



Aalto University
School of Engineering

Methods in Early Product Development

Prof. Katja Hölttä-Otto
09.09.2020

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Agenda

Introduction

Course – basic information

Product Development – introduction



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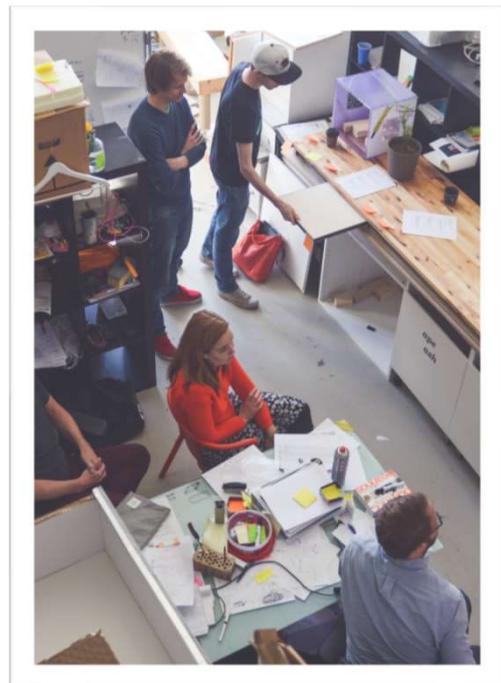
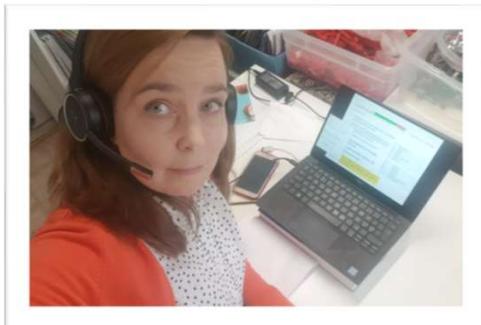
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Katja

**Teach: Product Development, ME310
Global Innovation**

**Research: Product Development methods
(Empathy, Creativity,
Prototyping, etc.)
+ Engineering education**



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Agenda

Introduction

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Product Development – introduction

Course description

This course will cover product development (including Design Thinking), the process and iterative nature of it as well as a selected methods in it. This class will be an active class with in class discussions, hands-on activities, etc. Active participation is essential part of your learning and is thus required. You will also apply the learnings immediately as part of the homework. This course directly compliments and supports other project based courses such as ME310 and PDP.

Learning objectives

After completion of the course the student:

- Understands the different product development process models and its phases
- Is able to use need finding methods
- Is able to apply user centered design methods
- Is able to apply concept design methods
- Is able to define proper requirements and constraints

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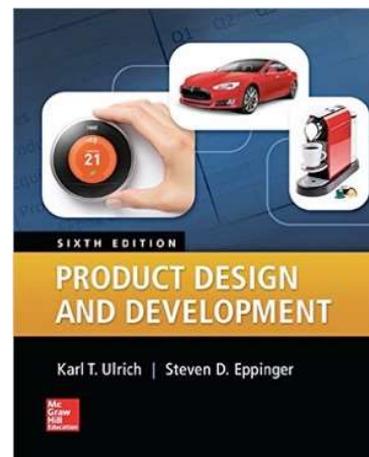
Course book & other readings

Ulrich & Eppinger: Product Design and Development, 5th edition or newer

(note: if you have an older edition, please obtain the modified and missing chapters. The 5th edition includes an important update compared to the 4th)

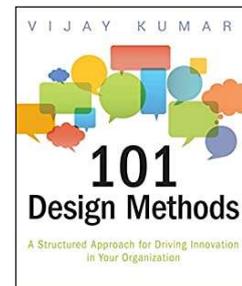
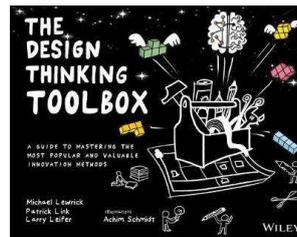
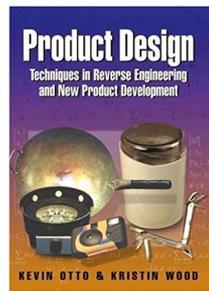
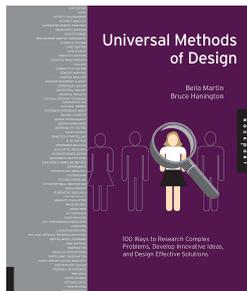
+additional readings

I will specify these separately when relevant.



