MGMT 579 – Sustainable Product Design and Development
Summer 2014

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Office: Paccar 558
Phone: 206-234-6498

Hours: by appointment
Email: aguschin@uw.edu

Class Meeting Dates and Time:
July 21 - August 25, Monday & Wednesday, 18:00-21:30

Course Description:
Today, to be competitive in the global economy, a company needs to master product design and development, and do it fast and at a reasonable cost, while satisfying ever-increasing demands of customers. A company also needs to pay attention to sustainability; this is a current market trend. After graduation, most Foster MBAs will be working at large product companies and this course will arm you with practical knowledge and will help to advance your career. You will learn modern tools and methods, including SolidWorks and 3D printing. Our focus is on integration of the marketing, design, industrial engineering, operations and manufacturing functions of the firm in creating new products. Topics include identifying customer needs, concept generation, industrial design and design for manufacturability and environment. Offered in cooperation with the MIT Sloan course Product Design and Development.

Course Objectives:
Upon successful completion of this course you will:
- Improve confidence in your abilities to create a new product
- Build competence with a set of tools and methods for PDD
- Build awareness of the role of multiple functions in creating a new product
- Improve ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective
- Enhance team working skills

Types of Learning:
- Project-based; Hands-on exercises; Case studies; Team presentations; Guest speakers; Company visits
- We will utilize the UW Mechanical Engineering SolidWorks Lab and 3D printing machine shop
Readings:
- Required Textbook: Ulrich and Eppinger, *Product Design and Development*, 5th, 4th or 3rd editions. All chapters are from this book.
- Selected articles and cases

Grading:
- Class participation: 30%
- Individual project proposal: 10%
- Team assignments: 30%
- Final team project presentation to judges 30%

Class Attendance
Class attendance is critical to participation in the learning experience and is required aside from circumstances related to (1) illness or (2) a critical work event with your sponsoring employer that cannot be rescheduled. If you are not able to attend a particular class session, please email me in advance. Regardless of the rationale, please note that you are responsible for the learning experience that takes place in your absence; please work within your MBA Team to address any material you may have missed.

Professionalism
Each student is expected to be fully engaged in class content and respectful of fellow students’ and your instructor’s attempts to do the same. During class discussions you should be willing to support your point of view and—at the same time—be willing to listen hard to what others have to say, even when their view differs from yours. You are encouraged to consider the impact of comments that may be distracting from the class such that each comment you offer potentially adds value to the overall dialogue in each class and over the entire quarter.

While you are free to use technologies that are directly related to class (e.g., a notebook computer for note taking or accessing a supporting Excel file or web page), please otherwise refrain from use of computer, phone, PDA, and similar technologies during class, other than use that would facilitate the purpose or objectives of the class. Use of technology other than for engaging in the activities associated with the class is distracting for you, your fellow students, and your instructor. Please also note that participation grades are based on quality of participation in class; high quality participation requires all of your attention and focus during class time.

Academic Integrity
I employ the principles and procedures espoused by the University of Washington Student Conduct Code to maintain academic integrity in the course. The Code establishes the expectation that students will practice high standards of professional honesty and integrity. In particular, implementation of the Code at the Foster School of Business prohibits cheating, attempted cheating, and plagiarism—including improper citations of source material—as it pertains to academic work. If you are unclear about how the Code applies to assignments for this course, for example, what kind of assistance is permissible for homework, whether you
may study with classmates for an exam, how to cite source material gather from the internet, etc., please ask for clarification. Suspected violations will be handled in compliance with the University of Washington Student Conduct Code (http://www.washington.edu/students/handbook/conduct.html) as outlined in Washington Administrative Code 478-120.

**Team Projects:**
You will work in teams and your challenge is to design and, ideally, produce a prototype of a physical product that can be easily manufactured. For team projects, you are encouraged to propose project ideas focusing on sustainable design, addressing green living, global health and global development.

**Project Guidelines:**
You are strongly encouraged to choose a project satisfying the following constraints:
- There should be a demonstrable market for the product.
- The product should have a high likelihood of containing fewer than 10 parts.
- The product should require no basic technological breakthroughs.
- You should validate your product with more than five potential users (more than 20 would be better).

