    - **Innovators** – venturesome, educated, multiple info sources;
    - **Early adopters** – social leaders, popular, educated;
    - **Early majority** – deliberate, many informal social contacts;
    - **Late majority** – skeptical, traditional, lower socio-economic status;
    - **Laggards** – neighbours and friends are main info sources, fear of debt.

4. **Crossing the Chasm** model developed by Geoffrey Moore - This is basically a modification of Everett Rogers' theory applied to technology markets and with a chasm added. According to Moore, the marketer should focus on one group of customers at a time, using each group as a base for marketing to the next group. The most difficult step is making the transition between visionaries (early adopters) and pragmatists (early majority). This is the chasm that he refers to. If successful, a firm can create a bandwagon effect in which the momentum builds and the product becomes a de facto standard.
5. **Technology driven models** - These are particularly relevant to software diffusion. The rate of acceptance of technology is determined by factors such as ease of use and usefulness.

Rate

According to Everett M. Rogers, the rate of diffusion is influenced by:

- The product's perceived advantage or benefit.
- Riskiness of purchase.
- Ease of product use - complexity of the product.
- Immediacy of benefits.
- Observability.
- Trialability.
- Price.
- Extent of behavioural changes required.
- Return on investment in the case of industrial products.

Models

There are several types of diffusion rate models:

1. **Penetration models** - use test market data to develop acceptance equations of expected sales volume as a function of time. Three examples of penetration models are:
    - Bass trial only model
    - Bass declining trial model
    - Fourt and Woodlock model
2. **Trial/Repeat models** - number of repeat buyers is a function of the number of trial buyers.
3. **Deterministic models** - assess number of buyers at various states of acceptance - later states are determined from calculations to previous states.
4. **Stochastic models** - recognize that many elements of the diffusion process are unknown but explicitly incorporate probabilistic terms.

Technological change

Original model of three phases of the process of Technological Change

Technological change (TC) is a term that is used to describe the overall process of invention, innovation and diffusion of technology or processes The term is redundant with technological development, technological achievement, and technological progress. In essence TC is the invention of a technology (or a process), the continuous process of improving a technology (in which it often becomes cheaper) and its diffusion throughout industry or society. In its earlier days, technological change was illustrated with the 'Linear Model of Innovation', which has now been largely discarded to be replaced with a model of technological change that involves innovation at all stages of research, development, diffusion and use.

Modelling technological change

When spoken about "modelling technological change" often the process of innovation is meant. This process of continuous improvement is often modelled as a curve depicting decreasing costs over time (for instance fuel cell which have become cheaper every year).

- TC is often modelled using a learning curve, ex.: Ct=C0 * Xt^-b
- TC itself is often included in other models (for instance climate change models) and was often taken as an exogenous factor. These days TC is more often included as an endogenous factor. This means that it is taken as something you can influence. It is generally accepted that policy can influence the speed and direction of TC (for instance more towards clean technologies). This is referred to as Induced Technological Change.

Invention

The creation of something new, or a "breakthrough" technology. For example, a personal computer.

Diffusion

The spread of a technology through a society or industry. The diffusion of a technology generally follows an S-shaped curve as early versions of technology are rather unsuccessful, followed by a period of successful innovation with high levels of adoption, and finally a dropping off in adoption as a technology reaches its maximum potential in a

market. In the case of a personal computer, it has made way beyond homes and into business settings, such as office workstations and server machines to host websites.

Technological change as a social process

Underpinning the idea of *technological change as a social process* is general agreement on the importance of social context and communication. According to this model, technological change is seen as a social process involving producers and adopters and others (such as government) who are profoundly affected by cultural setting, political institutions and marketing strategies.

Elements of diffusion

Emphasis has been on four key elements of the technological change process: (1) an innovative technology (2) communicated through certain channels (3) to members of a social system (4) who adopt it over a period of time. These elements are derived from Everett M. Rogers Diffusion of innovations theory using a communications-type approach.

Innovation

Rogers proposes that there are five main attributes of innovative technologies which influence acceptance. These are relative advantage, compatibility, complexity, trialability, and observability. *Relative advantage* may be economic or non-economic, and is the degree to which an innovation is seen as superior to prior innovations fulfilling the same needs. It is positively related to acceptance (i.e., the higher the relative advantage, the higher the adoption level, and vice versa). *Compatibility* is the degree to which an innovation appears consistent with existing values, past experiences, habits and needs to the potential adopter; a low level of compatibility will slow acceptance. *Complexity* is the degree to which an innovation appears difficult to understand and use; the more complex an innovation, the slower its acceptance. *Trialability* is the perceived degree to which an innovation may be tried on a limited basis, and is positively related to acceptance. Trialability can accelerate acceptance because small-scale testing reduces risk. *Observability* is the perceived degree to which results of innovating are visible to others and is positively related to acceptance.

Communication channels

Communication channels are the means by which a source conveys a message to a receiver. Information may be exchanged through two fundamentally different, yet complementary, channels of communication. Awareness is more often obtained through the *mass media*, while uncertainty reduction that leads to acceptance mostly results from *face-to-face communication*.

Social system

The social system provides a medium through which and boundaries within which, innovation is adopted. The structure of the social system affects technological change in several ways. Social norms, opinion leaders, change agents, government and the consequences of innovations are all involved. Also involved are cultural setting, nature of political institutions, laws, policies and administrative structures.

Time

Time enters into the acceptance process in several ways. The time dimension relates to the innovativeness of an individual or other adopter, which is the relative earlyness or lateness with which an innovation is adopted.

Factors

The term mythologised of technology refers to how technology start and elites who invented the new technology. By focusing on its process, it is proved MacKenzie and Wajcman's argument of "social determination of technology",(Green,2001,pp. 1-20) which means it is social that realizing technology change, and sustained it. There are four factors motivate technology innovation, which involve intellectual agenda, economic, politics, and existing infracture (Green,2001,pp. 1-20).

Elites

It is elites who have intellectual agenda make technology change possible. However, it can not split their knowledge. Knowledge is not neutral, as it is "Socially bound knowledge" (Green,2001,pp. 1-20). The elites can create new technology as they are able to access knowledge physically and they can afford it. Both procedures underpin knowledge privilege within social context. Moreover, to prevail the new technology in social, it acquires the avant-guards who obtain knowledge as well, which makes them able to manipulate new technology. As knowledge which plays a role of force in technology is only granted to a limit population in technology experiment period, it proves technology is not neutral.

Corporation Corporations which are driven by economic value benefit technology and are benefited as well. In order to continue elites' experimentation, financial support is necessary, and in most case it is from corporation funding. On the other hand, corporation would like to invest the invention as the potential huge commercial benefits from it. In this case, it implies that social determines technology as technology advance can not separate from economic support and it brings economic value as well.

Government To supply a steady environment for technology advance, the bureaucracy plays an essential role. It exerts its power and publishes laws to guarantee that investment can process properly, such as copyright. Without the safe social circumstance, the elites

methodology will be stolen by the others(Green,2001,pp. 1-20), which prevents the invention processing properly in such chaos.

Globalization as macro-social context Globalization trend is realized by technology advanced and motivates it as well. In another word, the global social change is increasingly both a cause and effect of technological enhance(Green,2001,pp. 1-20). Merchants appeal high technology, such as electronic business to run over-sea business, it not only benefits them enlarging their markets, but also make them finish business trading quicker. On the other hand, utilizing high technology realizes global social change, and makes communication access more conveniently. There is another way of how existing infrustration implements technology advance. Public policy can stimulate technology development (Danna, 2007). For instance, feminists invented satellite to provoke masculinity domination social pattern, and by which they established their roles as early communication adopters(Danna,2007,p87-110). Before feminism movement, women are looked down on, so they provoke unequal social pattern by their contribution.

Example

There is an example to elaborate how these four factors work in technology advance process- Edison’s bulb invention(Green,2001,pp. 1-20).Edison’s electrical power and lighting system can be achieved because of his inspiration. Via intellectual agenda(Green,2001,pp. 1-20), he published mythology, which aims to be funded by corporate without whom the research laboratories can not keep on. The corporation bought his idea for its potential bringing commercial benefit. As his invention of bulb liberates human movement (people can work not only in daytime, but also in evening), it inevitably prevails in overseas, and rise global social change.

Economics

Technological change is a term that is used in economics to describe a change in the set of feasible production possibilities.

Neutral technological change refers to the behaviour of technological change in models. A technological innovation is Hicks neutral, following John Hicks (1932), if a change in technology does not change the ratio of capital's marginal product to labour's marginal product for a given capital to labour ratio. A technological innovation is Harrod neutral (following Roy Harrod) if the technology is labour-augmenting (i.e. helps labor); it is Solow neutral if the technology is capital-augmenting (i.e. helps capital).

Technology acceptance model

The **Technology Acceptance Model** (TAM) is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new technology, a number of factors influence their decision about how and when they will use it, notably:

- **Perceived usefulness** (PU) - This was defined by Fred Davis as "the degree to which a person believes that using a particular system would enhance his or her job performance".
- **Perceived ease-of-use** (PEOU) - Davis defined this as "the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).

History

TAM is one of the most influential extensions of Ajzen and Fishbein's theory of reasoned action (TRA) in the literature. It was developed by Fred Davis and Richard Bagozzi (Davis 1989, Bagozzi & Warshaw 1992). TAM replaces many of TRA's attitude measures with the two technology acceptance measures— *ease of use*, and *usefulness*. TRA and TAM, both of which have strong behavioural elements, assume that when someone forms an intention to act, that they will be free to act without limitation. In the real world there will be many constraints, such as limit the freedom to act (Bagozzi & Warshaw 1992).

Bagozzi, Davis and Warshaw say:

> *Because new technologies such as personal computers are complex and an element of uncertainty exists in the minds of decision makers with respect to the successful adoption of them, people form attitudes and intentions toward trying to learn to use the new technology prior to initiating efforts directed at using. Attitudes towards usage and intentions to use may be ill-formed or lacking in conviction or else may occur only after preliminary strivings to learn to use the technology evolve. Thus, actual usage may not be a direct or immediate consequence of such attitudes and intentions.* (Bagozzi & Warshaw 1992)

Earlier research on the diffusion of innovations also suggested a prominent role for perceived ease of use. Tornatzky and Klein (Tornatzky & Klein 1982) analysed the adoption, finding that compatibility, relative advantage, and complexity had the most significant relationships with adoption across a broad range of innovation types. Eason studied perceived usefulness in terms of a fit between systems, tasks and job profiles, using the terms "task fit" to describe the metric (quoted in Stewart 1986)

Usage

Several researchers have replicated Davis's original study (Davis 1989) to provide empirical evidence on the relationships that exist between usefulness, ease of use and system use (Adams, Nelson & Todd 1992; Davis 1989; Hendrickson, Massey & Cronan 1993; Segars & Grover 1993; Subramanian 1994; Szajna 1994). Much attention has focused on testing the robustness and validity of the questionnaire instrument used by Davis. Adams et al. (Adams 1992) replicated the work of Davis (Davis 1989) to demonstrate the validity and reliability of his instrument and his measurement scales. They also extended it to different settings and, using two different samples, they demonstrated the internal consistency and replication reliability of the two scales. Hendrickson et al. (Hendrickson, Massey & Cronan 1993) found high reliability and good test-retest reliability. Szajna (Szajna 1994) found that the instrument had predictive validity for intent to use, self-reported usage and attitude toward use. The sum of this research has confirmed the validity of the Davis instrument, and to support its use with different populations of users and different software choices.

Segars and Grover (Segars & Grover 1993) re-examined Adams *et al.*'s (Adams, Nelson & Todd 1992) replication of the Davis work. They were critical of the measurement model used, and postulated a different model based on three constructs: usefulness, effectiveness, and ease-of-use. These findings do not yet seem to have been replicated.

Mark Keil and his colleagues have developed (or, perhaps rendered more popularisable) Davis's model into what they call the Usefulness/EOU Grid, which is a 2×2 grid where each quadrant represents a different combination of the two attributes. In the context of software use, this provides a mechanism for discussing the current mix of usefulness and EOU for particular software packages, and for plotting a different course if a different mix is desired, such as the introduction of even more powerful software (Keil, Beranek & Konsynski 1995).

Criticisms of TAM as a "theory" include its lack of falsifiability, questionable heuristic value, limited explanatory and predictive power, triviality, and lack of any practical value. (Chuttur 2009)

Venkatesh and Davis extended the original TAM model to explain perceived usefulness and usage intentions in terms of social influence and cognitive instrumental processes. The extended model, referred to as TAM2, was tested in both voluntary and mandatory settings. The results strongly supported TAM2 (Venkatesh & Davis 2000).

In an attempt to integrate the main competing user acceptance models, Venkatesh et al. formulated the Unified Theory of Acceptance and Use of Technology (UTAUT). This model was found to outperform each of the individual models (Adjusted R square of 69 percent) (Venkatesh et al. 2003).

