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## ICT Innovation – Spring 20157

MSc in Computer Science and MEng Telecom. Engineering  
EIT Masters ITA, S&P,SDE

### Lecture 05 – Concept Development – Selection and Testing

Prof. Fabio Massacci



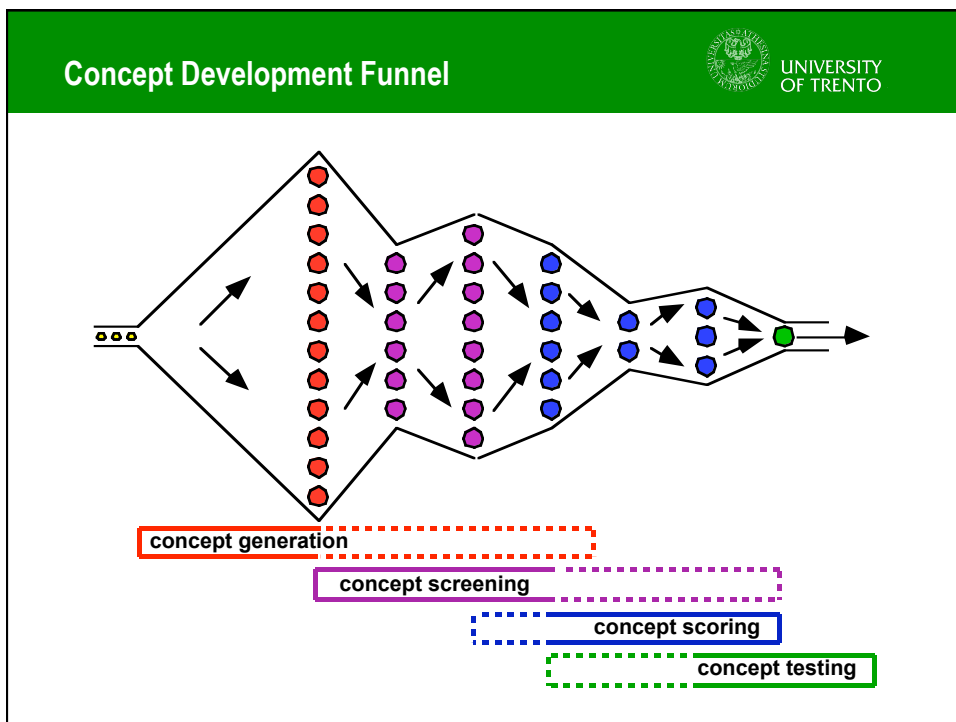
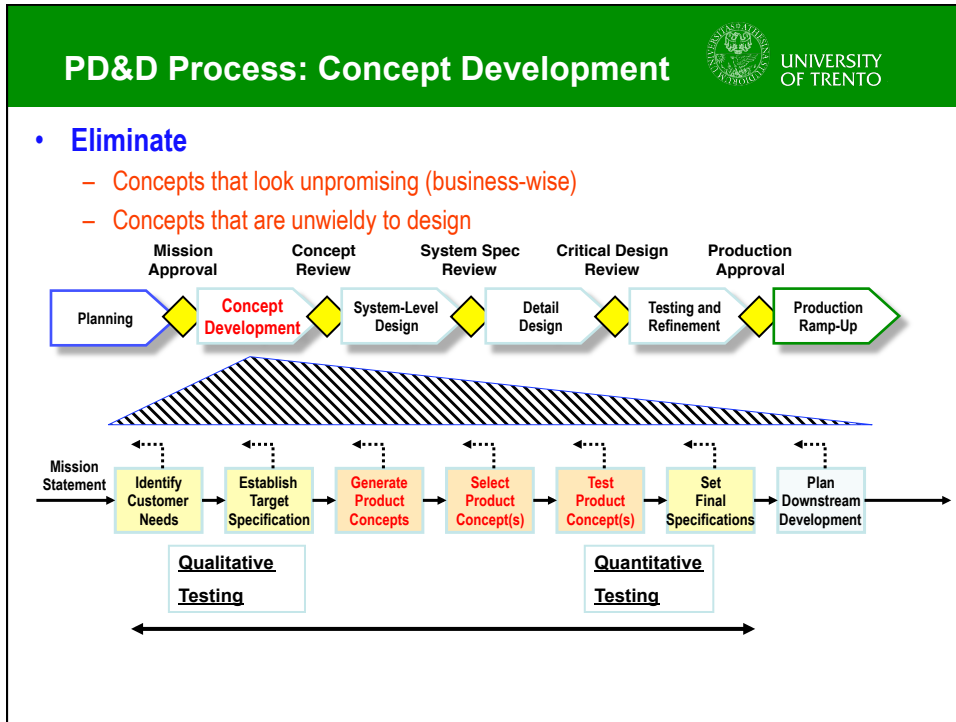
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## PD&D Process: Concept Development