Examples of past projects are available on Canvas.

**Project Hints:**
- Save any highly proprietary ideas for another context.
- Most successful projects tend to have at least one team member with strong personal interest in the target market.
- It is great to have a connection to a commercial venture that may be interested in the product.
- Most products are really not very well designed. The experience in this class is that if you pick almost any product satisfying the above project guidelines, you will be able to develop a product that is superior to everything currently on the market. A book titled *The Design of Everyday Things* by Donald A. Norman (Doubleday, 1990) discusses good and bad examples and provides principles and guidelines for good design.
- Just because you have used a lousy product doesn’t mean that a better one doesn’t exist. Do some thorough research to identify competitive products and solutions.

**COURSE ASSIGNMENTS**

**Individual Project Proposal**
This is the only individual assignment for this class. Exercises 2 and 3 in Chapter *Identifying Customer Needs* can serve as a starting point for project proposals. Sample proposals are available on Canvas.
Prepare a project proposal in any format that fits on one 8.5x11 page (one side only). We will photocopy the proposals and distribute them in class #2. Proposals should include:

- A brief, descriptive project title (2-4 words).
- Your name, phone number, and email.
- The 3 nearest competitors (existing solutions) and price.
- A description of the product opportunity you have identified. Your description should include: market need, shortcomings of existing competitive products, and definition of the target market and its size.
- Please do not present any of your own product ideas or solutions at this point; our strict focus in this phase of the course is on the market opportunity and not on solution concepts.

Prepare a 1-min presentation. It should include:

- A verbal or visual demonstration of the product opportunity you have described in your proposal. Given that the audience will be able to read your proposal at their leisure, you might spend your time explaining the richness of the market opportunity and demonstrating the existing competitive products.
- Convincing arguments why your classmates should vote for your product proposal.
- Any special skills or assets you have (marketing expertise, access to a shop, materials, electronics wizardry, etc.)

Note that the 1-min time constraint will be strictly enforced. After presentations, you will vote for the top project ideas. Teams will be formed to work on these projects.

All team assignments must be handed in at the beginning of the class session in which they are due. The assignments are intended to pace the development process for your product. Since there is no slack in this schedule the assignments must be completed on or before the scheduled due date in order to maintain the project schedule. Please adhere to the following guidelines for your team assignments:

- Be concise. Most assignments can be completed in a few pages. One exception to this guideline is concept sketches, which should be formatted with one concept per page.
- Combine all your work in one PowerPoint® file. (Teams would be asked to give ad hoc presentations of their homework to exhibit best practices and pitfalls).

Sample team assignments are available on Canvas.

Assignment 1: Assess the Product Opportunity Potential

- Follow the Real-Win-Worth-it framework (Chapter: Opportunity Identification), prepare a 3-min presentation. Your presentation should include three slides: 1) Market need—is it real? 2) Existing competitive products – can you win? 3) Market potential – is it worth it? Note that the 3-min time constraint will be strictly enforced.
Assignment 2: Mission Statement and Customer Needs List  
**Due class 3**
- Write a mission statement for your project team as described in Chapter Product Planning.
- Based on customer interviews and/or surveys, develop an organized list of customer needs for your product as described in Chapter Identifying Customer Needs.
- Identify competitive products and list strengths and weaknesses of each.

Assignment 3: Concepts, Target Specs and Patent Review  
**Due class 5**
- Every team member to prepare several sketches and bullet-point descriptions of alternative concepts for your product. For each sketch, note which of the important customer needs it addresses and which it does not.
- Choose three critical customer needs from your list and prepare a list of the target specifications as defined in Chapter Product Specifications. Provide justification to support these targets.
- Perform a preliminary patent searching to identify patents most closely related to your product idea. Briefly describe the 3 closest matches. Explain what you have learned from the search and how this might affect your approach to further development. You may research patent information at [www.uspto.gov](http://www.uspto.gov) or [www.google.com/patents](http://www.google.com/patents).