Independent of TAM, Scherer (Scherer 1986) developed the Matching Person & Technology Model in 1986 as part of her National Science Foundation-funded

dissertation research. The MPT Model is fully described in her 1993 text (Scherer 2005, 1st ed. 1993}}), "Living in the State of Stuck," now in its 4th edition. The MPT Model has accompanying assessment measures used in technology selection and decision-making, as well as outcomes research on differences among technology users, non-users, avoiders, and reluctant users.

Chapter- 12

Technology Lifecycle

Most new technologies follow a similar **technology maturity lifecycle** describing the technological maturity of a product. This is not similar to a product life cycle, but applies to an entire technology, or a generation of a technology.

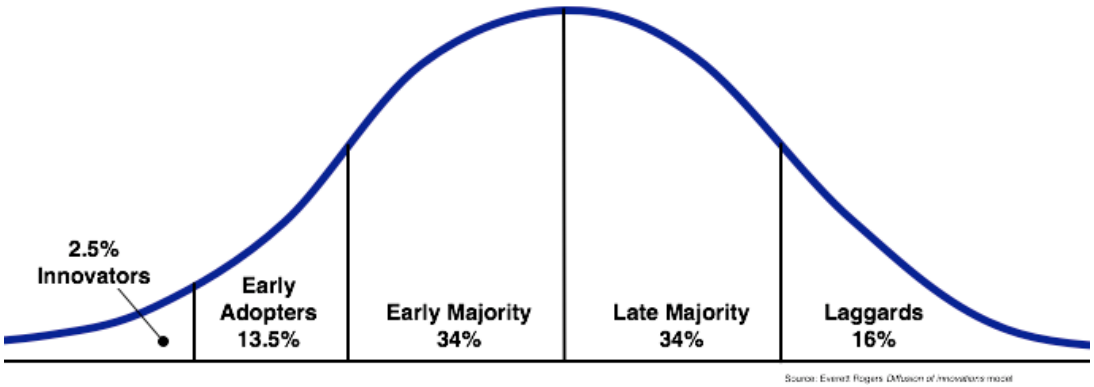
Technology adoption is the most common phenomenon driving the evolution of industries along the industry lifecycle. After expanding new uses of resources they end with exhausting the efficiency of those processes, producing gains that are first easier and larger over time then exhaustingly more difficult, as the technology matures.

Technology perception dynamics

There is usually technology hype at the introduction of any new technology, but only after some time has passed can it be judged as mere hype or justified true acclaim. Because of the logistic curve nature of technology adoption, it is difficult to see in the early stages whether the hype is excessive.

The two errors commonly committed in the early stages of a technology's development are:

- fitting an exponential curve to the first part of the growth curve, and assuming eternal exponential growth
- fitting a linear curve to the first part of the growth curve, and assuming that takeup of the new technology is disappointing



Rogers' bell curve

Similarly, in the later stages, the opposite mistakes can be made relating to the possibilities of technology maturity and market saturation.

Technology adoption typically occurs in an S curve, as modelled in diffusion of innovations theory. This is because customers respond to new products in different ways. Diffusion of innovations theory, pioneered by Everett Rogers, posits that people have different levels of readiness for adopting new innovations and that the characteristics of a product affect overall adoption. Rogers classified individuals into five groups: innovators, early adopters, early majority, late majority, and laggards. In terms of the S curve, innovators occupy 2.5%, early adopters 13.5%, early majority 34%, late majority 34%, and laggards 16%.

Stages

From a layman's perspective, the technological maturity can be broken down into five distinct stages.

1. Bleeding edge - any technology that shows high potential but hasn't demonstrated its value or settled down into any kind of consensus. Early adopters may win big, or may be stuck with a white elephant.
2. Leading edge - a technology that has proven itself in the marketplace but is still new enough that it may be difficult to find knowledgeable personnel to implement or support it.
3. State of the art - when everyone agrees that a particular technology is the right solution.
4. Dated - still useful, still sometimes implemented, but a replacement leading edge technology is readily available.
5. Obsolete - has been superseded by state-of-the-art technology, maintained but no longer implemented.

Disruptive Technology

A **disruptive innovation** is an innovation that disrupts an existing market. The term is used in business and technology literature to describe innovations that improve a product or service in ways that the market does not expect, typically by lowering price or designing for a different set of consumers.

In contrast to "disruptive" innovation, a "sustaining" innovation does not have an effect on existing markets. Sustaining innovations may be either "discontinuous" (i.e. "transformational") or "continuous" (i.e. "evolutionary"). Transformational innovations are not always disruptive. Although the automobile was a transformational innovation, it was not a disruptive innovation, because early automobiles were expensive luxury items that did not disrupt the market for horse-drawn vehicles. The market for transportation

essentially remained intact until the debut of the lower priced Ford Model T in 1908 by making higher speed, motorized transportation available to the masses.

History and usage of the term

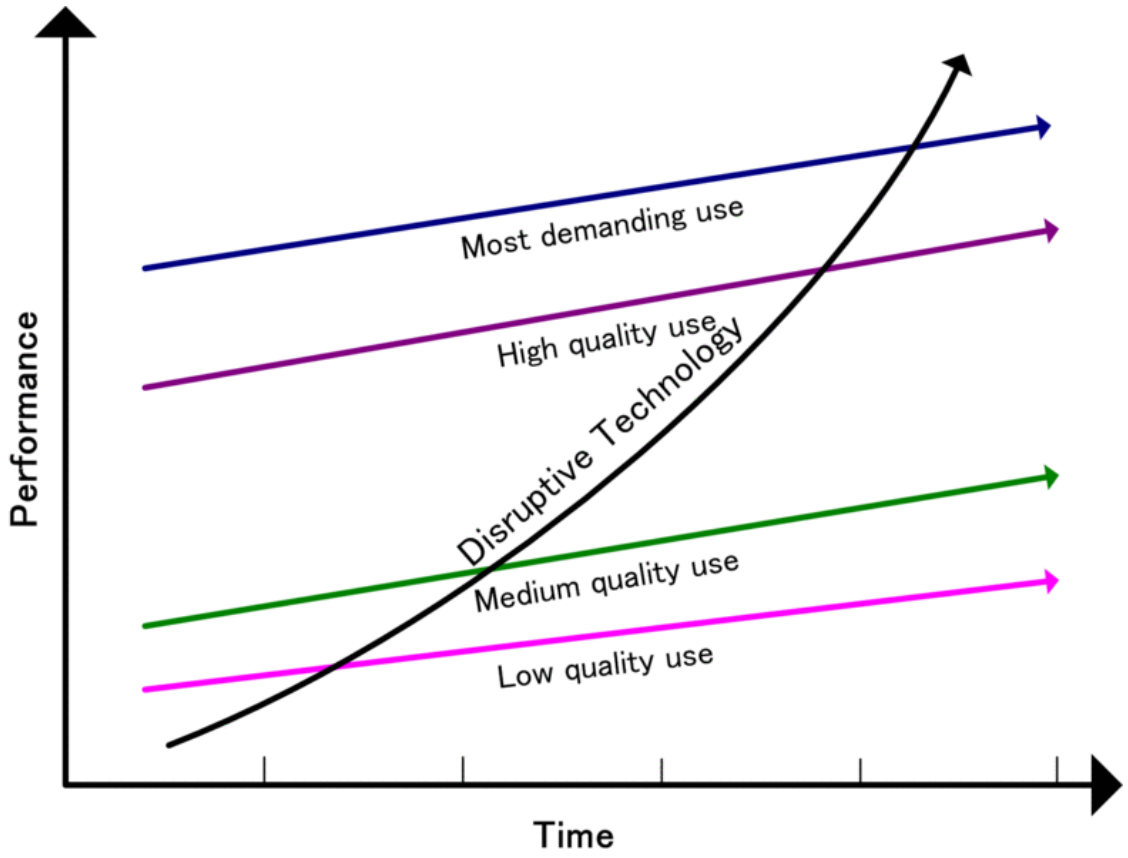
The term *disruptive technologies* was coined by Clayton M. Christensen and introduced in his 1995 article *Disruptive Technologies: Catching the Wave*, which he co-wrote with Joseph Bower. The article is aimed at managing executives who make the funding/purchasing decisions in companies rather than the research community. He describes the term further in his book *The Innovator's Dilemma*. (1997) In his sequel, *The Innovator's Solution*, (2003) Christensen replaced *disruptive technology* with the term *disruptive innovation* because he recognized that few technologies are intrinsically disruptive or sustaining in character. It is the strategy or business model that the technology enables that creates the disruptive impact. The concept of disruptive technology continues a long tradition of the identification of radical technical change in the study of innovation by economists, and the development of tools for its management at a firm or policy level. However, Christensen's evolution from a technological focus to a business modelling focus is central to understanding the evolution of business at the market or industry level. For example, Christensen's contemporary emphasis on the applied business model rather than the technology itself was developed by Henry Chesbrough's pioneering notion of Open Innovation.

The theory

Christensen defines a disruptive innovation as a product or service designed for a new set of customers.

"Generally, disruptive innovations were technologically straightforward, consisting of off-the-shelf components put together in a product architecture that was often simpler than prior approaches. They offered less of what customers in established markets wanted and so could rarely be initially employed there. They offered a different package of attributes valued only in emerging markets remote from, and unimportant to, the mainstream."

Christensen argues that disruptive innovations can hurt successful, well managed companies that are responsive to their customers and have excellent research and development. These companies tend to ignore the markets most susceptible to disruptive innovations, because the markets have very tight profit margins and are too small to represent significant growth.



How low-end disruption occurs over time

Christensen distinguishes between "low-end disruption" which targets customers who do not need the full performance valued by customers at the high end of the market and "new-market disruption" which targets customers who have needs that were previously unserved by existing incumbents.

"Low-end disruption" occurs when the rate at which products improve exceeds the rate at which customers can adopt the new performance. Therefore, at some point the performance of the product overshoots the needs of certain customer segments. At this point, a disruptive technology may enter the market and provide a product which has lower performance than the incumbent but which exceeds the requirements of certain segments, thereby gaining a foothold in the market.

In low-end disruption, the disruptor is focused initially on serving the least profitable customer, who is happy with a good enough product. This type of customer is not willing to pay premium for enhancements in product functionality. Once the disruptor has gained foot hold in this customer segment, it seeks to improve its profit margin. To get higher profit margins, the disruptor needs to enter the segment where the customer is willing to pay a little more for higher quality. To ensure this quality in its product, the disruptor needs to innovate. The incumbent will not do much to retain its share in a not so profitable segment, and will move up-market and focus on its more attractive customers.

After a number of such encounters, the incumbent is squeezed into smaller markets than it was previously serving. And then finally the disruptive technology meets the demands of the most profitable segment and drives the established company out of the market.

"New market disruption" occurs when a product fits a new or emerging market segment that is not being served by existing incumbents in the industry.

Examples of disruptive innovations

Innovation	Disrupted market	Notes
8 inch floppy disk drive	14 inch floppy disk drive	The hard disk drive market has had unusually large changes in market share over the past fifty years. According to Clayton M. Christensen's research, the cause of this instability was a repeating pattern of disruptive innovations. For example, in 1981, 8 inch drives (used in mini computers) were "vastly superior" to 5.25 inch drives (used in desktop computers). However, 8 inch drives were not affordable for the new desktop machines. The simple 5.25 inch drive, assembled from technologically inferior "off-the-shelf" components, was an "innovation" only in the sense that it was new. However, as this market grew and the drives improved, the companies that manufactured them eventually triumphed while many of the existing manufacturers of eight inch drives fell behind.
5.25 inch floppy disk drive	8 inch floppy disk drive	
3.5 inch floppy disk drive	5.25 inch floppy disk drive	
Downloadable Digital Media	CDs, DVDs	In the 1990s, the music industry phased out the single. This left consumers with no means to purchase individual songs. This market was filled by peer-to-peer file sharing technologies, which were initially free, and then by online retailers such as the iTunes music store and Amazon.com. This low end disruption eventually undermined the sales of physical, high-cost CDs.
Hydraulic excavators	Cable-operated excavators	Hydraulic excavators were clearly innovative at the time of introduction but they gain widespread use only decades after. However, cable-operated excavators are still used in some cases, mainly for large excavations.
Mini steel mills	vertically integrated steel mills	By using mostly locally available scrap and power sources these mills can be cost effective even though not large.
Minicomputers	Mainframes	Minicomputers were originally presented as an inexpensive alternative to mainframes and mainframe manufacturers did not consider them
Personal	Minicomputers,	