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Other books/Sources I like to use and have in my bookshelf (not required course books)



https://www.thedesignexchange.org/design_methods

<https://www.designkit.org/methods>

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Assessment

The course consists of active lectures as well as individual and team assignments. **Some assignments will be graded in class only and some will be handed in for grading.** This will be specified separately for each case and applies for both individual and team assignments. The reflection journal is an all semester individual journal assignment that is **graded as a whole at the end of the term.**

- Homework 30%
- Team assignments/seminars 30%
- Reflection Journal 30%
- Participation 10%

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Assessment

COVID UPDATE

The course consists of active lectures as well as individual and team assignments. **Some assignments will be graded pass/fail and some 0-100%.** This will be **specified separately for each case** and applies for both individual and team assignments. The **reflection journal** is an all semester individual journal assignment that is **graded as a whole at the end of the term.**

- Individual homework 40%
- Team assignments/seminar 30%
- Reflection Journal 30%

I expect everything to be handed in time, if you need an extension, ask early and you are likely to get it. Also, if you are ill, just let me know and hand in once you are well again.

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Virtual tools used*

Zoom for live classes



Miro for in-class collaborative work

Miro for in-class questions/comments



MyCourses Discussion board for course related questions & announcements

MyCourses for course material

MyCourses for Assignment submission



AI Aalto-yliopisto
Aalto-universitetet
Aalto University **MyCourses**



Email for personal contact with Katja

*Subject to change as we learn what works and does not work well

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Zoom:



<https://aalto.zoom.us/j/66476505051?pwd=Uks1Q3hEd2VtZSszRUZnNIRxWkVIUT09>

Meeting ID: 664 7650 5051

Passcode: 518838

One tap mobile

+358341092129,,66476505051# Finland

+358942451488,,66476505051# Finland

Dial by your location

+358 3 4109 2129 Finland

+358 9 4245 1488 Finland

+358 9 7252 2471 Finland

Meeting ID: 664 7650 5051

Find your local number: <https://aalto.zoom.us/j/66476505051?pwd=Uks1Q3hEd2VtZSszRUZnNIRxWkVIUT09>

Join by SIP

66476505051@109.105.112.236

66476505051@109.105.112.235

Join by H.323

109.105.112.236

109.105.112.235

Meeting ID: 664 7650 5051

Passcode: 518838



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Miro

If you do not have an education account, get one. It is free.
Use your Aalto address.

https://miro.com/app/board/o9J_ktflo2k=



My Courses



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MyCourses

<https://mycourses.aalto.fi/course/view.php?id=29522>

Email katja.holtt-otto@aalto.fi



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Schedule

Date	Mode	Topic	Chapter	
Wed	9.9.	Live	Introduction - what is Product Development?	1+2
Fri	11.9.		Opportunity Identification & Mission Statement	3 (+4)
Wed	16.9.	Live	Opportunities & Identifying customer needs	5 +11
Fri	18.9.		Identifying customer needs continued	5
Wed	23.9.	Live	Interpreting and Organizing customer needs	5
Fri	25.9.		Product Specifications	6
Wed	30.10.	Live	Specifications continued + Concept generation	6+7
Fri	2.10.		Concept generation	7
Wed	7.10.	Live	Concept Selection	8 (+11)
Fri	9.10.		Concept Testing	9
Wed	14.10.		Winds of Change	
Fri	16.10.		Winds of Change	



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Schedule and Learning Outcomes

Date	Topic
Wed	9.9. Introduction - what is Product Development?
Fri	11.9. Opportunity Identification & Mission Stmtnt
Wed	16.9. Opportunities & Identifying customer needs
Fri	18.9. Identifying customer needs continued
Wed	23.9. Interpreting and Organizing customer needs
Fri	25.9. Product Specifications
Wed	30.10. Specifications continued + Concept generation
Fri	2.10. Concept generation
Wed	7.10. Concept Selection
Fri	9.10. Concept Testing
Wed	14.10. Winds of Change
Fri	16.10. Winds of Change

Learning objectives:

