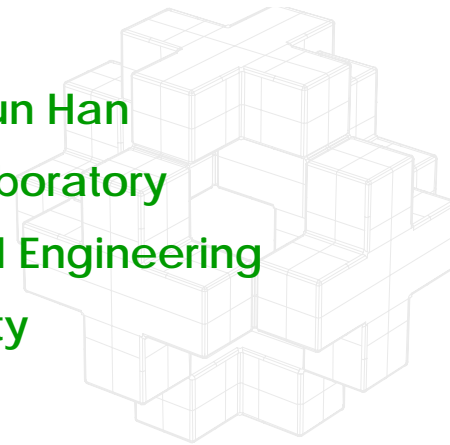
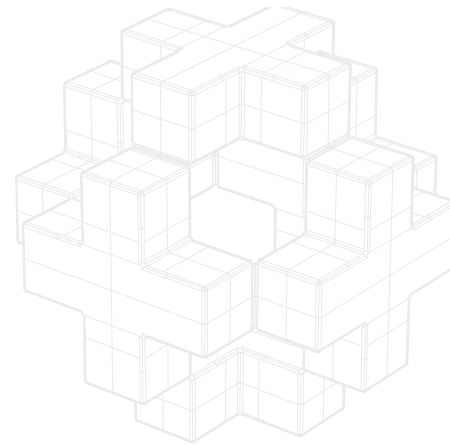

Chemical Product Design

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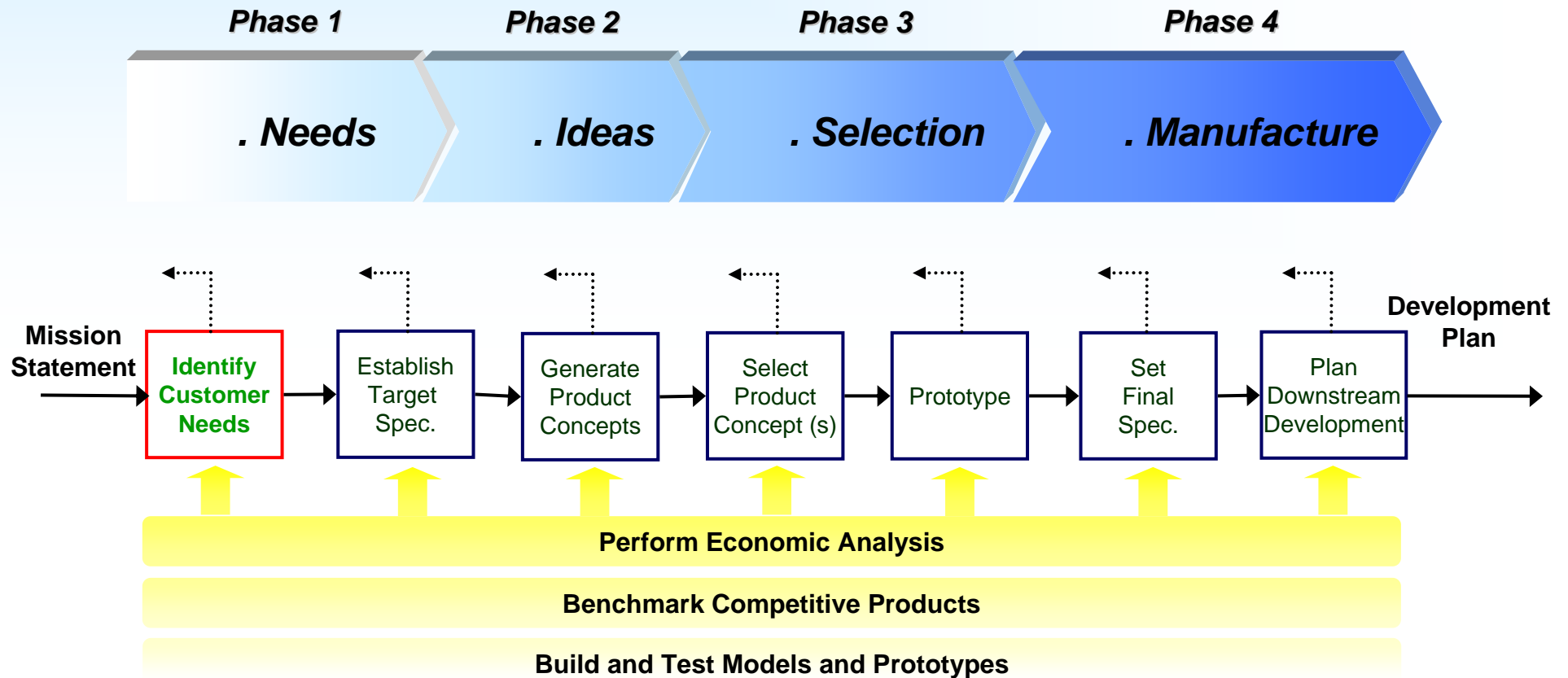
PART IV. Identify Customer's Needs