computers	Workstations. Word processors, Lisp machines	a serious threat in their market. Eventually, the market for minicomputers became much larger than the market for mainframes. Similarly, the market for main frames and mini-computers was seriously disrupted by personal computers. Although they were not at all competitive at the time of their introduction in the 1970s, by the mid 1980s they had improved exponentially and could compete directly with the more expensive machines.
Desktop publishing	Traditional publishing	Early desktop-publishing systems could not match high-end professional systems in either features or quality. Nevertheless, they lowered the cost of entry to the publishing business, and economies of scale eventually enabled them to match, and then surpass, the functionality of the older dedicated publishing systems.
Computer printers	Offset printing	Offset printing has a high overhead cost, but very low unit cost compared to computer printers, and superior quality. But as printers, especially laser printers, have improved in speed and quality, they have become increasingly useful for creating documents in limited issues.
Digital photography	Originally, instant photography, now increasingly all chemical photography	Early digital cameras suffered from low picture quality and resolution and long shutter lag. Quality and resolution are no longer major issues and shutter lag is much less than it used to be. The convenience of small memory cards and portable hard drives that hold hundreds or thousands of pictures, as well as the lack of the need to develop these pictures, also helped. Digital cameras have a high power consumption (but several lightweight battery packs can provide enough power for thousands of pictures). Cameras for classic photography are stand-alone devices. In the same manner, high-resolution digital video recording has replaced film stock, except for high-budget motion pictures.
High speed CMOS video sensors	Photographic film	When first introduced, high speed CMOS sensors were less sensitive, had lower resolution, and cameras based on them had less duration (record time). The advantage of rapid setup time, editing in the camera, and nearly-instantaneous review quickly eliminated 16 mm high speed film systems. CMOS-based cameras also require

		less power (single phase 110 V AC and a few amps for CMOS, vs. 240 V single- or three-phase at 20-50 A for film cameras). Continuing advances have overtaken 35 mm film and are challenging 70 mm film applications.
Steamships	Sailing ships	The first steamships were deployed on inland waters where sailing ships were less effective, instead of on the higher profit margin seagoing routes. Hence steamships originally only competed in traditional shipping lines' "worst" markets.
Telephones	Telegraphy	When Western Union infamously declined to purchase Alexander Graham Bell's telephone patents for $100,000, their highest-profit market was long-distance telegraphy. Telephones were only useful for very local calls. Short-distance telegraphy barely existed as a market segment, which explains Western Union's decision.
Automobiles	Rail transport	At the beginning of the 20th century, rail (including streetcars) was the fastest and most cost-efficient means of land transportation for goods and passengers in industrialized countries. The first cars, buses and trucks were used for local transportation in suburban areas, where they often replaced streetcars and industrial tracks. As highways expanded, medium- and later long-distance transports were relocated to road traffic, and some railways closed down. As rail traffic has a lower ton-kilometer cost, but a higher investment and operating cost than road traffic, rail is still preferred for large-scale bulk cargo (such as minerals). Since rail has always been faster than contemporary road vehicles, it is viable for passengers in populated regions like Western Europe, south and east Asia and the Northeast Corridor. When urban density increases, rail systems often become more attractive and make a comeback.
Private jet	Supersonic transport	The Concorde aircraft has so far been the only supersonic airliner in extensive commercial traffic. However, it catered to a small customer segment, which could later afford small private sub-sonic jets. The loss of speed was compensated by flexibility. Supersonic flight is also banned above inhabited land, due to sonic

		booms. The Concorde service was withdrawn in 2003.
Plastic	Metal, wood, glass etc	Bakelite and other early plastics had very limited use - their main advantages were electric insulation and low cost. New forms had advantages such as transparency, elasticity and combustibility. In the early 21st century, plastics can be used for nearly all household items previously made of metal, wood and glass.
Light-emitting diodes	Light bulbs	A LED is significantly smaller and less power-consuming than a light bulb. The first optical LEDs were weak, and only useful as indicator lights. Later models could be used for indoor lighting, and future ones will probably be strong enough to serve as street lights. Classical light bulbs for lower light indoor use remain, possible mainly because of sentimental and aesthetic value, although some lamps using other technologies have designs resembling light bulbs. Incandescent light bulbs are being phased out in many countries.
Digital synthesizer	Electronic organ and piano	Synthesizers were initially low-cost, low-weight alternatives to electronic organs and acoustic pianos. Today's synthesizers feature many automated functions and have replaced them for home and hobby users.
Mobile Telephony	Mobile Discount Operators	Mobile Discount / No Frills Operators (MDOs aka. MVNOs) first focused on a low-distribution-cost-through-internet sales model. In later times, innovations like low-priced mobile-internet tariffs were brought to market. This tripped the development of a new discount category in the market which was later entered by the large discount retail chains with own branded offerings leveraging their distribution power in the lower tier of the market.
LCD	CRT	The first liquid crystal displays (LCD) were monochromatic and had low resolution. They were used in watches and other handheld devices, but during the early 2000s these (and other planar technologies) largely replaced the dominant cathode ray tube (CRT) technology for computer displays and television sets, although CRT technologies have improved with advances like true-flat panels and digital controls only

		recently.
Digital calculator	Mechanical calculator	Facit AB used to dominate the European market for calculators, but did not adapt digital technology, and failed to compete with digital competitors.
Podcasting	Broadcast Radio & TV	With the advent of podcasting, broadcast radio and television have seen a decline in their listeners/viewers. Broadcasting companies have had to look for innovative ways to "time-shift" their content so that consumers can watch or view media when and where they desire.

Business implications

Disruptive technologies are not always disruptive to customers, and often take a long time before they are significantly disruptive to established companies. They are often difficult to recognize. Indeed, as Christensen points out and studies have shown, it is often entirely rational for incumbent companies to ignore disruptive innovations, since they compare so badly with existing technologies or products, and the deceptively small market available for a disruptive innovation is often very small compared to the market for the established technology.

Even if a disruptive innovation is recognized, existing businesses are often reluctant to take advantage of it, since it would involve competing with their existing (and more profitable) technological approach. Christensen recommends that existing firms watch for these innovations, invest in small firms that might adopt these innovations, and continue to push technological demands in their core market so that performance stays above what disruptive technologies can achieve.

Disruptive technologies, too, can be subtly disruptive, rather than prominently so. Examples include digital photography (the sharp decline in consumer demand for common 35 mm print film has had a deleterious effect on free-riders such as slide and infrared film stocks, which are now more expensive to produce) and IP/Internet telephony, where the replacement technology does not, and sometimes cannot practically replace all of the non-obvious attributes of the older system (sustained operation through municipal power outages, national security priority access, the higher degree of obviousness that the service may be life-safety critical or deserving of higher restoration priority in catastrophes, etc).

Chapter- 13

Planned Obsolescence and Product Differentiation

Planned Obsolescence

Planned obsolescence or **built-in obsolescence** in industrial design is a policy of deliberately planning or designing a product with a limited useful life, so it will become obsolete or nonfunctional after a certain period. Planned obsolescence has potential benefits for a producer because to obtain continuing use of the product the consumer is under pressure to purchase again, whether from the same manufacturer (a replacement part or a newer model), or from a competitor which might also rely on planned obsolescence.

For an industry, planned obsolescence stimulates demand by encouraging purchasers to buy sooner if they still want a functioning product. Built-in obsolescence is used in many different products, from vehicles to light bulbs, from buildings to proprietary software. There is, however, the potential backlash of consumers who learn that the manufacturer invested money to make the product obsolete faster; such consumers might turn to a producer (if any exists) that offers a more durable alternative.

Planned obsolescence was first developed in the 1920s and 1930s when mass production had opened every minute aspect of the production process to exacting analysis.

Estimates of planned obsolescence can influence a company's decisions about product engineering. Therefore the company can use the least expensive components that satisfy product lifetime projections. Such decisions are part of a broader discipline known as value engineering.

Origins of the term

Origins of *planned obsolescence* go back at least as far as 1932 with Bernard London's pamphlet *Ending the Depression Through Planned Obsolescence*. However, the phrase was first popularized in 1954 by Brooks Stevens, an American industrial designer. Stevens was due to give a talk at an advertising conference in Minneapolis in 1954. Without giving it much thought, he used the term as the title of his talk.

From that point on, "planned obsolescence" became Stevens' catchphrase. By his definition, planned obsolescence was "Instilling in the buyer the desire to own something a little newer, a little better, a little sooner than is necessary."

The term was quickly taken up by others, but Stevenson's definition was challenged. By the late 1950s, *planned obsolescence* had become a commonly-used term for products designed to break easily or to quickly go out of style. In fact, the concept was so widely recognized that in 1959 Volkswagen mocked it in a now-legendary advertising campaign. While acknowledging the widespread use of planned obsolescence among automobile manufacturers, Volkswagen pitched itself as an alternative. "We do not believe in planned obsolescence," the ads suggested. "We don't change a car for the sake of change."

In 1960, cultural critic Vance Packard published *The Waste Makers*, promoted as an exposé of "the systematic attempt of business to make us wasteful, debt-ridden, permanently discontented individuals."

Packard divided planned obsolescence into two sub categories: **obsolescence of desirability** and **obsolescence of function**. "Obsolescence of desirability", also called "psychological obsolescence", referred to marketers' attempts to wear out a product in the owner's mind. Packard quoted industrial designer George Nelson, who wrote: "Design... is an attempt to make a contribution through change. When no contribution is made or can be made, the only process available for giving the illusion of change is 'styling!'"

Rationale behind the strategy

In Democracy in America (1840), Alexis de Toqueville noted the rise of planned obsolescence in the United States:

> "I accost an American sailor, and I inquire why the ships of his country are built so as to last but for a short time; he answers without hesitation that the art of navigation is every day making such rapid progress, that the finest vessel would become almost useless if it lasted beyond a certain number of years."

The rationale behind the strategy is to generate long-term sales volume by reducing the time between repeat purchases, (referred to as shortening the replacement cycle). Firms that pursue this strategy believe that the additional sales revenue it creates more than offsets the additional costs of research and development and opportunity costs of existing product line cannibalization. The rewards are by no means certain: In a competitive industry, this can be a risky strategy because consumers may decide to buy from competitors. Because of this, gaining by this strategy requires fooling the consumers on the actual cost per use of the item in comparison to the competition.

Shortening the replacement cycle has many critics as well as supporters. Critics such as Vance Packard claim the process wastes resources and exploits customers. Resources are

used up making changes, often cosmetic changes, that are not of great value to the customer. Supporters claim it drives technological advances and contributes to material well-being. They claim that a market structure of planned obsolescence and rapid innovation may be preferred to long-lasting products and slow innovation. In a fast-paced competitive industry market success requires that products are made obsolete by actively developing replacements. Waiting for a competitor to make products obsolete is a sure guarantee of future demise.

The main concern of the opponents of planned obsolescence is not the existence of the process, but its possible postponement. They are concerned that technological improvements are not introduced even though they could be. They are worried that marketers will refrain from developing new products, or postpone their introduction because of product cannibalization issues. For example, if the payback period for a product is five years, a firm might refrain from introducing a new product for at least five years even though it may be possible for them to launch in three years. This postponement is only feasible in monopolistic or oligopolistic markets. In more competitive markets rival firms will take advantage of the postponement and launch their own products.

Types of obsolescence

Technical or functional obsolescence

The design of most consumer products includes an expected average lifetime permeating all stages of development. Thus, it must be decided early in the design of a complex product how long it is designed to last so that each component can be made to those specifications.

Planned obsolescence is made more likely by making the cost of repairs comparable to the replacement cost, or by refusing to provide service or parts any longer. A product might even never have been serviceable. Creating new lines of products that do not interoperate with older products can also make an older model quickly obsolete, forcing replacement. Examples include change of formats and peripheral devices in computers, change of formats in home movies and audio recordings (tapes to different types of CDs/DVDs/Blu-Ray).

Planned functional obsolescence is a type of technical obsolescence in which companies introduce new technology which replaces the old. The old products do not have the same capabilities or functionality as the new ones. For example a company that sold video tape decks while they were developing DVDs was engaging in planned obsolescence. They were actively planning to make their existing product (video tape) obsolete by developing a substitute product (DVDs) with greater functionality (better quality). Associated products that are complements to the old products also become obsolete with the introduction of new products. For example video tape holders saw the same fate as video tapes and video tape decks.

Proprietary batteries

Many portable consumer electronics contain proprietary, often lithium-based batteries. These batteries last only about 500 cycles before losing large amounts of their capacity. Rechargeable lithium batteries always contain integrated circuits (IC), they are required because of the above average risk of fire or explosion the batteries have when improperly charged. The IC keeps track of statistics of the battery to determine the current full charge point for the battery. A manufacturer can set the algorithms of the IC to be ultra conservative or time/cycle based, rather than based around the physical properties of the battery cells; this artificially limits the life of the battery. The IC will not permit the device to charge the battery any more than the IC dictates. Production of these batteries is usually stopped at around the same time the product is discontinued, therefore rendering the product worthless once the batteries start to wear out. Some people will reset the ICs in the battery pack, and obtain almost their original runtime on the battery (minus the natural decay the battery cells), only to have to do it again in the future because the IC ran down the limit. While battery packs can be rebuilt and fitted with new cells, this is either too costly or too time consuming for most consumers.