- Understands the different product development process models and its phases
- Is able to use need finding methods
- Is able to apply user centered design methods
- Is able to apply concept design methods
- Is able to define proper requirements and constraints

You choose your own objective, and learn from your peers



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Schedule with homework estimation (subject to change)

Date	Mode	Topic	Chapter	Homework
Wed	9.9.	Live	Introduction - what is Product Development?	1+2 (Launch Journal (Indiv. Graded) assignment)
Fri	11.9.		Opportunity Identification & Mission Statement	3 (+4) Indiv. Pass/Fail
Wed	16.9.	Live	Opportunities & Identifying customer needs	5 +11
Fri	18.9.		Identifying customer needs continued	5 Individual, graded
Wed	23.9.	Live	Interpreting and Organizing customer needs	5
Fri	25.9.		Product Specifications	6 Team, Pass/Fail
Wed	30.10	Live	Specifications continued + Concept generation	6+7 (Seminar (Team, graded) launch)
Fri	2.10.		Concept generation	7 Individual, Pass/Fail
Wed	7.10.	Live	Concept Selection	8 (+11)
Fri	9.10.		Concept Testing	9 Individual, Graded
Wed	14.10		Winds of Change	
Fri	16.10		Winds of Change	(Journal is due)



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Journal – on going assignment

The journal is an **ongoing assignment** that culminates in a **reflection essay assignment at the end** of the class and replaces the exam.

It is a collection of all your homework and possible other notes you may wish to add along the term. It may be digital or in a physical notebook. Leave a wide margin or space on all pages for notes, insights and learnings. The journal reflection assignment at the end will be based on these notes etc. in the margin. You should add the insights and notes at any time – as you write the assignment, afterwards when covering a new topic and you see a link between the topics, or perhaps when you wake up in the middle of the night with an idea! The instructions for the essay are given later. Due Monday 19.10, 9am (you may return it earlier).

Write notes here

Do your homework assignments in this space. Glue/Paste in if needed.

Date all entries

Leave a wide margin. Write insights, learnings and other notes here.

Date all entries

Thought
p. 20.
020

Sticky notes is another option for notes



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Task 1 – warm up & Miro test

Why did you choose this class?

Let's all join the class Miro board (MEPD) and write there why You are taking this class.



https://miro.com/app/board/o9J_ktflo2k=/

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Introduction

Course – basic information

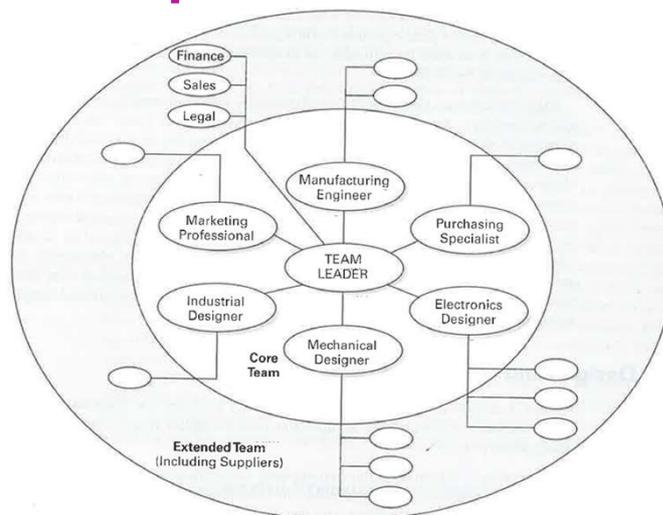
Product Development – introduction

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What is Product Development?

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Who Develops Products?



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Product Development and Quality

ISO 9001 is the international standard for Quality Management Systems (QMS), published by ISO (the International Organization for Standardization). In order to be released and updated, ISO 9001 had to be agreed upon by a majority of member countries so that it would become an internationally recognized standard, which means it is accepted by a majority of countries worldwide. www.iso.org



ISO 9001 process

Design and Development Planning	A process and review including who is responsible for what tasks
Design Inputs	Gathering needs and requirements from all the stakeholders including government or industry mandated regulations
Design and Development Outputs	These are the documents (drawings files etc.) that define the design, and can be whatever you want to use to define it
Design and Development Review	Regular reviews to make sure that the process is working properly that the design requirements will be met
Design & Development Verification	Verification is usually part of the design reviews. Verification takes the design outputs (drawings, build instructions, test instructions, etc) and ensures that every requirement from the design inputs is included.
Design and Development Validation	Validation is when you build the first product and test to make sure that it meets all the requirements, and intended use
Control of Design and Development Changes	Ensuring changes are tracked and their impact to the rest of the system in taken into the account.