- Gather raw data from customers
- Interpret raw data
- Organize the needs
- Establish importance
- Reflect on the process



Procedure

Phase 1. Needs – Identify customer needs



Identify customer needs

The goal of the method

- ❖ Ensure that the product is focused on **customer needs**.
- ❖ Identify **latent or hidden needs** as well as explicit needs.
- ❖ Provide a **fact base** for justifying the product specifications.
- ❖ Create an **archival record** of the needs activity of the development process.
- ❖ Ensure that no **critical customer needs** is missed or forgotten.
- ❖ Develop a **common understanding** of customer needs among members of the development team.

Customer needs process

Identification of customer needs process

1. **Gather** raw data from customers

- Interviews
- Focus groups
- Observation

2. **Interpret** raw data

- Need Statements

3. **Organize** the needs

- Hierarchy

4. **Establish importance**

- Surveys
- Quantified needs

5. **Reflect** on the process

- Continuous improvement



**Integrate product specifications
step !!!**

Define the Scope

Mission Statement

Mission Statement: Target Product

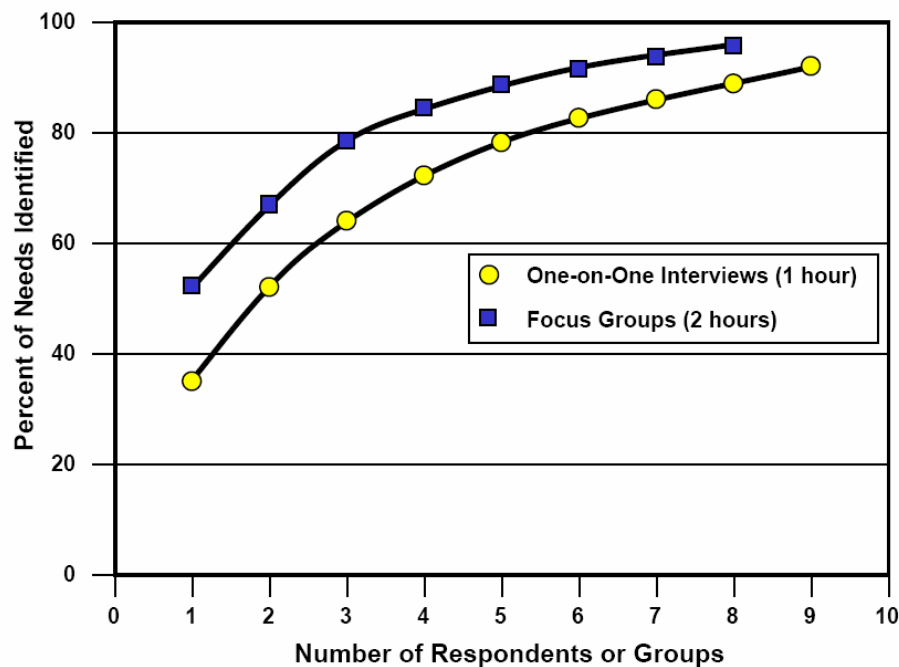
Product Description	<ul style="list-style-type: none"> ❖ The description includes key customer benefit, avoid to implying a specific product concept. ❖ Product vision statement.
Key Business Goals	<ul style="list-style-type: none"> ❖ The project goal supports the corporate strategy. ❖ goals for time, cost, and quality. ex) timing of the product introduction, desired financial performance, market share target
Primary Market	<ul style="list-style-type: none"> ❖ Primary target market for the product.
Secondary Markets	<ul style="list-style-type: none"> ❖ Secondary target market for the product. ❖ They should be considered in he development effort.
Assumptions and Constraints	<ul style="list-style-type: none"> ❖ They restrict the range of possible product concept. ❖ They help to maintain a manageable project scope
Stakeholders	<ul style="list-style-type: none"> ❖ List of the product stakeholders. ❖ All of the groups of people who are affected by the product's success or failure. ❖ Begin with the end user and the external customers of the product who makes the buying decision about he product. ❖ The customers of the product who reside within the firm ex) the sales force, the sales organization, and the production department

