BUILD4SCALE™ NY:
AN INTRODUCTION TO THE BUILD4SCALE™ WORKSHOP

June 8, 2020
1:00 pm
FuzeHub Overview

- FuzeHub is a non-profit organization that serves as the statewide New York MEP Center (Manufacturing Extension Partnership)
- Supported by Empire State Development’s Division of Science, Technology & Innovation (NYSTAR)
- Extensive network of experts, programs and funding for NY State manufacturers.
Agenda

- What is Build4Scale™?
- Workshop Overview
- Workshop Content:
  - Prototyping
  - Design
  - Bill of Materials
  - Bill of Process
  - Lean
- Membership Program
Build4Scale™ Overview

- Curriculum built by the U.S. Department of Energy
- Help companies with manufacturing readiness
- Close the gap between innovation and commercialization
Build4Scale™ Curriculum

- Teach design, engineering, and manufacturing fundamentals in the early stage of product development
- Help innovators avoid common pitfalls
  - Design to meet customer needs
  - Market requirements/certifications
  - Understand manufacturing process
  - Product cost/price
- Provide know-how to help innovators work with contract manufacturers
Build4Scale™ Website

www.build4scale.org
Support from DOE: American Inventions Made Onshore (AIM Onshore)

Tailored workshops from Build4Scale modules

Interactive process with meaningful exercises

Focus on product design and manufacturability issues for early stage companies
Workshop Goals

- Provide actionable takeaways that can be implemented short term
  - Design optimization (Design for “X”, Lean Design)
  - Lower costs (Bill of Material / Bill of Process)
- Increase your team’s manufacturing knowledge for:
  - More confident discussions with contract manufacturers
  - Better product / process understanding to improve funding pitches
  - Identifying where you need resources outside of your team and provide contacts to fill those gaps.
## Workshop Modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Content</th>
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</thead>
<tbody>
<tr>
<td>Prototyping</td>
<td>Starting point, prove concept, customer feedback, iterate</td>
</tr>
<tr>
<td>Design for X</td>
<td>Critical analysis, prioritization, long-term cost savings</td>
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<tr>
<td>Bill of Materials</td>
<td>Organization, planning, cost tracking/reductions/estimating</td>
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<tr>
<td>Bill of Process</td>
<td>Reduce complexity, remove inefficiencies, scale up production</td>
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<tr>
<td>Lean Design</td>
<td>Ties everything together, best version of your product</td>
</tr>
</tbody>
</table>
Section I: Prototyping
Section II: Design for X
Section III: Bill of Materials
Section IV: Bill of Process
Section V: Lean Design
Section I: Prototyping

- Why is prototyping important?
  - Prove technology works
  - Customer feedback
  - Proof of concept for investors
  - Insights for patent application

<table>
<thead>
<tr>
<th>Alpha</th>
<th>Beta</th>
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</thead>
<tbody>
<tr>
<td>Key features, functionality</td>
<td>More polished</td>
</tr>
<tr>
<td>“Lab experiment”</td>
<td>Commercial environment</td>
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<tr>
<td>Demonstrates capabilities</td>
<td>Customer feedback</td>
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</tbody>
</table>
Section I: Prototyping

- Examples to demonstrate the concepts
- Key Question:
  - When to revise versus when to lock design
- Resources:
  - Prototyping methods
  - How to locate providers
- Exercise:
  - Customer Discovery Checklist
  - Market Validation Checklist
Section II: Design for X
Section II: Design for X

- Why is design important to product cost and time to market?
- Making adjustments/improvements before going into production:
  - Minimizes retooling costs
  - Saves rework time
  - Avoids inventory scrapping costs
Section II: Design for X

- Consider your product from many perspectives and prioritize design elements according to 7 criteria:
  1. Customer use / Market Acceptance
  2. Manufacturability / Assembly
  3. Durability / Reliability
  4. Installation
  5. Maintenance
  6. Logistics / Packaging
  7. Sustainability
Section II: Design for X

Example: Hose Reel

- Raw material costs increased
- Product margin suffered
- Couldn’t forfeit retail shelf space
- Solution: Redesign product
Section II: Design for X

- **Tapered Shape**
  - Allows nesting for shipment

- **Wrought Iron Look**
  - High end
  - Less resin
  - Less pigment

- **Folding Handle**
  - More efficient for shipping

- **Reverse Handle Rotation**
  - Better for ergonomics

- **Folding Handle**
  - More efficient for shipping

- **Gear Reduction Mechanism**
  - For easier winding

- **Snap-Together Construction**

- **Ground Level Hose Entry**
  - For ease of use
What Are You Designing For?