Systemic obsolescence

Planned systemic obsolescence is the deliberate attempt to make a product obsolete by altering the system in which it is used in such a way as to make its continued use difficult. New software is frequently introduced that is not compatible with older software. This makes the older software largely obsolete. Even though an older version of a word processing program is operating correctly, it might not be able to read data saved by newer versions. The lack of interoperability forces many users to purchase new programs prematurely. The greater the network externalities in the market, the more effective this strategy is. Oftentimes, developers of hardware will try to prevent a product from being backwards compatible with older interchangeable cartridges and proprietary connector plugs.

Another way of introducing systemic obsolescence is to eliminate service and maintenance for a product. If a product fails, the user is forced to purchase a new one. This strategy seldom works because there are typically third parties that are prepared to perform the service if parts are still available. One place it does work is in proprietary software, where copyright forbids third parties from performing some kinds of service. One example of this type of obsolescence is Microsoft's termination of support for earlier versions of Windows and older service packs on more recent versions. (although Microsoft is actually supporting XP until 2014). While, Apple Inc.'s introduction of Mac OS X (post-purchase of NeXT in 1997), which is Unix-based and incompatible with previous versions of the company's operating systems (although a compatibility layer was provided for several years). This strategy can have an unintended consequence; if a customer is not dependent on the specific proprietary system they may switch to a different system in hopes of longer support.

Style obsolescence

Marketing may be driven primarily by aesthetic design. Product categories in this case display a fashion cycle. By continually introducing new designs, and retargeting or discontinuing others, a manufacturer can "ride the fashion cycle". Such product categories include automobiles (style obsolescence), with a strict yearly schedule of new models; the almost entirely style-driven clothing industry (riding the fashion cycle); and the mobile phone industries with constant minor feature 'enhancements' and restyling.

Planned style obsolescence occurs when marketers change the styling of products so customers will purchase products more frequently. The style changes are designed to make owners of the old model feel "out of date". It is also designed to differentiate the product from the competition, thereby reducing price competition. One example of style obsolescence is the automobile industry, in which manufacturers typically make style changes every year or two. As the former CEO of General Motors, Alfred P. Sloan stated in 1941, "Today the appearance of a motorcar is a most important factor in the selling end of the business—perhaps the most important factor— because everyone knows the car will run."

Some marketers go one step further: they attempt to initiate fashions or fads. Successfully created fashions or fads include Beanie Babies, Ninja Turtles, Cabbage Patch Kids, pet rocks, acid wash jeans, and tank tops. Obsolescence is built into these products in the sense that marketers are aware of the shortness of their product life cycles so they work within that constraint. When Beanie Babies sales revenue started to decline, company president Ty Warner decided to go for one last Christmas marketing push and then drop the product.

Another strategy is to take advantage of fashion changes, often called the fashion cycle. The fashion cycle is the repeated introduction, rise, popular culmination, and decline of a style as it progresses through various social strata. Marketers can "ride the fashion cycle" by changing the mix of products that they direct at various market segments. This is very common in the clothing industry. A certain style of dress will initially be aimed at a very high income segment, then gradually be re-targeted to lower income segments. The fashion cycle can repeat itself, in which case a stylistically obsolete product may regain popularity and cease to be obsolete.

Notification obsolescence

Some companies have developed a version of obsolescence in which the product informs the user when it is time to buy a replacement. Examples of this include water filters that display a replacement notice after a predefined time and disposable razors that have a strip that changes color. Whether the user is notified before the product has actually deteriorated or the product simply deteriorates more quickly than is necessary, planned obsolescence is the result. In this way planned obsolescence may be introduced without the company going to the expense of developing a "more up to date" replacement model.

In some cases, notification may be combined with the deliberate disabling of a product to prevent it from working, thus requiring the buyer to purchase a replacement. Inkjet printer manufacturers who employ proprietary smart chips in their ink cartridges to prevent them from being used after a certain threshold (number of pages, time, etc.), even though the cartridge may still contain usable ink or could be refilled. Some medical equipment also exploits this technique to ensure a steady stream of revenue from sales of replacement consumables. This constitutes programmed obsolescence in that there is no random component to the decline in function.

Economics of planned obsolescence

Planned obsolescence tends to work best when a producer has at least an oligopoly. Before introducing a planned obsolescence, the producer has to know that the consumer is at least somewhat likely to buy a replacement from them. In these cases of planned obsolescence, there is an information asymmetry between the producer–who knows how long the product was designed to last–and the consumer, who does not. When a market becomes more competitive, product lifespans tend to increase. When Japanese vehicles with longer lifespans entered the American market in the 1960s and 1970s, American carmakers were forced to respond by building more durable products.

There are some industries where there is significant competition and consumers have chosen to go for products that will fail more quickly anyway. All that is needed is that the probability of repeat purchasing from the same producer exceeds that of initially choosing the producer.

Even in a situation where planned obsolescence is appealing to both producer and consumer there can also be significant harm to society in the form of negative externalities. Continuously replacing, rather than repairing, products creates more waste, pollution, uses more natural resources, and results in more consumer spending. One workaround for these setbacks can involve a consumer getting more tech-savvy about them so they can jury-rig them to work with newer equipment similar to a MacGyverism; and upcycling the resources can offset the budget for home projects, whereas downcycling allows for more generalized purposes to live on. And those consumer strategies can counter the setbacks.

Others have defended planned obsolescence as a necessary driving force behind innovation and economic growth. Many products, such as DVDs, become both cheaper and more useful the more people have them. Planned obsolescence will also tend to benefit those companies with the most modern and up-to-date products, thus encouraging extra investment in research and development that often has large positive externalities.

Obsolescence and durability

If marketers expect a product to become obsolete, they can design it to last for a specific lifetime. If a product will be technically or stylistically obsolete in five years, many marketers will design the product so it will only last for that time. This is done through a

technical process called value engineering. An example is home entertainment electronics which tend to be designed and built with moving components like motors and gears that last until technical or stylistic innovations make them obsolete.

These products could be built with higher-grade components, but they are not because it is stated that this imposes an unnecessary cost on the purchaser. Value engineering will reduce the cost of making the product and lower the price to consumers. A company will typically use the least expensive components that satisfy product's lifetime projections.

The use of value engineering techniques have led to planned obsolescence being associated with product deterioration and inferior quality. Vance Packard claimed that this could give engineering a bad name, because it directed creative engineering energies toward short-term market ends rather than more lofty and ambitious engineering goals.

Planned obsolescence in software

Software companies are sometimes thought to deliberately drop support for older technologies as a calculated attempt to force users to purchase new products to replace those made obsolete. Most proprietary software will ultimately reach an end-of-life point, at which the manufacturer will cease updates and support. As free software can always be updated and maintained by the end user, the user is not at the sole mercy of a proprietary vendor.

Fair trade

In the United Kingdom, planned obsolescence engineered into products is considered a breach of customer rights. The Office of Fair Trading and Trading Standards Institute investigate claims of products constantly failing just outside the warranty period. A famous case of this was the 'Click Wheel' Apple iPod, which many consumers found to fail within 18 months of purchase.

Product Lining

Product lining is the marketing strategy of offering for sale several related products. Unlike product bundling, where several products are combined into one, lining involves offering several related products individually. A line can comprise related products of various sizes, types, colors, qualities, or prices. **Line depth** refers to the number of product variants in a line. **Line consistency** refers to how closely related the products that make up the line are. **Line vulnerability** refers to the percentage of sales or profits that are derived from only a few products in the line.

The number of different product lines sold by a company is referred to as **width of product mix**. The total number of products sold in all lines is referred to as **length of product mix**. If a line of products is sold with the same brand name, this is referred to as family branding. When you add a new product to a line, it is referred to as a **line**

extension. When you add a line extension that is of better quality than the other products in the line, this is referred to as **trading up** or **brand leveraging**. When you add a line extension that is of lower quality than the other products of the line, this is referred to as **trading down**. When you trade down, you will likely reduce your brand equity. You are gaining short-term sales at the expense of long term sales.

Image anchors are highly promoted products within a line that define the image of the whole line. Image anchors are usually from the higher end of the line's range. When you add a new product within the current range of an incomplete line, this is referred to as **line filling**.

Price lining is the use of a limited number of prices for all your product offerings. This is a tradition started in the old five and dime stores in which everything cost either 5 or 10 cents. Its underlying rationale is that these amounts are seen as suitable price points for a whole range of products by prospective customers. It has the advantage of ease of administering, but the disadvantage of inflexibility, particularly in times of inflation or unstable prices.

There are many important decisions about product and service development and marketing. In the process of product development and marketing we should focus on strategic decisions about product attributes, product branding, product packaging, product labeling and product support services. But product strategy also calls for building a product line.

Product Differentiation

A concept in Economics and Marketing proposed by Edward Chamberlin in his 1933 Theory of Monopolistic Competition.

In marketing, **product differentiation** (also known simply as "differentiation") is the process of distinguishing a product or offering from others, to make it more attractive to a particular target market. This involves differentiating it from competitors' products as well as a firm's own product offerings.

Differentiation can be a source of competitive advantage. Although research in a niche market may result in changing a product in order to improve differentiation, the changes themselves are not differentiation. Marketing or product differentiation is the process of describing the differences between products or services, or the resulting list of differences. This is done in order to demonstrate the unique aspects of a firm's product and create a sense of value. Marketing textbooks are firm on the point that any differentiation must be valued by buyers (e.g.). The term unique selling proposition refers to advertising to communicate a product's differentiation.

In economics, successful product differentiation leads to monopolistic competition and is inconsistent with the conditions for perfect competition, which include the requirement that the products of competing firms should be perfect substitutes. There are three types of product differentiation: 1. Simple: based on a variety of characteristics 2. Horizontal: based on a single characteristic but consumers are not clear on quality 3. Vertical: based on a single characteristic and consumers are clear on its quality

The brand differences are usually minor; they can be merely a difference in packaging or an advertising theme. The physical product need not change, but it could. Differentiation is due to buyers perceiving a difference, hence causes of differentiation may be functional aspects of the product or service, how it is distributed and marketed, or who buys it. The major sources of product differentiation are as follows.

- Differences in quality which are usually accompanied by differences in price
- Differences in functional features or design
- Ignorance of buyers regarding the essential characteristics and qualities of goods they are purchasing
- Sales promotion activities of sellers and, in particular, advertising
- Differences in availability (e.g. timing and location).

The objective of differentiation is to develop a position that potential customers see as unique. The term is used frequently when dealing with freemium business models, in which businesses market a free and paid version of a given product. Given they target a same group of customers, it is imperative that free and paid versions be effectively differentiated.

Differentiation primarily impacts performance through reducing directness of competition: As the product becomes more different, categorization becomes more difficult and hence draws fewer comparisons with its competition. A successful product differentiation strategy will move your product from competing based primarily on price to competing on non-price factors (such as product characteristics, distribution strategy, or promotional variables).

Most people would say that the implication of differentiation is the possibility of charging a price premium; however, this is a gross simplification. If customers value the firm's offer, they will be less sensitive to aspects of competing offers; price may not be one of these aspects. Differentiation makes customers in a given segment have a lower sensitivity to other features (non-price) of the product.

Whole Product

In marketing, a **whole product** is a generic product (or core product) augmented by everything that is needed for the customer to have a compelling reason to buy. The core product is the tangible product that the customer experiences. The whole product typically augments the core product with additional elements required for the product to have compelling value to a customer. For example, if a personal computer is the core

product, then whole product would include software applications, training classes, peripheral devices (mouse, keyboard, printer, etc), and internet service. Without these additional product components, the core product would not be very useful.

think of idea, create product, sell product, MAKE MONEY

The concept of the whole product was first introduced by Regis McKenna

Chapter- 14

G. E. Multi Factoral Analysis and Growth-share Matrix

G. E. Multi Factoral Analysis

The **GE matrix** is an alternative technique used in brand marketing and product management to help a company decide what product(s) to add to its product portfolio, and which market opportunities are worthy of continued investment. Also known as the 'Directional Policy Matrix,' the GE multi-factor model was first developed by General Electric in the 1970s.

Conceptually, the **GE Matrix** is similar to the Boston Box as it is plotted on a two-dimensional grid. In most versions of the matrix:

- the Y-Axis comprises *industry attractiveness* measures, such as Market Profitability, Fit with Core Skills etc. and
- the X-Axis comprises *business strength* measures, such as Price, Service Levels etc.