“What product do you develop ?”

The methods we cover apply to all types of products (and often services, it is about the process.

	Stanley Tools Jobmaster Screwdriver	Rollerblade In-Line Skate	Hewlett-Packard DeskJet Printer	Volkswagen New Beetle Automobile	Boeing 777 Airplane
Annual production volume	100,000 units/year	100,000 units/year	4 million units/year	100,000 units/year	50 units/year
Sales lifetime	40 years	3 years	2 years	6 years	30 years
Sales price	\$5	\$150	\$130	\$20,000	\$260 million
Number of unique parts (part numbers)	3 parts	35 parts	200 parts	10,000 parts	130,000 parts
Development time	1 year	2 years	1.5 years	3.5 years	4,5 years
Internal development team (peak size)	3 people	5 people	100 people	800 people	6,800 people
External development team (peak size)	3 people	10 people	75 people	800 people	10,000 people
Development cost	\$150,000	\$750,000	\$50 million	\$400 million	\$3 billion
Production investment	\$150,000	\$1 million	\$25 million	\$500 million	\$3 billion

EXHIBIT 1-3 Attributes of five products and their associated development efforts. All figures are approximate, based on publicly available information and company sources.

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4 types of Product Development Projects

1. Fundamentally new products
2. Incremental improvements to existing products
3. Derivatives of existing product platform
 - Product Family – Generation
 - Product Family - Variants
4. New Product Platform




VW Passat 2020



2019



2018



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2000



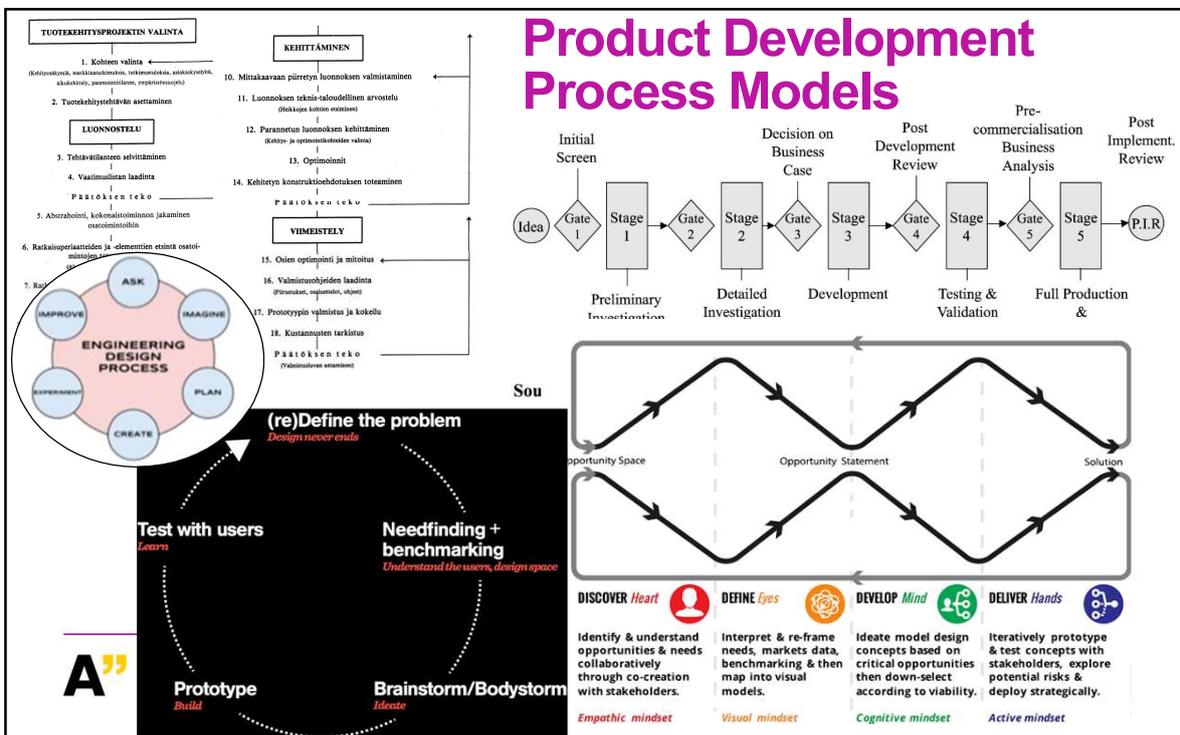


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Product Development Processes at companies

