# Chemical Product Design

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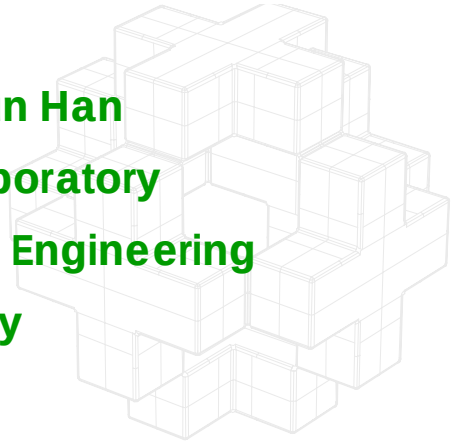
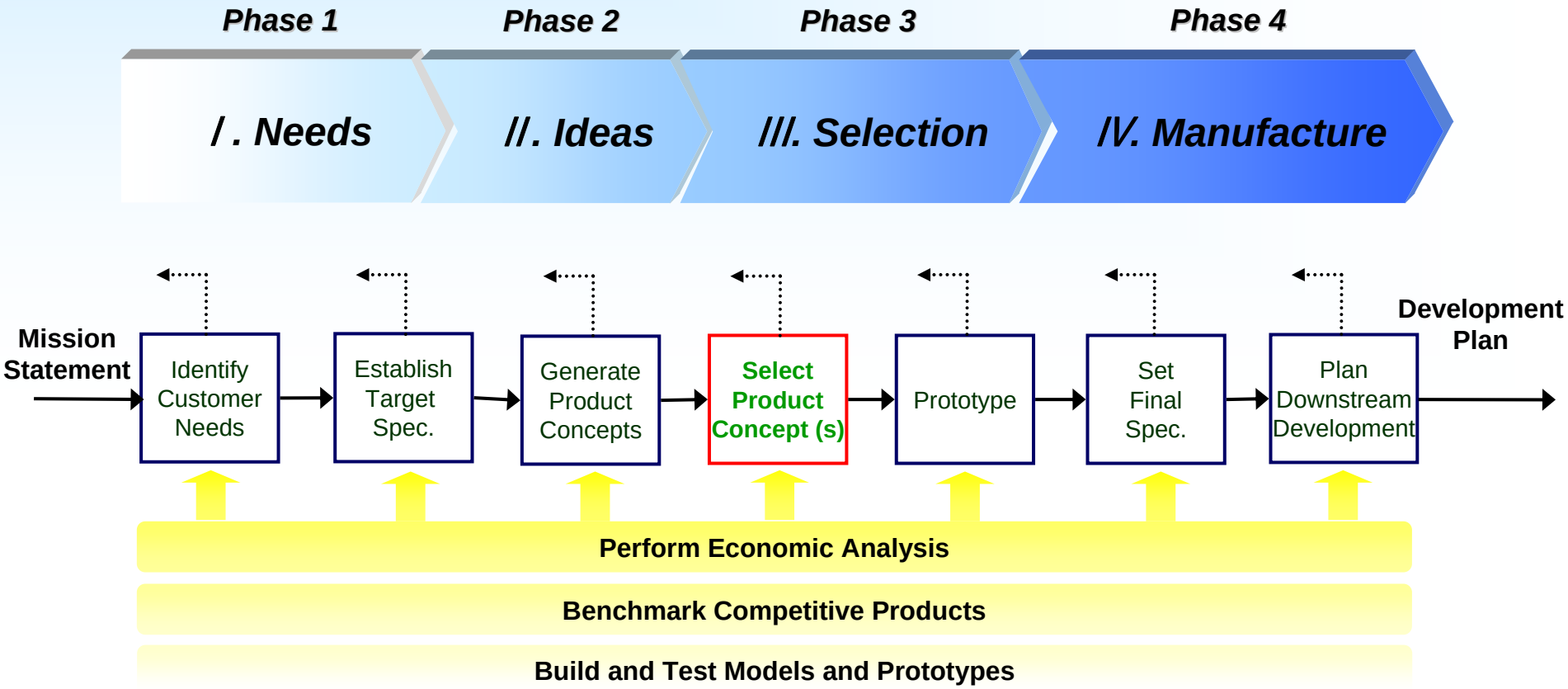