- **Design**
  - Concepts that are easy to produce
  - Concepts that have a potential market

**Target Specs**  
Based on customer needs and benchmarking


**Final Specs**  
Based on selected concept, feasibility, models, testing, and trade-offs



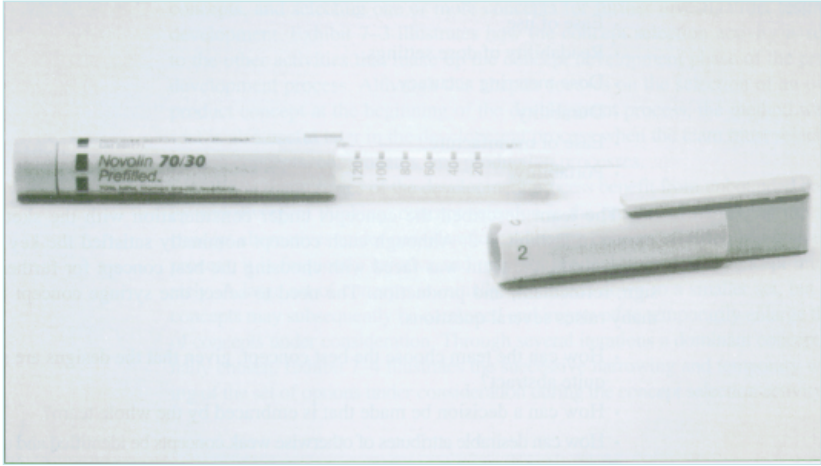

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## Concept Selection Process

- **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


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## Concept Selection Example:



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### Example: Concept Screening

SELECTION CRITERIA	CONCEPT VARIANTS							REF.
	A	B	C	D	E	F	G	
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	

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### Example: Concept Scoring

Selection Criteria	Weight	Concepts							
		A (reference) Master Cylinder		DF Lever Stop		E Swash Ring		G+ Dial Screw+	
		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	


### Concept Selection Exercise: Mechanical Pencils



### Mechanical Pencils: Customer Needs – Students Evaluation in Class




- **Easy to grip for writing - 3**
  - Comfortable in handling
- **Lightweight - 5**
- **Easy to change - 2**
- **Eraser on the back – 1 (low quality)**
- **Looks beautiful – 2-4 (man-woman difference)**
- **Different colors – Important but hard to rate**
- **Cheap - 5**
- **Button on top or side for the point?**
  - (lead you don't have to change but you consume it )
- **Clip – 4**
- **Easy to operate after dropping - 3**


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## Pen Criteria

- **Smoothness of writing --- 7**
- ~~Ink or gel~~
- **Easy of handling 8**
- **Fashionable – Instills pride - 2**
- **Writing thickness - 11**
- **Clickable - 1**
- ~~Long-lasting~~
- **Robustness, Durability 7**
- **Weight – 3**
- ~~Angle of writing~~
- ~~Level of ink visible~~
- **Ease of manufacturing -> implies cost (usually)**