See public example here:

ABB process focuses on the gates, what you need to report in each:

<https://slideplayer.com/slide/3372775/>

GE Healthcare innovation process (not for incremental product development):

<https://www.slideshare.net/sherbrookeinnopole/sils-2015-innovation-at-ge-healthcare>

How KONE links customer centeredness into their strategy:

https://www.slideshare.net/Solita_Oy/case-kone-uusi-asiakashtinen-strategia-ja-case-cx-lab

Related to next lecture on Opportunities, see 3M innovation process:

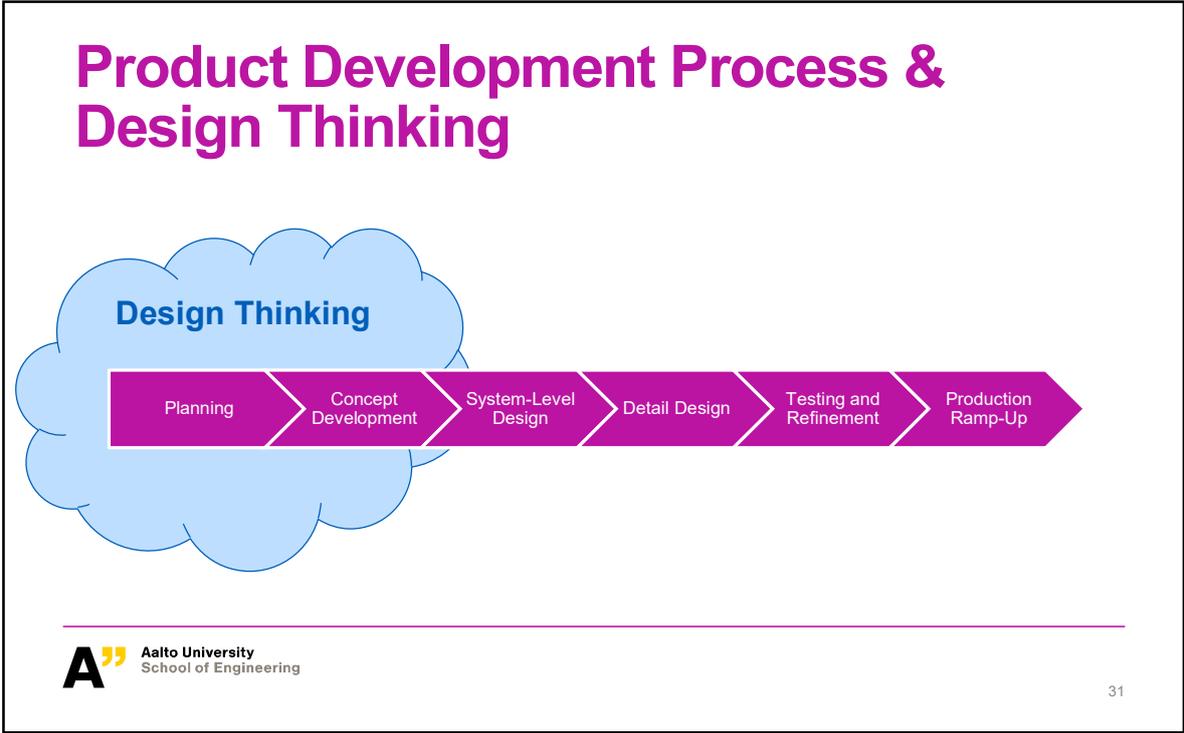
<https://www.slideshare.net/castillozavala/3-m-presentation-roberto-andrs-castillo-zavala>