# PART VIII. Concept Selection

- Concept selection

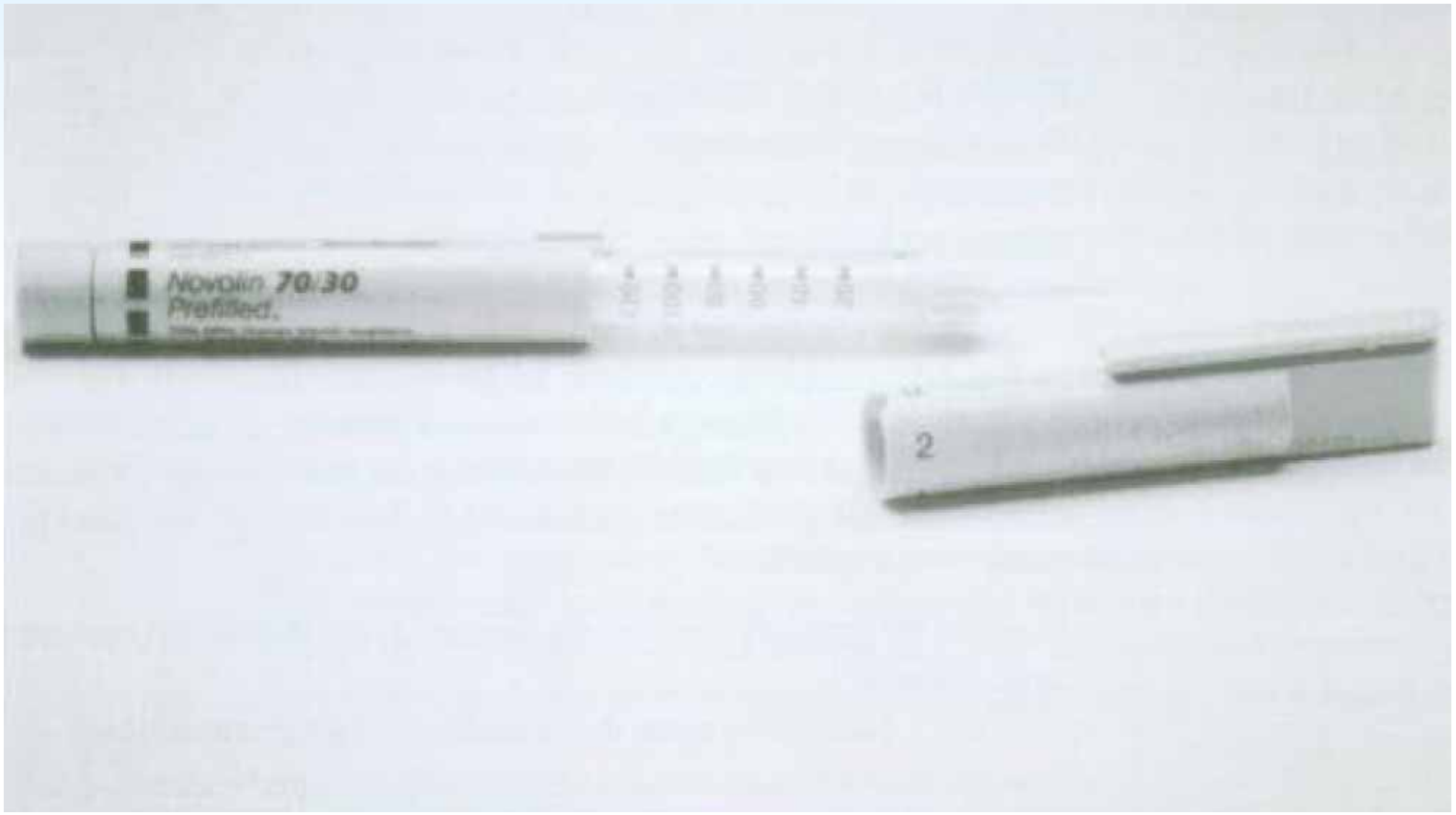
# Procedure


Phase 1
Phase 2
Phase 3
Phase 4
I. Needs
II. Ideas
III. Selection
IV. Manufacture
Mission Statement
Identify Customer Needs
Establish Target Spec.
Generate Product Concepts
Select Product Concept (s)
Prototype
Set Final Spec.
Plan Downstream Development
Development Plan
Perform Economic Analysis
Benchmark Competitive Products
Build and Test Models and Prototypes

# Concept Selection Process

- **Prepare the Matrix**
  - Criteria
  - Reference Concept
  - Weightings
- **Rate Concepts**
  - Scale (+, -,  0) or (1 - 5)
  - Compare to Reference Concept or Values
- **Rank Concepts**
  - Sum Weighted Scores
- **Combine and Improve**
  - Remove Bad Features
  - Combine Good Qualities
- **Select Best Concept**
  - May Be More than One
  - Beware of Average Concepts
- **Reflect on the Process**
  -Continuous Improvement