Assignment 4: Final Concept Selection and Models  
**Due class 7**
- Use and show a concept selection matrix (screening or scoring) to select at most three concepts for further consideration.
- Show some physical models for these top product concepts.
- Decide on a single concept and be prepared to explain your choice.
- Prepare a list of the key uncertainties or questions you still need to address to determine the viability of your product. For each one, specify an associated plan of action (such as analysis, mock ups, interviews, experiments, etc.).

Assignment 5: Life Cycle Assessment  
**Due class 8**
- Assess the environmental impact of your product and compare to competing products. Identify the sources of the greatest impacts and ways to potentially reduce them.

Assignment 6: Final Specs and 3D CAD Model  
**Due class 9**
- Create an updated one-page description and sketch of your product concept.
- Prepare a 3D CAD assembly drawing of the alpha prototype you intend to build. An assembly drawing shows all the parts in their assembled positions.
- Identify the critical-to-function (CTF) specs and include documentation showing how you arrived at these CTFs.
- Include a bill of materials indicating whether the prototype parts will be purchased or fabricated and a description of the assembly process. Indicate the material and fabrication process you have selected for each prototype part.
- List the web resources and vendors you have found to be helpful.
- Make a drawing or sketch of the production version of the product. Describe the differences between the prototype you will build and the production product. Briefly explain how the production product would be manufactured.
• Describe your prototyping plans.

**Assignment 7: Final Presentation and Demo to Judges**  
**Due Mon, August 25**

Prepare a 15-minute presentation describing and demonstrating your product. Your presentation should mainly concentrate on the product itself, although you may wish to emphasize any particularly impressive portions of your development process. Also include:

- Market need and competitive products
- Financial model (as described in Chapter *Product Development Economics*). Explain the scenario you are analyzing (startup activity, established manufacturer, etc.).
- Life Cycle Analysis

An effective presentation includes color photographs or video presentation along with a live display of the hardware. This presentation should be of the quality you would make to convince a top management group to purchase the rights to your product or to fund its final development and launch. Be prepared to answer questions about all aspects of your project.

**COURSE SCHEDULE**

<table>
<thead>
<tr>
<th>Class/Date</th>
<th>Topics/Readings</th>
<th>Assignment Due</th>
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| Before Class 1 | In order to reduce your workload during the course, please review the following materials before the first class:  
5. Gates Foundation target project areas (Global Development and Global Health): [http://www.gatesfoundation.org/What-We-Do](http://www.gatesfoundation.org/What-We-Do)  
6. See the RedDot Product Design winners: [http://red-dot.de/pd/online-exhibition/?lang=en&c=0&a=0&y=2012&i=0&oes=%20](http://red-dot.de/pd/online-exhibition/?lang=en&c=0&a=0&y=2012&i=0&oes=%20)  
7. IDEO Social Innovation projects: [http://ideo.org/projects](http://ideo.org/projects)  
| Class 1 Mon, 7/21 | Introduction and Team Project  
• Read the course syllabus |   |
### Class 2
**Wed, 7/23**

- **Customer Needs**
  - Read Chapter: Identifying Customer Needs
  - [Optional] Read the BusinessWeek article Lego is for Girls (Dec 2011)

**Case 9-695-026: Sweetwater**
Assignment questions:
1. What do you consider to be the most important needs associated with water purification devices such as the Sweetwater Guardian? Get information from wilderness enthusiasts and find out what they think.
2. How do competitors’ products meet those needs?
3. How Sweetwater’s product should address those needs?

### Class 3
**Mon, 7/28**

- **Product Specifications**
  - Read Chapter: Product Specifications (complete Exercise 1 and be prepared to discuss the Questions)

**Case 9-692-044: Honda Today**
Assignment questions:
1. How would you characterize Honda’s approach to PD?
2. What should Kamimura do to increase engine volume?
3. What do you think Honda’s competitors will do?