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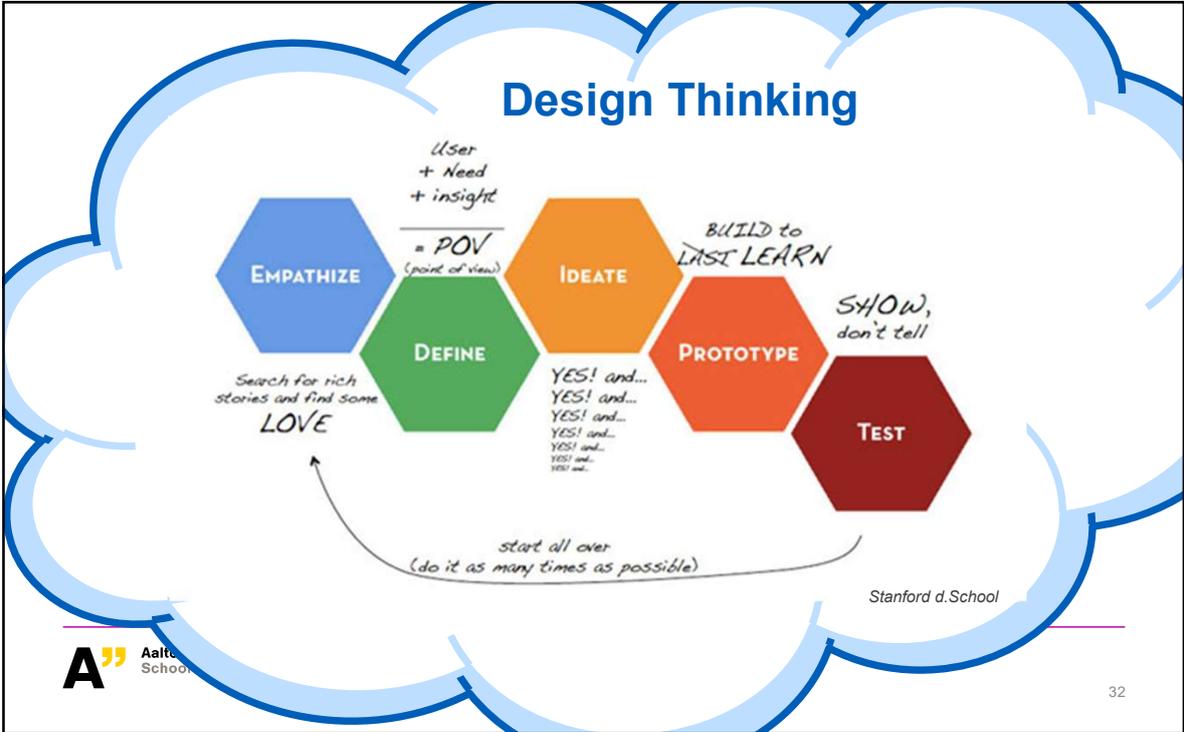
Product Development Process



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Methods in Early Product Development

Design Thinking

Planning

Concept Development

System-Level Design

Detail Design

Testing and Refinement

Production Ramp-Up

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Relation to the other Product Development courses

Design Thinking

Planning

Concept Development

System-Level Design

Detail Design

Testing and Refinement

Production Ramp-Up

MEC E3001 Product Development Project PDP

MEC E3003 System Engineering

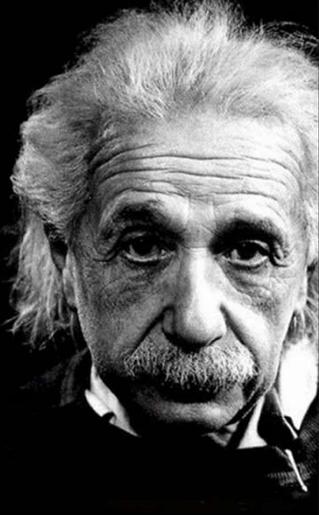
ME310 Global Innovation Program / IDBM

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"If I had only one hour to save the world, I would spend fifty-five minutes defining the problem, and only five minutes finding the solution."