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## Pens for writing


	InkJoy	SoftFeel	Pilot G-2
Smoothness of writing	+6, +	+5, -7 -	+8, -6 +
Easy to Use	+1, -8 -	+12, -1 +	+12, -1 +
Robust/Durable	+6, -3 +	+8, -12 -	+14, +
Ease of Manufacturing	+16, +	+8, +	-17 -

PLUS	3	2	3
SAME			
MINUS	1	2	1
NET	2	0	0
RANK	1	2	1

**Remember...**

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- **The goal of concept selection is not to**
  - Select the best concept.
- **The goal of concept selection is to**
  - Develop the best concept.
- **So remember to combine and refine the concepts to develop better ones!**
- **But beware of the best "average" product.**
  - Perform concept selection for each different customer group and compare results.
  - Check sensitivity of selection to relative weightings and ratings

**Usage Model is key for concept selection**

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- **Recall VHS vs Betamax main issue**
  - Betamax and VHS essentially based on similar technology
  - There is margin for improvement. Which feature to select?
- **Betamax intended usage → live videocamera recording**
  - **Small size is best**
    - you don't want to carry out heavy and unwieldy cameras
  - **Duration not so important**
    - you are not going to continuously record live stuff, can change easily tape
- **VHS intended usage → unattended TV recording**
  - **Long duration is best**
    - you don't want to go back home or wake up in middle of night to change tape
  - **Size immaterial**
    - recorder is laying together with TV set which is likely much bulkier
- **"Average" concept utterly useless**

## Concept Testing is Used for Several Purposes



- **Ok, you selected a concept, how do you test it?**
  - Ask the customers!
- **What market to be in?**
  - Benchmarking
  - Forecasting demand
- **Which feature exactly?**
  - Selecting among alternative concepts
  - Confirming concept selection decision
  - Soliciting improvement ideas
- **Ready to launch?**
  - Go/no-go decisions


## Concept Testing Process




- **Define the test**
  - Define the purpose of the test
  - Choose a survey population
  - Choose a survey format
- **Execute test**
  - Communicate the concept
  - Measure customer response
- **Interpret the results**
  - Reflect on the results and the process




**emPower Electric Scooter**




- **Purpose of concept test:**
  - What market to be in?
- **Sample population:**
  - College students who live 1-3 miles from campus
  - Factory transportation
- **Survey format:**
  - Face-to-face interviews



**Communicating the Concept**




- **Verbal description**
- **Sketch**
- **Photograph or rendering**
- **Storyboard**
- **Video**
- **Simulation**
- **Interactive multimedia**
- **Physical appearance model**
- **Working prototype**





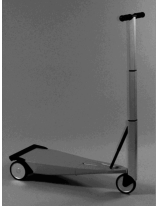


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## Verbal Description

- **What it is**
  - The product is a lightweight electric scooter that can be easily folded and taken with you inside a building or on public transportation.
- **How it works**
  - The scooter weighs about 25 pounds. It travels at speeds of up to 15 miles per hour and can go about 12 miles on a single charge.
- **Key feature**
  - The scooter can be recharged in about two hours from a standard electric outlet.
- **Key benefit**
  - The scooter is easy to ride and has simple controls — just an accelerator button and a brake.


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## Various Presentational Formats

		
<b>Sketch</b>	<b>Rendering</b>	<b>Storyboard</b>
		
<b>3D CAD Model</b>	<b>Appearance Model</b>	<b>Working Prototype</b>

Survey Format

- **PART 1, Qualification**
  - How far do you live from campus?
    - <If not 1-3 miles, thank the customer and end interview.>
  - How do you currently get to campus from home?
  - How do you currently get around campus?
- **PART 2, Product Description**
  - <Present the concept description.>
- **PART 3, Purchase Intent**
  - If the product were priced according to your expectations, how likely would you be to purchase the scooter within the next year?

I would definitely not purchase the scooter.

I would probably not purchase the scooter.

I might or might not purchase the scooter.