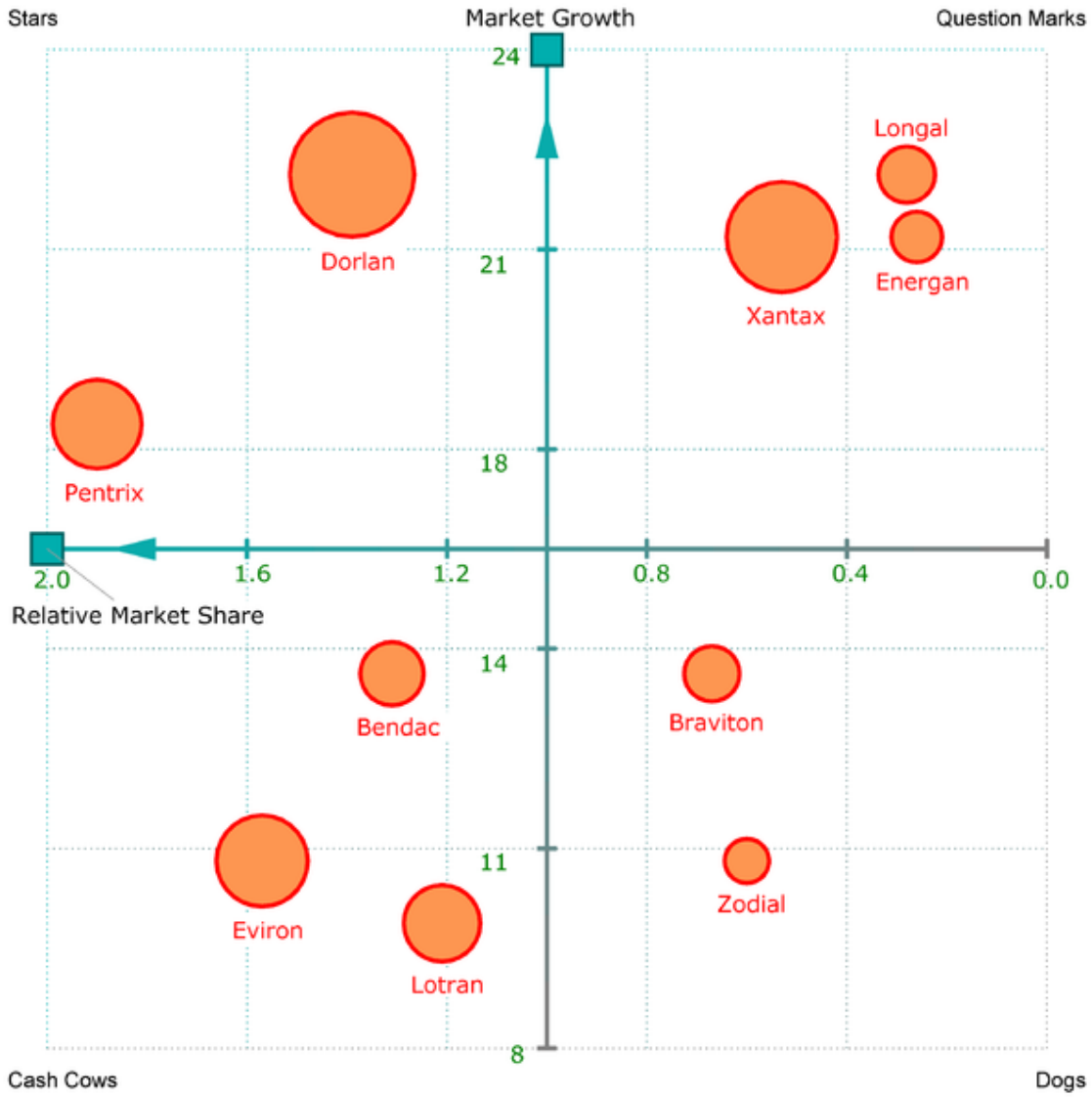
Each product, brand, service, or potential product is mapped as a piechart onto this industry attractiveness/business strength space. The diameter of each piechart is proportional to the Volume or Revenue accruing to each opportunity, and the solid slice of each pie represents the share of the market enjoyed by the planning company.

The planning company should invest in opportunities that appear to the top left of the matrix. The rationale is that the planning company should invest in segments that are both attractive and in which it has established some measure of competitive advantage. Opportunities appearing in the bottom right of the matrix are both unattractive to the planning company and in which it is competitively weak. At best, these are candidates for cash management; at worst candidates for divestment. Opportunities appearing 'in between' these extremes pose more of a problem, and the planning company has to make a strategic decision whether to 'redouble its efforts' in the hopes of achieving market leadership, manage them for cash, or cut its losses and divest.

Growth-share Matrix

The **BCG matrix** (aka B.C.G. analysis, BCG-matrix, Boston Box, Boston Matrix, Boston Consulting Group analysis, portfolio diagram) is a chart that had been created by Bruce Henderson for the Boston Consulting Group in 1968 to help corporations with analyzing their business units or product lines. This helps the company allocate resources and is used as an analytical tool in brand marketing, product management, strategic management, and portfolio analysis.

Chart



BCG Matrix

To use the chart, analysts plot a scatter graph to rank the business units (or products) on the basis of their relative market shares and growth rates.

- ***Cash cows*** are units with high market share in a slow-growing industry. These units typically generate cash in excess of the amount of cash needed to maintain the business. They are regarded as staid and boring, in a "mature" market, and every corporation would be thrilled to own as many as possible. They are to be "milked" continuously with as little investment as possible, since such investment would be wasted in an industry with low growth.
- ***Dogs***, or more charitably called *pets*, are units with low market share in a mature, slow-growing industry. These units typically "break even", generating barely enough cash to maintain the business's market share. Though owning a break-even unit provides the social benefit of providing jobs and possible synergies that assist other business units, from an accounting point of view such a unit is worthless, not generating cash for the company. They depress a profitable company's return on assets ratio, used by many investors to judge how well a company is being managed. *Dogs*, it is thought, should be sold off.
- ***Question marks*** (also known as problem child) are growing rapidly and thus consume large amounts of cash, but because they have low market shares they **do not generate much cash**. The result is a large net cash consumption. A question mark has the potential to gain market share and become a star, and eventually a cash cow when the market growth slows. If the question mark does not succeed in becoming the market leader, then after perhaps years of cash consumption it will degenerate into a dog when the market growth declines. Question marks must be analyzed carefully in order to determine whether they are worth the investment required to grow market share.
- ***Stars*** are units with a high market share in a fast-growing industry. The hope is that *stars* become the next *cash cows*. Sustaining the business unit's market leadership may require extra cash, but this is worthwhile if that's what it takes for the unit to remain a leader. When growth slows, stars become *cash cows* if they have been able to maintain their category leadership, or they move from brief *stardom* to *dogdom*.

As a particular industry matures and its growth slows, all business units become either *cash cows* or *dogs*. The natural cycle for most business units is that they start as *question marks*, then turn into *stars*. Eventually the market stops growing thus the business unit becomes a *cash cow*. At the end of the cycle the cash cow turns into a *dog*.

The overall goal of this ranking was to help corporate analysts decide which of their business units to fund, and how much; and which units to sell. Managers were supposed to gain perspective from this analysis that allowed them to plan with confidence to use money generated by the *cash cows* to fund the *stars* and, possibly, the *question marks*. As the BCG stated in 1970:

> *Only a diversified company with a balanced portfolio can use its strengths to truly capitalize on its growth opportunities. The balanced portfolio has:*
>
> - *stars whose high share and high growth assure the future;*
> - *cash cows that supply funds for that future growth; and*

- *question marks to be converted into stars with the added funds.*

Practical use of the BCG Matrix

For each product or service, the 'area' of the circle represents the value of its sales. The BCG Matrix thus offers a very useful 'map' of the organization's product (or service) strengths and weaknesses, at least in terms of current profitability, as well as the likely cashflows.

The need which prompted this idea was, indeed, that of managing cash-flow. It was reasoned that one of the main indicators of cash generation was relative market share, and one which pointed to cash usage was that of market growth rate.

Derivatives can also be used to create a 'product portfolio' analysis of services. So Information System services can be treated accordingly.

Relative market share

This indicates likely cash generation, because the higher the share the more cash will be generated. As a result of 'economies of scale' (a basic assumption of the BCG Matrix), it is assumed that these earnings will grow faster the higher the share. The exact measure is the brand's share relative to its largest competitor. Thus, if the brand had a share of 20 percent, and the largest competitor had the same, the ratio would be 1:1. If the largest competitor had a share of 60 percent; however, the ratio would be 1:3, implying that the organization's brand was in a relatively weak position. If the largest competitor only had a share of 5 percent, the ratio would be 4:1, implying that the brand owned was in a relatively strong position, which might be reflected in profits and cash flows. If this technique is used in practice, this scale is logarithmic, not linear.

On the other hand, exactly what is a high relative share is a matter of some debate. The best evidence is that the most stable position (at least in Fast Moving Consumer Goods FMCG markets) is for the brand leader to have a share double that of the second brand, and triple that of the third. Brand leaders in this position tend to be very stable—and profitable; the Rule of 123.

The reason for choosing relative market share, rather than just profits, is that it carries more information than just cash flow. It shows where the brand is positioned against its main competitors, and indicates where it might be likely to go in the future. It can also show what type of marketing activities might be expected to be effective.

Market growth rate

Rapidly growing in rapidly growing markets, are what organizations strive for; but, as we have seen, the penalty is that they are usually net cash users - they require investment. The reason for this is often because the growth is being 'bought' by the high investment, in the reasonable expectation that a high market share will eventually turn into a sound

investment in future profits. The theory behind the matrix assumes, therefore, that a higher growth rate is indicative of accompanying demands on investment. The cut-off point is usually chosen as 10 per cent per annum. Determining this cut-off point, the rate above which the growth is deemed to be significant (and likely to lead to extra demands on cash) is a critical requirement of the technique; and one that, again, makes the use of the BCG Matrix problematical in some product areas. What is more, the evidence, from FMCG markets at least, is that the most typical pattern is of very low growth, less than 1 per cent per annum. This is outside the range normally considered in BCG Matrix work, which may make application of this form of analysis unworkable in many markets.

Where it can be applied, however, the market growth rate says more about the brand position than just its cash flow. It is a good indicator of that market's strength, of its future potential (of its 'maturity' in terms of the market life-cycle), and also of its attractiveness to future competitors. It can also be used in growth analysis.

Critical evaluation

The matrix ranks only market share and industry growth rate, and only implies actual profitability, the purpose of any business. (It is certainly possible that a particular *dog* can be profitable without cash infusions required, and therefore should be retained and not sold.) The matrix also overlooks other elements of industry. With this or any other such analytical tool, ranking business units has a subjective element involving guesswork about the future, particularly with respect to growth rates. Unless the rankings are approached with rigor and scepticism, optimistic evaluations can lead to a dot com mentality in which even the most dubious businesses are classified as "question marks" with good prospects; enthusiastic managers may claim that cash must be thrown at these businesses immediately in order to turn them into stars, before growth rates slow and it's too late. Poor definition of a business's market will lead to some *dogs* being misclassified as *cash bulls*.

As originally practiced by the Boston Consulting Group, the matrix was undoubtedly a useful tool, in those few situations where it could be applied, for graphically illustrating cashflows. If used with this degree of sophistication its use would still be valid. However, later practitioners have tended to over-simplify its messages. In particular, the later application of the names (problem children, stars, cash cows and dogs) has tended to overshadow all else—and is often what most students, and practitioners, remember.

This is unfortunate, since such simplistic use contains at least two major problems:

'Minority applicability'. The cashflow techniques are only applicable to a very limited number of markets (where growth is relatively high, and a definite pattern of product life-cycles can be observed, such as that of ethical pharmaceuticals). In the majority of markets, use may give misleading results.

'Milking cash bulls'. Perhaps the worst implication of the later developments is that the (brand leader) cash bulls should be milked to fund new brands. This is not what research

into the FMCG markets has shown to be the case. The brand leader's position is the one, above all, to be defended, not least since brands in this position will probably outperform any number of newly launched brands. Such brand leaders will, of course, generate large cash flows; but they should not be `milked' to such an extent that their position is jeopardized. In any case, the chance of the new brands achieving similar brand leadership may be slim—certainly far less than the popular perception of the Boston Matrix would imply.

Perhaps the most important danger is, however, that the apparent implication of its four-quadrant form is that there should be balance of products or services across all four quadrants; and that is, indeed, the main message that it is intended to convey. Thus, money must be diverted from `cash cows' to fund the `stars' of the future, since `cash cows' will inevitably decline to become `dogs'. There is an almost mesmeric inevitability about the whole process. It focuses attention, and funding, on to the `stars'. It presumes, and almost demands, that `cash bulls' will turn into `dogs'.

The reality is that it is only the `cash bulls' that are really important—all the other elements are supporting actors. It is a foolish vendor who diverts funds from a `cash cow' when these are needed to extend the life of that `product'. Although it is necessary to recognize a `dog' when it appears (at least before it bites you) it would be foolish in the extreme to create one in order to balance up the picture. The vendor, who has most of his (or her) products in the `cash cow' quadrant, should consider himself (or herself) fortunate indeed, and an excellent marketer, although he or she might also consider creating a few stars as an insurance policy against unexpected future developments and, perhaps, to add some extra growth. There is also a common misconception that 'dogs' are a waste of resources. In many markets 'dogs' can be considered loss-leaders that while not themselves profitable will lead to increased sales in other profitable areas.