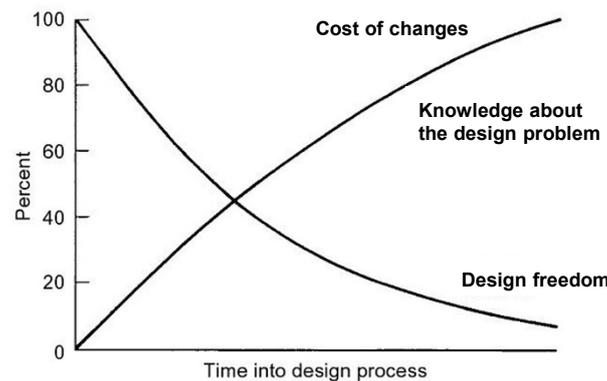


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The design process paradox



Time into design process	Cost of changes (%)	Knowledge about the design problem (%)	Design freedom (%)
0	0	0	100
50	50	50	50
100	100	100	0

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Ullman 2003

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Methods in Early Product Development



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Activities in Product Development Process

Planning	Concept Development	System-Level Design	Detail Design	Testing and Refinement	Production Ramp-Up
Identify opportunities	Identify user needs	Establish system arch.	Define part geometry	Performance testing	Customer testing
Benchmarking	Prioritize user needs	Plan product family	Choose materials	User testing	Eval production output
Resource allocation	Establish target specifications	Primary component design	Assign tolerances	Regulatory approvals	Begin full production
Identify production & supply chain strategy	Testing of experimental prototypes	Perform make-buy analysis	Tooling design	Refine quality assurance process	Post project review
	User testing	Identify service issues	Develop marketing plan	Supplier ramp-up	
	Economic analysis	Production plan		Develop sales plan	

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In-class assignment

In breakout rooms, read the given text and list all the skills and areas of knowledge that are useful for a good product developer



Source: BCC Research
March 29, 2018 09:00 ET

Global Rainwater Harvesting Technology Market to Reach \$1.5 Billion by 2022

Growth Will Be Steady for Both Rooftop and Land-based Capturing Systems

WELLESLEY, Mass., March 29, 2018 (GLOBE NEWSWIRE) -- With applications ranging from landscape use, livestock watering, in-home use, and the prevention of soil erosion, the outlook for rainwater harvesting technologies is bright, according to a report by **BCC Research**.

The global market for water capture and use specially absorption applications was valued at \$1.1 billion in 2016 and forecast to grow by a compound annual growth rate (CAGR) of 5.3% through 2022, when it will be worth an estimated \$1.5 billion, according to the report [Rainwater Harvesting Technologies, Global Markets to 2022](#).

Major players in the market include 21st Century Enviro Engineers, Adept Water Technologies, Bam Plastics, Caldwell Tanks, Davey Water Products, Ecozi, Farmland Rainwater Harvesting Systems, Global Environmental Management Services, Harvest H2O, Interpump, Jen Construction Materials, Kershaw Group, Lakota Water, M2 Water Solutions, Natural Systems International, Oasis Water Harvesting, Pacific Aquascape, Raincatcher Products & Services, Sage Water Solutions, Tigerflow Systems and UV Pure Technologies.

Research Highlights

- The market has two segments: the basic equipment used in harvesting and the process of erecting, commissioning, servicing and maintaining that equipment. The equipment segment is expecting a CAGR through 2022 of 5.1% and a projected value of \$1.3 billion. The maintenance and planning segment is expecting a CAGR of 6.2% and a 2022 value of \$205 million.
- Rainwater collection has been employed for centuries. Other water harvesting methods used today include stormwater, gray water, groundwater and condensate capture. There are passive capture methods, such as vegetated swales, and active methods, such as gray water capture and filtration.
- Rainwater harvesting is practiced worldwide. Rooftop-based rainwater harvesting systems anticipate a CAGR of 5.4% through 2022 with an expected value of \$982 million. Land-based rainwater harvesting systems anticipate a 4.9% CAGR through 2022 and an anticipated value of \$513 million.

"Inefficient water management and improper re-use of water are two major reasons for water scarcity in many parts of the world," said BCC Research analyst and report author Srinivasa Rajaram. "Rainwater harvesting is an easy and affordable solution to overcome such water stress and it acts as an important alternative as a decentralized water source. This type of alternative water source also helps in reducing the use of fresh water from surface and groundwater sources."

In the United States, Governments Pitch In With Incentives

A number of states in the U.S. offer incentives designed to encourage rainwater harvesting. In and Arizona, a one-time 25% tax credit is available to offset the cost of a water conservation system. In drought-affected California, there are tax breaks for backyard rainwater capture systems and a proposal to exclude rainwater capture systems from property tax assessments. In Santa Fe, N.M., rainwater catchment is a requirement for new dwellings. Other incentives are offered in Texas, Ohio, Oklahoma, and the Virgin Islands.

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