Gather raw data

- ❖ Interviews
- ❖ Focus Groups
- ❖ Observing the product in use

Griffin, Abbie and John R. Hauser, "The Voice of the Customer," *Marketing Science*, 12, (1993).

Gather Raw Data from Customers



Research by Griffin and Hauser shows that one 2-hour focus group reveals about the same number of needs as two 1-hour interviews. Because interviews are usually **less costly** (per hour) than focus groups and because an interview often allows the product development team to experience the use environment of the product, we recommend that **interviews** be the primary data collection method.

Gather raw data

How many customers?

Griffin and Hauser also addressed the question of how many customers to interview in order to reveal most of the customer needs. In one study, they estimated that 90% of the customer needs for picnic coolers were revealed after 30 interviews. In another study, they estimated that 98% of the customer needs for a piece of office equipment were revealed after 25 hours of data collection in both focus groups and interviews.

As a practical guideline for most products, conducting fewer than **10 interviews is probably inadequate and 50 interviews are probably too many**. These guidelines apply to cases in which the development team is addressing a single market segment.

Interpret Raw Data

Five Guidelines for Writing Needs Statements

Guideline	Customer Statement	Need Statement Wrong	Need Statement Right
“What” Not “How”	“Why don’t you put protective shields around the battery contacts?”	The screwdriver battery contacts are covered by a plastic sliding door.	The screwdriver battery is protected from accidental shorting.
Specificity	“I drop my screwdriver all the time.”	The screwdriver is rugged.	The screwdriver operates normally after repeated dropping.
Positive Not Negative	“It doesn’t matter if it’s raining, I still need to work outside on Saturdays.”	The screwdriver is not disabled by the rain.	The screwdriver operates normally in the rain.
Attribute of the Product	“I’d like to charge my battery from my cigarette lighter.”	An automobile cigarette lighter adapter can charge the screwdriver battery.	The screwdriver battery can be charged from an automobile cigarette lighter
Avoid “Must” and “Should”	“I hate it when I don’t know how much juice is left in the batteries of my cordless tools.	The screwdriver should provide an indication of the energy level of the battery.	The screwdriver provides an indication of the energy level of the battery.

Organize the Needs

Hierarchical List of Customer Needs

The SD provides plenty of power to drive screws.

- * The SD maintains power for several hours of heavy use.
- ** The SD can drive screws into hardwood.
The SD drives sheet metal screws into metal ductwork.
- *** The SD drives screws faster than by hand.

The SD makes it easy to start a screw.

- * The SD retains the screw before it is driven.
- ! * The SD can be used to create a pilot hole.

The SD works with a variety of screws.

- ** The SD can turn philips, torx, socket, and hex head screws.
- ** The SD can turn many sizes of screws.

The SD can access most screws.

- The SD can be maneuvered in tight areas.
- ** The SD can access screws at the end of deep, narrow holes.

The SD turns screws that are in poor condition.

- The SD can be used to remove grease and dirt from screws.
- The SD allows the user to work with painted screws.

The SD feels good in the user's hand.

- *** The SD is comfortable when the user pushes on it.
- *** The SD is comfortable when the user resists twisting.
 - * The SD is balanced in the user's hand.
 - ! The SD is equally easy to use in right or left hands.
The SD weight is just right.
The SD is warm to touch in cold weather.
The SD remains comfortable when left in the sun.

The SD is easy to control while turning screws.

- *** The user can easily push on the SD.
- *** The user can easily resist the SD twisting.
The SD can be locked "on."
- ! ** The SD speed can be controlled by the user while turning a screw.

The SD is easy to set-up and use.

- * The SD is easy to turn on.
- * The SD prevents inadvertent switching off.
- * The user can set the maximum torque of the SD.
- ! * The SD provides ready access to bits or accessories.
- * The SD can be attached to the user for temporary storage.