Alternatives

As with most marketing techniques, there are a number of alternative offerings vying with the BCG Matrix although this appears to be the most widely used (or at least most widely taught—and then probably 'not' used). The next most widely reported technique is that developed by McKinsey and General Electric, which is a three-cell by three-cell matrix—using the dimensions of `industry attractiveness' and `business strengths'. This approaches some of the same issues as the BCG Matrix but from a different direction and in a more complex way (which may be why it is used less, or is at least less widely taught). Perhaps the most practical approach is that of the Boston Consulting Group's Advantage Matrix, which the consultancy reportedly used itself though it is little known amongst the wider population.

Other uses

The initial intent of the growth-share matrix was to evaluate business units, but the same evaluation can be made for product lines or any other cash-generating entities. This should only be attempted for real lines that have a sufficient history to allow some

prediction; if the corporation has made only a few products and called them a product line, the sample variance will be too high for this sort of analysis to be meaningful.

Product Bundling

Product bundling is a marketing strategy that involves offering several products for sale as one combined product. This strategy is very common in the software business (for example: bundle a word processor, a spreadsheet, and a database into a single office suite), in the cable television industry (for example, basic cable in the United States generally offers many channels at one price), and in the fast food industry in which multiple items are combined into a complete meal. A bundle of products is sometimes referred to as a **package deal** or a **compilation** or an **anthology**.

Bundling is most successful when:

- There are economies of scale in production,
- There are economies of scope in distribution,
- Marginal costs of bundling are low.
- production set-up costs are high,
- Customer acquisition costs are high.
- Consumers appreciate the resulting simplification of the purchase decision and benefit from the joint performance of the combined product.
- Consumers have heterogeneous demands and such demands for different parts of the bundle product are inversely correlated. For example, assume consumer A values word processor at $100 and spreadsheet processor at $60, while consumer B values word processor at $60 and spreadsheet at $100. Seller can generate maximum revenue of $240 by setting $60 price for each product - both consumers will buy both products. Revenue cannot be increased without bundling because as seller increases the price above $60 for one of the goods, one of the consumers will refuse to buy it. With bundling, seller can generate revenue of $320 by bundling the products together and selling the bundle at $160.

Product bundling is most suitable for high volume and high margin (i.e., low marginal cost) products. Research by Yannis Bakos and Erik Brynjolfsson found that bundling was particularly effective for digital "information goods" with close to zero marginal cost, and could enable a bundler with an inferior collection of products to drive even superior quality goods out of the market place.

In oligopolistic and monopolistic industries, product bundling can be seen as an unfair use of market power because it limits the choices available to the consumer. In these cases it is typically called product tying.

Pure bundling occurs when a consumer can only purchase the entire bundle or nothing, **mixed bundling** occurs when consumers are offered a choice between the purchasing the entire bundle or one of the separate parts of the bundle.

Pure bundling can be further divided into two cases: in **joint bundling**, the two products are offered together for one bundled price, and, in **leader bundling**, a leader product is offered for discount if purchased with a non-leader product. **Mixed-leader bundling** is a variant of leader bundling with the added possibility of buying the leader product on its own.

Bundling in political economy is a type of product bundling in which the product is a candidate in an election who markets his bundle of attributes and positions to the voters.

In peer-to-peer swarming systems for content dissemination, such as BitTorrent, bundling consists of disseminating multiple files together in a single swarm. Empirical evidence and analytical models indicate that bundling improves content availability in those systems. Both pure and mixed bundling are supported by BitTorrent.

Software

Bundled software, commonly known as **software bundles** or **bundleware**, is the practice of including several related games or other software into a single package. Bundled software can be older software titles being resold to maximize profits for those particular games, sometimes to remainder inventory. Other software is bundled to allow users to have the game and all of its expansions, such as Blizzard Software's "Battle Chest" series for such games as *Diablo II*, *StarCraft* and the *Warcraft* series.

In the online environment, software bundling has increasingly been used whereby third party software is offered with the download of a primary download.

Chapter- 15

Product Manager

A **product manager** investigates, selects, develops, products for an organisation, performing the activity of product management.

A product manager considers numerous factors such as intended demographic, the products offered by the competition, and how well the product fits in with the company's business model. Generally, a product manager manages one or more tangible products. However, the term may be used to describe a person who manages intangible products, such as music, information, and services.

A product manager's role in tangible goods industries is similar to a program director's role in service industries.

Diverse interpretations regarding the role of the product manager are the norm. The product manager title is often used in many ways to describe drastically different duties and responsibilities. Even within the high-tech industry where product management is better defined, the product manager's job description varies widely among companies. This is due to tradition and intuitive interpretations by different individuals.

In the financial services industry (banking, insurance etc.), product managers manage products (for example, credit card portfolios), their profit and loss, and also determine the business development strategy.

In a Scrum environment, a Product Manager is also referred to as the Product Owner, and usually has the main role of representing the product to the customer. Some of the responsibilities of the Product Owner include marketing of the product and analysis of the competition.

In some companies, the product manager also acts as a:

- Product marketing manager — may perform all outbound marketing activities
- Project manager — may perform all activities related to schedule and resource management
- Program manager — may perform activities related to schedule, resource, and cross-functional execution

Project Manager

A **project manager** is a professional in the field of project management. Project managers can have the responsibility of the planning, execution, and closing of any project, typically relating to construction industry, architecture, computer networking, telecommunications or software development.

Many other fields in the production, design and service industries also have project managers.

Overview

A project manager is the person responsible for accomplishing the stated project objectives. Key project management responsibilities include creating clear and attainable project objectives, building the project requirements, and managing the triple constraint for projects, which are *cost*, *time*, and *quality* (also known as scope).

A project manager is often a client representative and has to determine and implement the exact needs of the client, based on knowledge of the firm they are representing. The ability to adapt to the various internal procedures of the contracting party, and to form close links with the nominated representatives, is essential in ensuring that the key issues of cost, time, quality and above all, client satisfaction, can be realized.

The term and title 'project manager' has come to be used generically to describe anyone given responsibility to complete a project. However, it is more properly used to describe a person with full responsibility and the same level of authority required to complete a project. If a person does not have high levels of both responsibility and authority then they are better described as a project administrator, coordinator, facilitator or expeditor.

Project manager topics

Project management
: Project Management is quite often the province and responsibility of an individual project manager. This individual seldom participates directly in the activities that produce the end result, but rather strives to maintain the progress and mutual interaction and tasks of various parties in such a way that reduces the risk of overall failure, maximizes benefits, and restricts costs.

Products and services
: Any type of product or service — pharmaceuticals, building construction, vehicles, electronics, computer software, financial services, etc. — may have its implementation overseen by a project manager and its operations by a product manager.

Project tools
: The tools, knowledge and techniques for managing projects are often unique to Project Management. For example: work breakdown structures, critical path analysis and earned value management. Understanding and applying the tools and

techniques which are generally recognized as good practices are not sufficient alone for effective project management. Effective project management requires that the project manager understands and uses the knowledge and skills from at least four areas of expertise. Examples are PMBOK, Application Area Knowledge: standards and regulations set forth by ISO for project management, General Management Skills and Project Environment Management

Project teams

When recruiting and building an effective team, the manager must consider not only the technical skills of each person, but also the critical roles and chemistry between workers. A project team has mainly three separate components: Project Manager, Core Team and Contracted Team.

Risk

Most of the project management issues that influence a project arise from risk, which in turn arises from uncertainty. The successful project manager focuses on this as his/her main concern and attempts to reduce risk significantly, often by adhering to a policy of open communication, ensuring that project participants can voice their opinions and concerns.

Types of project managers

Construction Project Manager

Construction project managers in the past were individuals, who worked in construction or supporting industries and were promoted to foreman. It was not until the late 20th century that construction and Construction management became distinct fields.

Until recently, the American construction industry lacked any level of standardization, with individual States determining the eligibility requirements within their jurisdiction. However, several Trade associations based in the United States have made strides in creating a commonly-accepted set of qualifications and tests to determine a project manager's competency.

- The Project Management Institute has made some headway into being a standardizing body with its creation of the Project Management Professional (PMP) designation.
- The Constructor Certification Commission of the American Institute of Constructors holds semiannual nationwide tests. Eight American Construction Management programs require that students take these exams before they may receive their Bachelor of Science in Construction Management degree, and 15 other Universities actively encourage their students to consider the exams.
- The Associated Colleges of Construction Education, and the Associated Schools of Construction have made considerable progress in developing national standards for construction education programs.

The profession has recently grown to accommodate several dozen Construction Management Bachelor of Science programs.

The US Navy Construction Battalion, nicknamed the SeaBees, puts their command through strenuous training and certifications at every level. To become a Chief Petty Officer in the SeaBees is equivalent to a BS in Construction Management with the added benefit of several years of experience to their credit.

Architectural Project Manager

Architectural project manager are project managers in the field of architecture. They have many of the same skills as their counterpart in the construction industry. An architect will often work closely with the construction project manager in the office of the General contractor (GC), and at the same time, coordinate the work of the design team and numerous consultants who contribute to a construction project, and manage communication with the client. The issues of budget, scheduling, and quality-control are the responsibility of the Project Manager in an architect's office.

Software Project Manager

A Software Project Manager has many of the same skills as their counterparts in other industries. Beyond the skills normally associated with traditional project management in industries such as construction and manufacturing, a software project manager will typically have an extensive background in software development. Many software project managers hold a degree in Computer Science, Information Technology or another related field and will typically have worked in the industry as a software engineer.

In traditional project management a heavyweight, predictive methodology such as the waterfall model is often employed, but software project managers must also be skilled in more lightweight, adaptive methodologies such as DSDM, SCRUM and XP. These project management methodologies are based on the uncertainty of developing a new software system and advocate smaller, incremental development cycles. These incremental or iterative cycles are timeboxed (constrained to a known period of time, typically from one to four weeks) and produce a working subset of the entire system deliverable at the end of each iteration. The increasing adoption of lightweight approaches is due largely to the fact that software requirements are very susceptible to change, and it is extremely difficult to illuminate all the potential requirements in a single project phase before the software development commences.

The software project manager is also expected to be familiar with the Software Development Life Cycle (SDLC). This may require in depth knowledge of requirements solicitation, application development, logical and physical database design and networking. This knowledge is typically the result of the aforementioned education and experience. There is not a widely accepted certification for software project managers, but many will hold the PMP designation offered by the Project Management Institute, PRINCE2 or an advanced degree in project management, such as a MSPM or other graduate degree in technology management.

Responsibilities

The specific responsibilities of the Project Manager vary depending on the industry, the company size, the company maturity, and the company culture. However, there are some responsibilities that are common to all Project Managers, noting:

- Developing the project plan
- Managing the project stakeholders
- Managing the project team
- Managing the project risk
- Managing the project schedule
- Managing the project budget
- Managing the project conflicts

Education, certifications and networks

Individuals wishing to obtain professional certifications may take one or more of the offerings available from a variety of organizations:

The Project Management Institute offers the following credentials to project managers:

- Project Management Professional (PMP)
- Certified Associate in Project Management (CAPM),
- Program Management Professional (PgMP)
- PMI Risk Management Professional (PMI-RMP), and
- PMI Scheduling Professional (PMI-SP)

Other institutions and organizations:

- The University of Wisconsin's Masters Certificate in Project Management
- CompTIA offers Project+ Certification
- The Canadian Construction Association (CCA) offers GSC as Project Manager.
- The UK Office of Government Commerce offers PRINCE2 certification.
- The Australian Institute of Project Management (AIPM) offers Registered Project Manager (RegPM) certification.
- The Defense Acquisition University (DAU) and its School of Program Management offers practitioner training in every element of project management for members of the Federal Government, Defense industry and allied nations.

There are other graduate degrees in project and technology management, such as an MSPM. However, the majority of all project management skills may be developed through the completion of a Ph.D, D.Phil or other similar higher Doctorate.

The IPMA is an international network of national project management societies such as Association for Project Management in the UK. IPMA serves as an umbrella organisation representing national societies which offer their certifications.

Project Management training

Methods of Project Management training are very diverse. Much of the training received by most project managers is on the job training. Other sources of training include

- University degree programs in project management
- Business degree programs with some level of Project Management emphasis
- Certification preparatory classes and training
- Social media such as blogs and podcasts
- Books
- Seminars and conferences
- Local group meetings (I.E. local chapters)

Program Management

Program management or **programme management** is the process of managing several related projects, often with the intention of improving an organization's performance. In practice and in its aims it is often closely related to systems engineering.

There are two different views of how programs differ from projects.

On one view, projects deliver outputs, discrete parcels or "chunks" of change; programs create outcomes. On this view, a project might deliver a new factory, hospital or IT system. By combining these projects with other deliverables and changes, their programs might deliver increased income from a new product, shorter waiting lists at the hospital or reduced operating costs due to improved technology.