### Class 4
**Wed, 7/30**

- **Concept Generation**
  - Read Chapter: Concept Generation (prepared to discuss Questions 1-2)

**Case 9-994-023: Apple PowerBook: Design Quality and Time to Market**
Assignment questions:
1. What challenges did Apple face in the fall of 1989?
2. How would you characterize Apple’s approach to PD?
3. What factors led to the PowerBook’s success? What are the reasons it shouldn’t have succeeded?
4. What role did design play in its success?
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<tr>
<th>Class 5</th>
<th>Mon, 8/4</th>
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<tr>
<td><strong>SolidWorks and Prototyping</strong></td>
<td>5. What did Apple learn from this project?</td>
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<td>- Tour of the UW Rapid Prototyping Lab, presentation by UW Mechanical Engineering and SolidWorks team exercise</td>
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<td>- Read Chapter: Prototyping (be prepared to discuss the Questions)</td>
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<th>Wed, 8/6</th>
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<tr>
<td><strong>Concept Selection and Testing</strong></td>
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<tr>
<td>- Read Chapter: Concept Selection (complete Exercise 1 &amp; 2 + be prepared to discuss the Questions)</td>
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<tr>
<td>- Read Chapter: Concept Testing (be prepared to discuss Questions 1 &amp; 2)</td>
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<td>- [Optional] Read Technology Readiness Levels by Mankins (NASA, 1995)</td>
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<td><strong>Case 9-697-040: Team New Zealand (A)</strong></td>
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<td>Assignment questions:</td>
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<td>1. How would you evaluate Team NZ’s use of simulation in the design process? How did their approach differ from other syndicates?</td>
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<td>2. What would you advise them to do (two similar boats now; two different boats now; one boat now, one boat later)?</td>
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<th>Class 7</th>
<th>Mon, 8/11</th>
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<td><strong>Design for Environment</strong></td>
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<tr>
<td>- Read Chapter 12 (5th edition): Design for Environment (complete Exercise 1-3 and be prepared to discuss Questions 1-3 &amp; 6)</td>
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<tr>
<td>- <em>Think about the products you use and identify one that has reduced environmental impact. Be prepared to describe the product in class.</em></td>
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<th>Class 8</th>
<th>Wed, 8/13</th>
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<tr>
<td><strong>Industrial Design</strong></td>
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<tr>
<td>- Chapter: Industrial Design (be prepared to discuss the Questions)</td>
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<tr>
<td>- <em>Think about the products you use and identify one that exhibits good industrial design. Bring it to class and demonstrate what you like about the design.</em></td>
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<td>- Guest speaker</td>
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<td><strong>Case 9-990-001: Braun AG: The KF 40 Coffee Machine</strong></td>
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<td>Assignment questions:</td>
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<td>1. Braun is an elite-market company with manufacturing in high-wage</td>
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<td>Class 9</td>
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<td><strong>Design for Manufacturing</strong></td>
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<tr>
<td>• <a href="#">Chapter: Design for Manufacturing</a> (complete Exercise 1-2 and be prepared to discuss Question 2)</td>
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<td><strong>Intellectual Property</strong></td>
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<td>• <a href="#">Chapter: Patents and IP</a> (complete Exercise 2 &amp; 4 and be prepared to discuss the Questions)</td>
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<td>• Look up a patent number on a product you like. Be prepared to explain to the class what the novel, useful and non-obvious invention is and how the claims describe it.</td>
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<td><strong>Case 9-688-040: Boeing 767: From Concept to Production (A)</strong></td>
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<td>Assignment questions:</td>
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<td>1. How would you describe Boeing’s approach to product development? What are its basic elements? Strengths and weaknesses?</td>
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<td>3. Which method should Boeing use to convert the first 30 Boeing 767s from 3-person to 2-person cockpits? Why?</td>
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<th>Class 10</th>
<th>Wed, 8/20</th>
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<td><strong>Tour and presentation by the leading product design firm</strong></td>
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<td><strong>Course Feedback</strong> (prepare three slides: 1. What worked well; 2. What didn’t + constructive suggestions how to improve; 3. Case ranking and which of them you would suggest not include again and why)</td>
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<tr>
<th>Mon 8/25</th>
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<tr>
<td><strong>Foster First Evening MBA Product Design Competition</strong></td>
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- As. #6
- As. #7