The SD power is convenient.

- * The SD is easy to recharge.
The SD can be used while recharging.
- *** The SD recharges quickly.
The SD batteries are ready to use when new.
- ! ** The user can apply torque manually to the SD to drive a screw.

The SD lasts a long time.

- ** The SD tip survives heavy use.
The SD can be hammered.
- * The SD can be dropped from a ladder without damage.

The SD is easy to store.

- * The SD fits in a toolbox easily.
- ** The SD can be charged while in storage.
The SD resists corrosion when left outside or in damp places.
- ! * The SD maintains its charge after long periods of storage.
The SD maintains its charge when wet.

The SD prevents damage to the work.

- * The SD prevents damage to the screw head.
The SD prevents scratching of finished surfaces.

The SD has a pleasant sound when in use.

The SD looks like a professional quality tool.

The SD is safe.

The SD can be used on electrical devices.

Importance ratings for the secondary needs are indicated by the number of *'s, with *** denoting critically important needs. Latent needs are denoted by !.

Establish Importance

Example Importance Survey

Cordless Screwdriver Survey

For each of the following cordless screwdriver features, please indicate on a scale of 1 to 5 how important feature is to you. Please use the following scale:

1. Feature is undesirable. I would not consider a product with this feature.
2. Feature is not important, but I would not mind having it.
3. Feature would be nice to have, but is not necessary.
4. Feature is highly desirable, but I would consider a product without it.
5. Feature is critical. I would not consider a product without this feature.

Also indicate by checking the box to the right if you feel that the feature is unique, exciting, and/or unexpected.

Importance of feature on scale of 1 to 5

Check box if feature is unique
exciting, and/or unexpected.

- | | |
|--|--------------------------|
| : The screwdriver maintains power for several hours of heavy use | <input type="checkbox"/> |
| : The screwdriver can drive screws into hardwood. | <input type="checkbox"/> |
| : The screwdriver speed can be controlled by the user while turning a screw. | <input type="checkbox"/> |
| : The screwdriver has a pleasant sound when in use. | <input type="checkbox"/> |

And so forth.

Chemical Industry Example

Customer Needs = Product Quality Factors

Source: Wibowo, Christianto and Ng Ka M. “Product-Oriented Process Synthesis and Development: Creams and Pastes”, AIChE Journal vol.47, no. 12, December 2001.

Gather raw data from customers – Observing the product in use

The product attributes that the creams and pastes are expected to possess are determined first. While the primary concern is always functionality, quality factors such as ease of application, stability, and appearance are often crucial in customer satisfaction. For example, consumer perception when a moisturizing cream is applied to the skin, whether it is smooth, oily, cold, or tacky, is an important consideration, apart from protecting the skin from dryness.

A cosmetic or pharmaceutical product should be stable for over a year, subject to the expected changes in external temperature, humidity, and the presence of direct sunlight. Next page lists some examples of typical product quality factors for creams and pastes.

Chemical Industry Example

Customer Needs = Product Quality Factors

Source: Wibowo, Christianto and Ng Ka M. "Product-Oriented Process Synthesis and Development: Creams and Pastes", AIChE Journal vol.47, no. 12, December 2001.

Functional Quality Factors	Rheological Quality Factors
<ul style="list-style-type: none"> ❖ Protects parts of the body ❖ Cleans parts of the body ❖ Provides a protective or decorative coating ❖ Delivers an active pharmaceutical ingredient (API) 	<ul style="list-style-type: none"> ❖ Can be poured easily ❖ Spreads easily when rubbed on the skin ❖ Does not flow readily under gravity but easy to stir ❖ Should give a uniform coating when applied to a surface ❖ Should not flow by itself, but can be squeezed out of the container
Physical Quality Factors	Sensorial Quality Factors
<ul style="list-style-type: none"> ❖ Must be stable for a certain period of time ❖ Melts at a certain temperature ❖ Must release an ingredient at a controlled rate 	<ul style="list-style-type: none"> ❖ Feels smooth ❖ Does not feel oily ❖ Appears transparent, opaque, or pearlescent ❖ Does not cause irritation