# Example: Reusable Syringe



# Example: Reusable Syringe

## Concept Screening

| Selection Criteria | Concept Variants A | B | C | D | E | F | G | Ref. |
|---|---|---|---|---|---|---|---|---|
| **Ease of Handling** | **0** | **0** | **-** | **0** | **0** | **-** | **-** | **0** |
| **Ease of Use** | **0** | **-** | **-** | **0** | **0** | **+** | **0** | **0** |
| **Number Readability** | **0** | **0** | **+** | **0** | **+** | **0** | **+** | **0** |
| **Dose Metering** | **+** | **+** | **+** | **+** | **+** | **0** | **+** | **0** |
| **Load Handling** | **0** | **0** | **0** | **0** | **0** | **+** | **0** | **0** |
| **Manufacturing Ease** | **+** | **-** | **-** | **0** | **0** | **-** | **0** | **0** |
| **Portability** | **+** | **+** | **-** | **-** | **0** | **-** | **-** | **0** |
| PLUSES | **3** | **2** | **2** | **1** | **2** | **2** | **2** | |
| SAMES | **4** | **3** | **1** | **5** | **5** | **2** | **3** | |
| MINUSES | **0** | **2** | **4** | **1** | **0** | **3** | **2** | |
| NET | **3** | **0** | **-2** | **0** | **2** | **-1** | **0** | |
| RANK | **1** | **3** | **7** | **5** | **2** | **6** | **4** | |
| CONTINUE ? | Yes | Yes | No | No | Yes | No | Yes | |

# Example: Reusable Syringe

## Concept Screening

| | | Concepts | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | A (reference) Master Cylinder | | DF Lever Stop | | E Swash Ring | | G+ Dial Screw+ | |
| **Selection Criteria** | Weight | Rating | Weighted Score | Rating | Weighted Score | Rating | Weighted Score | Rating | Weighted Score |
| Ease of Handling | 5% | **3** | 0.15 | 3 | 0.15 | 4 | 0.2 | 4 | 0.2 |
| Ease of Use | 15% | **3** | 0.45 | 4 | 0.6 | 4 | 0.6 | 3 | 0.45 |
| Readability of Settings | 10% | 2 | 0.2 | **3** | 0.3 | 5 | 0.5 | 5 | 0.5 |
| Dose Metering Accuracy | 25% | **3** | 0.75 | 3 | 0.75 | 2 | 0.5 | 3 | 0.75 |
| Durability | 15% | 2 | 0.3 | 5 | 0.75 | 4 | 0.6 | **3** | 0.45 |
| Ease of Manufacture | 20% | **3** | 0.6 | 3 | 0.6 | 2 | 0.4 | 2 | 0.4 |
| Portability | 10% | **3** | 0.3 | 3 | 0.3 | 3 | 0.3 | 3 | 0.3 |
| | Total Score | 2.75 | | 3.45 | | 3.10 | | 3.05 | |
| | Rank | 4 | | 1 | | 2 | | 3 | |
| | Continue? | No | | Develop | | No | | No | |

# Strategies for Concept (Idea) Screening

- **Subjective**
  - Ex) “safe” or “more wearable”
- **Objective**
  - Ex) Filter life time or battery capacity
- **A more effective strategy – grade ideas using**

***- Scientific maturity***

Prefer designs based on scientific knowledge that we already have and understand

***- Engineering ease***

Prefer designs that imply straightforward engineering like that already used in established manufacturing

***- Minimum risk***

Don’t want to take unnecessary chances. At least, we want to know what our chances of success are

***- Low cost***

May want a rough estimate of the relative cost of our concepts (ideas).

***- Safety***

Want to identify which products are inherently safer or more dangerous than our benchmark

***- Low environmental impact***

Will tend to choose products that causes less pollution

# Improving the Idea Screening Process

- **Choice of the Benchmark**

  - Benchmark will be an existing product with the greatest market share

  - What we expect as a new product from competitors

  - What we hope we can make as the best of the existing type of product

- **Have Different Groups Score the Ideas**

  - One obvious group are other individuals in marketing who are outside our core team

  - Another group are the lead users of current products

- **Sensitivity Analysis of the Weighting Factors**

  - Change the weighting factors within sensible limits to see

# Chemical Industry Example

## Concept Screening Matrix for Printing Chaucer's Canterbury Tales

| Selection Criteria | Weighting Factor | Illuminated Manuscript | Printed Chaucer |
|---|---|---|---|
| **Quality** | **0.4** | **5** | **1** |
| **Cost** | **0.4** | **5** | **6** |
| **Quantity** | **0.2** | **5** | **8** |
| **Total Score** | | **5** | **4.4** |

***Note*: This matrix could be one developed by William Caxton, in 1476.**

## Concept Screening Matrix for Home Oxygen Supply

| Selection Criteria | Weighting Factor | Gas Cylinders | Hollow-Fiber Membranes | PSA |
|---|---|---|---|---|
| **Convenience** | **0.4** | **5** | **8** | **8** |
| **Noise** | **0.3** | **5** | **4** | **2** |
| **Cost** | **0.3** | **5** | **7** | **7** |
| **Total Score** | | **5** | **6.5** | **5.9** |

***Note*: Both membrane and PSA score better than cylinders delivered containing oxygen. However, no single process stands out compellingly.**