The other view is that a program is nothing more than either a large project or a set (or portfolio) of projects. On this second view, the point of having a program is to exploit economies of scale and to reduce coordination costs and risks. The project manager's job is to ensure that their project succeeds. The program manager, on the other hand, may not care about individual projects, but is concerned with the aggregate result or end-state. For example, in a financial institution a program may include one project that is designed to take advantage of a rising market, and another to protect against the downside of a falling market. These projects are opposites with respect to their success conditions, but they fit together in the same program.

According to the view that programs deliver outcomes but projects deliver outputs, program management is concerned with doing the right projects. The program manager has been described as 'playing chess' and keeping the overview in mind. The pieces to be used or sacrificed being the projects. Whereas project management is about doing projects right. And also according to this view, successful projects deliver on time, to budget and to specification, whereas successful programs deliver long term improvements to an organization. Improvements are usually identified through benefits. An organization should select the group of programs that most take it towards its strategic aims whilst remaining within its capacity to deliver the changes. On the other hand, the

view that programs are simply large projects or a set of projects allows that a program may need to deliver tangible benefits quickly.

Consider the following set of projects:

- design of the new product - this delivers a design specification,
- modifications to the production line or factory - delivers a manufacturing capability,
- marketing - delivers advertisements, brochures and pamphlets,
- staff training - delivers staff trained to sell and support the new product.

One view has it that these are different projects within a program. But in practice they can just as well be managed as sub-projects within a single project. Which approach to choose? Program and project management are both practical disciplines, and the answer to such a question must be "whatever works." What works depends very much on the nature of the organization in which the project or program is run. Typically a program is broken down into projects that reflect the organization's structure. The design project will be run by the design team, the factory will manage the modifications to the production line, and so on. Organizational structure and organizational culture are key factors in how to structure a program.

The distinction between the terms "outcome" and "output" is far from clear, except in a trivial sense. Each of the projects listed in the example above is designed to deliver some 'thing', known as a 'deliverable' or an 'output', and together they improve the organization. Where one draws the line between the complete single benefit that causes the improvement and its component parts is partly a matter of preference and partly a matter of the culture and structure of the organization. Either way, benefits will normally be enjoyed long after the end of the program and all of its component projects. The point is that to achieve maximum benefits, there must be an integration of parts into a whole. Whether this integration is managed in something that is called a project or a program is of secondary importance to understanding the benefits and managing the process of integration well.

Many programs are concerned with delivering a capability to change. Only when that capability is transferred to the line management and utilized by the host organization will the benefits actually be delivered. On this view, a program team cannot, on their own, deliver benefits. Benefits can only be delivered through the utilization of a new capability.

Programs are normally designed to deliver the organization's strategy, such as an ambition to be the fourth biggest supermarket in a region by 2015 or reduce wastage by 5% in two year's time.

According to Project Management Institute (PMI), *The Standard for Program Management, 2nd Ed.*, "A Program is a group of related projects managed in a coordinated to obtain benefits and control NOT available from managing them

individually. Programs may include elements of related work outside of the scope of the discreet projects in the program... Some projects within a program can deliver useful incremental benefits to the organization before the program itself has completed."

Program management also emphasizes the coordinating and prioritizing of resources across projects, managing links between the projects and the overall costs and risks of the program.

Program management may provide a layer above the management of projects and focuses on selecting the best group of projects, defining them in terms of their objectives and providing an environment where projects can be run successfully. Program managers should not micromanage, but should leave project management to the project managers.

The UK government, through the Office of Government Commerce, has invested heavily in program management. In public sector work in Europe, the term normally refers to multiple change projects: projects that are designed to deliver benefits to the host organization. An alternative to the Office of Government Commerce's methodology for program management is that of the private sector Project Management Institute.

Many organizations only run one program at a time, a program containing all their projects. In Project Management Institute terminology, this is more likely to be a project portfolio than a program. Some larger organizations may have multiple programs each designed to deliver a range of improvements. Some organizations use the concept of Systems Engineering where others use program management.

Key factors

Governance
: The structure, process, and procedure to control operations and changes to performance objectives. Governance must include a set of metrics to indicate the health and progress of the program in the most vital areas.

Alignment
: The program must support a higher level vision, goals and objectives.

Assurance
: Verify and validate the program, ensuring adherence to standards and alignment with the vision.

Management
: Ensure there are regular reviews, there is accountability, and that management of projects, stakeholders and suppliers is in place.

Integration
: Ensure that component parts fit together properly to make the intended whole. Optimize performance across the program value chain, functionally and technically.

Finances
: Track basic costs together with wider costs of administering the program.

Infrastructure

Allocation of resources influences the cost and success of the program. Infrastructure might cover offices, version control, and IT.

Planning
: Develop the plan bringing together the information on projects, resources, timescales, monitoring and control.

Improvement
: Continuously assess performance; research and develop new capabilities; and systemically apply learning and knowledge to the program.

Differences from project management

The key difference between a program and a project is the finite nature of a project - a project must always have a specific end date, else it is an ongoing program.

One view of the differences between an program and a project in business is that:

1. A project is unique and is of definite duration. A program is ongoing and implemented within a business to consistently achieve certain results for the business.
2. A project is designed to deliver an output or deliverable and its success will be in terms of delivering the right output at the right time and to the right cost.
3. Program management includes management of projects which, together, improve the performance of the organization. A program's success will be measured in terms of benefits.
4. Benefits are the measures of improvement of an organization and might include increased income, increased profits, decreased costs, reduced wastage or environmental damage, more satisfied customers. In central or local government organizations, benefits might include providing a better service to the community.
5. In the course of achieving required results, business programs will normally understand related business constraints and determine the processes required to achieve results based on resources allocated. Improvement of processes is a continuous operation that very much contrasts a program from a project.
6. At the lowest level project managers co-ordinate individual projects. They are overseen by the program manager who accounts to the program sponsor (or board).
7. There will normally be a process to change the predetermined scope of a project. Programs often have to react to changes in strategy and changes in the environment in which the organization changes.

Another view and another successful way of managing does not see any of the factors listed above as distinguishing projects from programs, but rather sees the program as being about portfolio management. On this view, program management is about selecting projects, adjusting the speed at which they run, and adjusting their scope, in order to maximize the value of the portfolio as a whole, and as economic or other external conditions change.

Yet another view is that a program management is nothing more than a large, complex project, where the integration aspect of project management is more important than in smaller projects. Integration management is a key feature of the Project Management Institute's approach to project management.

In practice it is not clear that there is such a clear-cut distinction. Projects (or programs) vary from small and simple to large and complex, what needs to be a managed as a program in one culture or organization may be managed as a project in another.

Software product manager

A typical software product manager is responsible for eliciting software requirements using a Marketing Requirements Document (MRD) developed by the product planning/marketing team and developing a high level Product Requirements Document (PRD) and an elaborate Software Requirements Specification (SRS) for the software engineering/development organization for subsequent design, development, and testing activities. In most organizations, the software product manager is responsible for creating User Acceptance Test (UAT) procedures, facilitating UAT sessions with end-users, and ensuring that the product meets the specifications and is deployed successfully.

Chapter- 16

Brand Management

Brand management is the application of marketing techniques to a specific product, product line, or brand. It seeks to increase a product's perceived value to the customer and thereby increase brand franchise and brand equity. Marketers see a brand as an implied promise that the level of quality people have come to expect from a brand will continue with future purchases of the same product. This may increase sales by making a comparison with competing products more favorable. It may also enable the manufacturer to charge more for the product. The value of the brand is determined by the amount of profit it generates for the manufacturer. This can result from a combination of increased sales and increased price, and/or reduced COGS (cost of goods sold), and/or reduced or more efficient marketing investment. All of these enhancements may improve the profitability of a brand, and thus, "Brand Managers" often carry *line-management* accountability for a brand's P&L (Profit and Loss) profitability, in contrast to marketing *staff* manager roles, which are allocated budgets from above, to manage and execute. In this regard, Brand Management is often viewed in organizations as a broader and more strategic role than Marketing alone.

The annual list of the world's most valuable brands, published by Interbrand and *Business Week*, indicates that the market value of companies often consists largely of brand equity. Research by McKinsey & Company, a global consulting firm, in 2000 suggested that strong, well-leveraged brands produce higher returns to shareholders than weaker, narrower brands. Taken together, this means that brands seriously impact shareholder value, which ultimately makes branding a CEO responsibility.

The discipline of brand management was started at Procter & Gamble as a result of a famous memo by Neil H. McElroy.

Principles of brand management

A good **brand name** should:

- be protected (or at least protectable) under Trademark law.
- be easy to pronounce.
- be easy to remember.
- be easy to recognize.
- be easy to know

- be easy to translate into all languages in the markets where the brand will be used.
- attract attention.
- suggest product benefits or suggest usage (note the tradeoff with strong trademark protection.)
- suggest the company or product image.
- distinguish the product's positioning relative to the competition.
- be attractive.
- stand out among a group of other brands.

>fighting brand >corporate branding >individual branding >family branding >"

Functions of brand

(For consumers) Identification of source of product, Assignment of responsibility to product maker, Risk reducer, Search cost reducer, Symbolic device, Signal of quality, Speak personality, Deliver its value qualitatively and quantitatively, Live up to consumer expectation. it speaks itself looks are more important

(For Manufacturers)

Means of identification to simplify handling and tracing, Means of legally protecting unique features, Signal of quality level to satisfied customers, Means of endowing products with unique associations, Source of competitive advantage, Source of financial returns. ("Strategic Brand Management" 3rd edition,Kevin Lane Keller)

Brand architecture

The different brands owned by a company are related to each other via brand architecture. In "product brand architecture", the company supports many different product brands with each having its own name and style of expression while the company itself remains invisible to consumers. Product naming plays an important role in communicating benefits to the consumer. Many companies will use the services of naming firms to be sure positive communication to the consumer is achieved. Procter & Gamble, considered by many to have created product branding, is a choice example with its many unrelated consumer brands such as Tide, Pampers, Abunda, Ivory and Pantene.

With "endorsed brand architecture", a mother brand is tied to product brands, such as The Courtyard Hotels (product brand name) by Marriott (mother brand name). Endorsed brands benefit from the standing of their mother brand and thus save a company some marketing expense by virtue promoting all the linked brands whenever the mother brand is advertising. This is most commonly referred to as "corporate branding". The mother brand is used and all products carry this name and all advertising speaks with the same voice. A good example of this brand architecture is the UK-based conglomerate Virgin. Virgin brands all its businesses with its name.

Techniques

Companies sometimes want to reduce the number of brands that they market. This process is known as "Brand Rationalization." Some companies tend to create more brands and product variations within a brand than economies of scale would indicate. Sometimes, they will create a specific service or product brand for each market that they target. In the case of product branding, this may be to gain retail shelf space (and reduce the amount of shelf space allocated to competing brands). A company may decide to rationalize their portfolio of brands from time to time to gain production and marketing efficiency, or to rationalize a brand portfolio as part of corporate restructuring.

A recurring challenge for brand managers is to build a consistent brand while keeping its message fresh and relevant. An older brand identity may be misaligned to a redefined target market, a restated corporate vision statement, revisited mission statement or values of a company. Brand identities may also lose resonance with their target market through demographic evolution. Repositioning a brand (sometimes called rebranding), may cost some brand equity, and can confuse the target market, but ideally, a brand can be repositioned while retaining existing brand equity for leverage.

Brand orientation is a deliberate approach to working with brands, both internally and externally. The most important driving force behind this increased interest in strong brands is the accelerating pace of globalization. This has resulted in an ever-tougher competitive situation on many markets. A product's superiority is in itself no longer sufficient to guarantee its success. The fast pace of technological development and the increased speed with which imitations turn up on the market have dramatically shortened product lifecycles. The consequence is that product-related competitive advantages soon risk being transformed into competitive prerequisites. For this reason, increasing numbers of companies are looking for other, more enduring, competitive tools – such as brands. Brand Orientation refers to "the degree to which the organization values brands and its practices are oriented towards building brand capabilities" (Bridson & Evans, 2004).

Online brand management

Companies are embracing brand reputation management as a strategic imperative and are increasingly turning to online monitoring in their efforts to prevent their public image from becoming tarnished. Online brand reputation protection can mean monitoring for the misappropriation of a brand trademark by fraudsters intent on confusing consumers for monetary gain. It can also mean monitoring for less malicious, although perhaps equally damaging, infractions, such as the unauthorized use of a brand logo or even for negative brand information (and misinformation) from online consumers that appears in online communities and other social media platforms. The red flag can be something as benign as a blog rant about a bad hotel experience or an electronic gadget that functions below expectations.