Chemical Industry Example

Customer Needs = Government Regulations

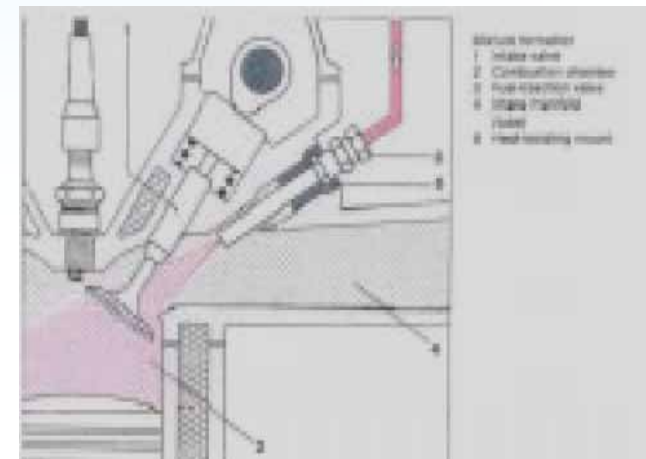
Source: Prasenjeet Ghosh, Anantha Sundaram, Venkat Venkatasubramanian, Caruthers James M. "Integrated Product Engineering: A Hybrid Evolutionary Framework", PSE 2000, Colorado

Gather raw data from customers – From the Government Policy

Objective : The construction of optimal fuel additive molecules given desired intake valve deposit requirements.

The Role of Additives : The prevention of decomposition on the valve by scavenging the deposit forming pre-cursors of the fuel

Constraints : A fuel package must produce an average deposit of less than 100mg/valve for certification. - By the US Environmental Agency (1986)



Chemical Industry Example

Customer Needs = Market Trend

Source: Wibowo, Christianto and Ng Ka M. "Product-Centered Processing: Chemical-Based Consumer Products", AIChE Journal vol.48, no. 6, December 2002.

Consumer Wants and Needs

- ◆ The product should last longer and/or cost less
- ◆ Products performing complementary functions should be combined in one products
- ◆ The use of a personal care product should be a pleasurable experience
- ◆ The product should be a smaller in size, easy to carry when traveling

Product Safety

- ◆ The product should not contain toxic solvent or allergenic materials
- ◆ The product should not contain dangerous chemical for little children
- ◆ The product should contain more natural ingredients

Legal and Environmental Issues

- ◆ It is preferable that the product is biodegradable
- ◆ Refillable container should be used to reduce waste

Chemical Industry Example

Customer Needs = Product Quality Factors

Source: Wibowo, Christianto and Ng Ka M. "Product-Centered Processing: Chemical-Based Consumer Products", AIChE Journal vol.48, no. 6, December 2002.

Quality Factor	Product Form/Delivery System							Performance Index
	Composite	Tablet/capsule	Powder/ Granule	Cream/ Paste	Viscous liquid	Dilute liquid	Aerosol	
<i>Sensorial Quality Factors</i>								
Visual appearance: transparent, opaque, pearlescent, color	√	√	√	√	√	√	√	Arbitrary indices based on panelist evaluation
Smell: fragrant, odorless, stinky	√	√	√	√	√	√	√	
Taste: sweet, sour, bitter	√	√	√	√	√	√	√	
Sense upon application: smooth, oily, sticky				√	√	√	√	
<i>Physicochemical Quality Factors</i>								
Product stability (resistance against creaming)				√	√	√	√	Shelf life
Ability to change phase upon application	√	√	√	√	√			Melting point, glass transition temperature
Hygroscopicity	√	√	√	√	√	√		Moisture absorption rate
Ease of dispersion in a liquid			√					Wetting time
Ability to dissolve in a liquid	√	√	√					Dissolution time
Rate at which an active ingredient is released	√	√	√	√	√	√		Release time
<i>Mechanical Quality Factors</i>								
Resistance to failure	√	√	√					Tensile strength
Resistance to indentation (hardness)	√	√	√					Hardness numbers
Ease of failure by fracture (toughness)	√	√	√					Fracture energy
Elasticity	√	√	√					Young's modulus
Ease of flow			√					Flow number
<i>Rheological Quality Factors</i>								
Ease of spreading when rubbed onto a surface, applied by brush, or shaken				√	√			Viscosity at application shear rate
Ability to flow under gravity				√	√			Yield value
Ability to provide even coating when applied on a surface				√	√			Minimum thickness at which even coating is observed