I would probably purchase the scooter.  
 ↑  
 “second box”

I would definitely purchase the scooter.  
 ↑  
 “top box”

Survey Format

- **PART 4, Comments**
  - What would you expect the price of the scooter to be?
    - Price point!
  - What concerns do you have about the product concept?
  - Can you make any suggestions for improving the product concept?
- **Thank you.**

**Interpreting the Results:  
Forecasting Sales**




- $Q = N \times A \times P$
- $Q$  = sales (annual)
- $N$  = Potential number of (annual) purchases
- $A$  = awareness x availability (fractions)
- $P$  = probability of purchase (surveyed)
  - $C$  = Conversion Rate “will buy” to “actually buy”
  - $F$  = Fraction of people who answered

**=  $C_{def} \times F_{definitely} + C_{prob} \times F_{probably}$**

↑  
 “top box”

↑  
 “second box”

**Forecasting Example:**



<ul style="list-style-type: none"> <li>• <b>Campus</b> <ul style="list-style-type: none"> <li>– <math>N</math> = off-campus grad students (200,000)</li> <li>– <math>A</math> = 0.2 (realistic) to 0.8 (every bike shop)</li> <li>– <math>P</math> = 0.4 x top-box + 0.2 x second-box</li> <li>– <math>Q</math> = 200,000 x 0.2 x [0.4 x 0.3 + 0.2 x 0.2]</li> </ul> </li> <li>• <b>Total sales: 6400 units/yr</b></li> <li>• <b>Price point: \$795</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Factories</b> <ul style="list-style-type: none"> <li>– <math>N</math> = current bicycle and scooter sales to factories (150,000)</li> <li>– <math>A</math> = 0.25 (single distributor’s share)</li> <li>– <math>P</math> = 0.4 x top-box + 0.2 x second-box</li> <li>– <math>Q</math> = 150,000 x 0.25 x [0.4 x 0.3 + 0.2 x 0.2]</li> </ul> </li> <li>• <b>Total sales: 6000 units/yr</b></li> <li>• <b>Price point: \$1500</b></li> </ul>
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**emPower's Market Decision: Factory Transportation**



**You also have to sell it and to make it...**



<ul style="list-style-type: none"> <li>• <b>Starting Point</b> <ul style="list-style-type: none"> <li>– Total sales: 6400 units/yr</li> <li>– Price point: \$795</li> </ul> </li> <li>• <b>Price Bites</b> <ul style="list-style-type: none"> <li>– 40-50% off Resellers                             <ul style="list-style-type: none"> <li>• Before final price</li> </ul> </li> <li>– 50% off Distributor                             <ul style="list-style-type: none"> <li>• Before retailers</li> <li>• 25% off before final price</li> </ul> </li> </ul> </li> <li>• <b>Production Costs</b> <ul style="list-style-type: none"> <li>– Margin:</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Starting Point</b> <ul style="list-style-type: none"> <li>– Total sales: 6400 units/yr</li> <li>– Price point: \$795</li> </ul> </li> <li>• <b>Price Bites</b> <ul style="list-style-type: none"> <li>– 35-45% off Distributors                             <ul style="list-style-type: none"> <li>• before final price</li> </ul> </li> </ul> </li> <li>• <b>Production Costs</b> <ul style="list-style-type: none"> <li>– Margin:</li> </ul> </li> </ul>
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Textbook

**Product Design and Development**  
 Karl T. Ulrich and Steven D. Eppinger  
 5th edition, Irwin McGraw-Hill, 2012

1. Introduction
2. Development Processes and Organizations
3. Opportunity Identification
4. Product Planning
5. Identifying Customer Needs
6. Product Specifications
- 7. Concept Generation**
- 8. Concept Selection**
- 9. Concept Testing**
10. Product Architecture
11. Industrial Design
12. Design for Environment
13. Design for Manufacturing
14. Prototyping
15. Robust Design
16. Patents and Intellectual Property
17. Product Development Economics
18. Managing Projects

KARL T. ULRICH · STEVEN D. EPPINGER