Brand Alliances

Brand alliances is a branding strategy used in a business alliance. Brand alliances are divided into three types:

Cobrands

A typical Yum! Brands co-branded restaurant that offer products from two or more of the company's brands (in this case, Taco Bell and KFC)

Cobrands are the usage of two or more brands on one certain product. For example, Dell computers carries three brands on their packages and cases: Dell, Microsoft Windows, and Intel.

A visible example of cobranding is Yum! Brands combining two or more of their restaurants under one roof. In many places it is not unusual to see a Long John Silver's and KFC or a Pizza Hut and Taco Bell combined.

Brand licenses

Brand licenses are a contractual agreement where a company lets another organisation use its brand on other products in exchange for a licensing fee.

An example of brand licensing is seen in the Walt Disney Company's relationship to Tokyo Disneyland. The theme park is owned by The Oriental Land Company, which licenses the theme from The Walt Disney Company.

Cross Marketing

Cross Marketing is an agreement for mutual promotion between two companies. One company for instance will include coupons for another company in its parcels to its clients if the other company will agree to include a promotion from the other company in its direct mails to its client base.

Brand Equity

Brand equity refers to the marketing effects and outcomes that accrue to a product with its brand name compared with those that *would* accrue if the same product did not have the brand name. And, at the root of these marketing effects is consumers' knowledge. In other words, consumers' knowledge about a brand makes manufacturers/advertisers respond differently or adopt appropriately adept measures for the marketing of the brand. The study of brand equity is increasingly popular as some marketing researchers have concluded that brands are one of the most valuable assets that a company has. Brand equity is one of the factors which can increase the financial value of a brand to the brand owner, although not the only one. Elements that can be included in the valuation of brand equity include (but not limited to): changing market share, profit margins, consumer recognition of logos and other visual elements, brand language associations made by consumers, consumers' perceptions of quality and other relevant brand values.

Measurement

There are many ways to measure a brand. Some measurements approaches are at the firm level, some at the product level, and still others are at the consumer level.

Firm Level: Firm level approaches measure the brand as a financial asset. In short, a calculation is made regarding how much the brand is worth as an intangible asset. For example, if you were to take the value of the firm, as derived by its market capitalization - and then subtract tangible assets and "measurable" intangible assets- the residual would be the brand equity. One high profile firm level approach is by the consulting firm Interbrand. To do its calculation, Interbrand estimates brand value on the basis of projected profits discounted to a present value. The discount rate is a subjective rate determined by Interbrand and Wall Street equity specialists and reflects the risk profile, market leadership, stability and global reach of the brand.

Product Level*:* The classic product level brand measurement example is to compare the price of a no-name or private label product to an "equivalent" branded product. The

difference in price, assuming all things equal, is due to the brand. More recently a revenue premium approach has been advocated.

***Consumer Level**:* This approach seeks to map the mind of the consumer to find out what associations with the brand the consumer has. This approach seeks to measure the awareness (recall and recognition) and brand image (the overall associations that the brand has). Free association tests and projective techniques are commonly used to uncover the tangible and intangible attributes, attitudes, and intentions about a brand. Brands with high levels of awareness and strong, favorable and unique associations are high equity brands.

All of these calculations are, at best, approximations. A more complete understanding of the brand can occur if multiple measures are used.

Positive brand equity vs. negative brand equity

A brand equity is the positive effect of the brand on the difference between the prices that the consumer accepts to pay when the brand known compared to the value of the benefit received.

There are two schools of thought regarding the existence of negative brand equity. One perspective states brand equity cannot be negative, hypothesizing only positive brand equity is created by marketing activities such as advertising, PR, and promotion. A second perspective is that negative equity can exist, due to catastrophic events to the brand, such as a wide product recall or continued negative press attention (Blackwater or Halliburton, for example).

Colloquially, the term "negative brand equity" may be used to describe a product or service where a brand has a negligible effect on a product level when compared to a no-name or private label product. The brand-related negative intangible assets are called “brand liability”, compared with “brand equity.”

Family branding vs. individual branding strategies

The greater a company's brand equity, the greater the probability that the company will use a family branding strategy rather than an individual branding strategy. This is because family branding allows them to leverage the equity accumulated in the core brand. Aspects of brand equity includes: brand loyalty, awareness, association, and perception of quality.

Examples

In the early 2000s in North America, the Ford Motor Company made a strategic decision to brand all new or redesigned cars with names starting with "F". This aligned with the previous tradition of naming all sport utility vehicles since the Ford Explorer with the letter "E". The Toronto Star quoted an analyst who warned that changing the name of the

well known Windstar to the Freestar would cause confusion and discard brand equity built up, while a marketing manager believed that a name change would highlight the new redesign. The aging Taurus, which became one of the most significant cars in American auto history, would be abandoned in favor of three entirely new names, all starting with "F", the Five Hundred, Freestar and Fusion. By 2007, the Freestar was discontinued without a replacement. The Five Hundred name was thrown out and Taurus was brought back for the next generation of that car in a surprise move by Alan Mulally. "Five Hundred" was recognized by less than half of most people, but an overwhelming majority was familiar with the "Ford Taurus".

Brand extension

Brand extension or **brand stretching** is a marketing strategy in which a firm marketing a product with a well-developed image uses the same brand name in a different product category. The new product is called a **spin-off**. Organizations use this strategy to increase and leverage brand equity (definition: the net worth and long-term sustainability just from the renowned name). An example of a brand extension is Jello-gelatin creating Jello pudding pops. It increases awareness of the brand name and increases profitability from offerings in more than one product category.

A brand's "extendibility" depends on how strong consumer's associations are to the brand's values and goals. Ralph Lauren's Polo brand successfully extended from clothing to home furnishings such as bedding and towels. Both clothing and bedding are made of linen and fulfill a similar consumer function of comfort and hominess. Arm & Hammer leveraged its brand equity from basic baking soda into the oral care and laundry care categories. By emphasizing its key attributes, the cleaning and deodorizing properties of its core product, Arm & Hammer was able to leverage those attributes into new categories with success. Another example is Virgin Group, which was initially a record label that has extended its brand successfully many times; from transportation (aeroplanes, trains) to games stores and video stores such a Virgin Megastores.

In the 1990s, 81% of new products used brand extension to introduce new brands and to create sales. Launching a new product, is not only time consuming but also needs a big budget to create awareness and to promote a product's benefits. Brand extension is one of the new product development strategies which can reduce financial risk by using the parent brand name to enhance consumers' perception due to the core brand equity.

While there can be significant benefits in brand extension strategies, there can also be significant risks, resulting in a diluted or severely damaged brand image. Poor choices for brand extension may dilute and deteriorate the core brand and damage the brand equity. Most of the literature focuses on the consumer evaluation and positive impact on parent brand. In practical cases, the failures of brand extension are at higher rate than the successes. Some studies show that negative impact may dilute brand image and equity. In

spite of the positive impact of brand extension, negative association and wrong communication strategy do harm to the parent brand even brand family.

Product extensions are versions of the same parent product that serve a segment of the target market and increase the variety of an offering. An example of a product extension is Coke vs. Diet Coke in same product category of soft drinks. This tactic is undertaken due to the brand loyalty and brand awareness they enjoy consumers are more likely to buy a new product that has a tried and trusted brand name on it. This means the market is catered for as they are receiving a product from a brand they trust and Coca Cola is catered for as they can increase their product portfolio and they have a larger hold over the market in which they are performing in.

Types of product extension

Brand extension research mainly focuses on the consumer evaluation of extension and attitude of the parent brand. Following the Aaker and Keller's (1990) model, they provide a sufficient depth and breadth proposition to examine consumer behaviour and conceptual framework. They use three dimensions to measure the fit of extension. First of all, the "Complement" is that consumer takes two product (extension and parent brand product) classes as complement to satisfy their specific needs. Secondly, the "Substitute" indicates two products have same user situation and satisfy their same needs which means the products class is very similar so that can replace each other. At last, the "Transfer" is the relationship between extension product and manufacturer which "reflects the perceived ability of any firm operating in the first product class to make a product in the second class". The first two measures focus on the consumer's demand and the last one focuses on firm's ability.

From the line extension to brand extension, however, there are many different way of extension such as "brand alliance", co-branding or "brand franchise extension". Tauber (1988) suggests seven strategies to identify extension cases such as product with parent brand's benefit, same product with different price or quality, etc. In his suggestion, it can be classified into two category of extension; extension of product-related association and non-product related association. Another form of brand extension, is a licensed brand extension. Where the brand-owner partners (sometimes with a competitor) who takes on the responsibility of manufacturer and sales of the new products, paying a royalty every time a product is sold.

Categorisation theory

Researchers tend to use "categorisation theory" as their fundamental theory to explore the links about the brand extension. When consumers face thousands of products, they not only are initially confused and disorderly in mind, but also try to categorise the brand association or image with their existing memory. When two or more products exit in front of consumers, they might reposition memories to frame a brand image and concept toward new introduction. A consumer can judge or evaluate the extension by their category memory. They categorise new information into specific brand or product class

label and store it. This process is not only related to consumer's experience and knowledge, but also involvement and choice of brand. If the brand association is highly related to extension, consumer can perceive the fit among brand extension. Some studies suggest that consumer may ignore or overcome the dissonance from extension especially flagship product which means the low perceived of fit does not dilute the flagship's equity.

Brand extension failure

Literature related to negative effect of brand extension is limited and the findings are revealed as incongruent. The early works of Aaker and Keller (1990) find no significant evidence that brand name can be diluted by unsuccessful brand extensions. Conversely, Loken and Roedder-John (1993) indicate that dilution effect do occur when the extension across inconsistency of product category and brand beliefs. The failure of extension may come from difficulty of connecting with parent brand, a lack of similarity and familiarity and inconsistent IMC messages.

"Equity of an integrated oriented brand can be diluted significantly from both functional and non-functional attributes-base variables", which means dilution does occur across the brand extension to the parent brand. These failures of extension make consumers create a negative or new association relate to parent brand even brand family or to disturb and confuse the original brand identity and meaning.

In addition, Martinez and de Chernatony (2004) classify the brand image in two types: the general brand image and the product brand image. They suggest that if the brand name is strong enough as Nike or Sony, the negative impact has no specific damage on general brand image and "the dilution effect is greater on product brand image than on general brand image". Consequently, consumers may maintain their belief about the attributes and feelings about parent brand, however their study does show that "brand extension dilutes the brand image, changing the beliefs and association in consumers' mind".

The flagship product is a money-spinner to a firm. Marketer spends budget and time to create maximum exposure and awareness for the product. Theoretically speaking, flagship product is usually had the top sales and highest awareness in its product category. In spite of Aaker and Keller's (1990) research which reports that prestigious brands are not harmed from failure of extensions, some evidence shows that the dilution effect has great and instant damage to the flagship product and brand family. Still, some studies suggest that even though overall parent belief is diluted; the flagship product would not be harmed. In addition, brand extension also "diminish[es] consumer's feelings and beliefs about brand name." To establish a strong brand, it is necessary to build up a "brand ladder".

Marketers may follow the order and model created by Aaker and Keller who are authorities on brand management, but branding does not always follow a rational line. One mistake can damage all brand equity. A classic extension failure example would be

Coca Cola launching “New Coke” in 1985. Although initially accepted a backlash against “New Coke” soon emerged among consumers. Not only did Coca Cola not succeed in developing a new brand but sales of the original flavour also decreased. Coca Cola had to make considerable efforts to regain customers who had turned to Pepsi cola.

Although there are few works about the failure of extensions, literature still provides sufficient in depth research around this issue. Studies also suggest that brand extension is a risky strategy to increase sales or brand equity. It should consider the damage of parent brand no matter what types of extension are used. Example. BIC Pens tried to produce BIC pantyhose. You can read some more here

Brand equity

Brand equity is defined as the main concern in brand management and IMC campaign. Every marketer should pursue the long term equity and pay attention to every strategy in detail. Because a small message dissonance would cause great failure of brand extension. On the other hand, consumer has his psychology process in mind. The moderating variable is a useful indication to evaluate consumer evaluation of brand extension.

Throughout the categorisation theory and associative network theory, consumer does have the ability to process information into useful knowledge for them. They would measure and compares the difference between core brand and extension product through quality of core brand, fit in category, former experience and knowledge, and difficulty of making. Consequently, in this article may conclude some points about consumer evaluation of brand extension:

1. Quality of core brand creates a strong position for brand and low the impact of fit in consumer evaluation.
2. Similarity between core brand and extension is the main concern of consumer perception of fit. The higher the similarity is the higher perception of fit.
3. Consumer’s knowledge and experience affect the evaluation before extension product trail.
4. The more innovation of extension product is, the greater positive fit can perceive.

A successful brand message strategy relies on a congruent communication and a clear brand image. The negative impact of brand extension would cause a great damage to parent brand and brand family. From a manager and marketer’s perspective, an operation of branding should maintain brand messages and associations within a consistency and continuum in the long way. Because the effects of negative impact from brand extension are tremendous and permanently. Every messages or brand extension can dilute the brand in nature.