1. Customer Use, Market Acceptance
   — Does your product design consider the customer’s safety, comfort, ease-of-use, and ergonomic factors?
   — Are there any market regulations your product needs to comply with?
   — Does your product require any certifications, or are there certifications which (though not required) will help set you apart from competitors?
What Are You Designing For?

1. Customer Use, Market Acceptance

2. Manufacturability, Assembly
   — Are your components efficient to manufacture? Evaluate material trade-offs, alternate components, etc. using the Bill of Material (BOM).
   — Is your product efficient to assemble? Consider the Bill of Process (BOP) or Process Steps to evaluate things like labor requirements, both in-house (during the manufacturing process) and in the field (if any assembly is required by the customer).
   — Have you considered capital equipment and tooling costs associated with making custom parts, versus using off-the-shelf parts?
   — Have you thought about how you will deal with getting rid of scrap that is generated during the manufacturing of your product?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
   — Does your product design consider the potential impact of noise, vibration, and harshness (NVH) in the environment it’s intended to operate?
   — Have you considered loading conditions on your product from external sources?
   — Does your product need to be designed to handle things like extreme temperatures, excessive humidity/moisture, or exposure to UV light?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
4. Installation, System Integration
   — Is your product designed to be easily integrated into its intended setting?
   — Is it easy to install (example: interchangeable, symmetric parts that can be installed frontwards or backwards)?
   — Does the form, fit, and function of your product design meet all requirements of the environment/system it will be installed in?
   — Is your product designed to work with any related or dependent sub-systems?
   — Will any operating dynamics or transient impacts from connected components affect your product in a negative way?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
4. Installation, System Integration

5. **Maintenance, Serviceability**
   — Is your product designed in a way that makes it easy to replace high-wear components (like batteries)?
   — Is your product designed to be easily maintained and serviced?
   — Conversely, if you want your product to be a consumable, have you designed it to be difficult to repair versus being entirely replaced?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
4. Installation, System Integration
5. Maintenance, Serviceability
6. Packaging, Logistics
   — Is your product properly protected from damage and harsh environmental conditions (temperature, humidity, vibration, etc.) during shipping/storage?
   — Is your product optimized to ship efficiently (how many units per box/crate/pallet, how many will fit in a 53 ft tractor trailer, have you considered weight limits, etc.)
   — Have you considered how your product will make it from the shipping carton to the store shelf (if relevant)?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
4. Installation, System Integration
5. Maintenance, Serviceability
6. Packaging, Logistics
7. Sustainability
   — Is it important that your product uses **bio-based** materials or **biodegradable** components (especially packaging)?
   — Have you considered how your product would be **recycled, reused, or refurbished**?
What Are You Designing For?

1. Customer Use, Market Acceptance
2. Manufacturability, Assembly
3. Durability, Operating Environment
4. Installation, System Integration
5. Maintenance, Serviceability
6. Packaging, Logistics
7. Sustainability

8. **Other considerations specific to your product**
   —Think about other factors that are important in your industry, especially things that could set you apart from competitors, and incorporate features into your product design that take advantage of these.
Section II: Design for X

Example: Hose Reel

1. Customer use / Market Acceptance
   - Aesthetics, gearing advantage, low entry
2. Manufacturability / Assembly
   - Thinner walls, fewer parts, snaps, tooling inserts
3. Durability / Reliability
   - More robust water system, less gear wear
4. Installation
   - Swivel hose attachment, mounting stakes
5. Maintenance
   - 2-piece basket for access to water system
6. Logistics / Packaging
   - Folding handle, nesting design
7. Sustainability
   - Less resin, minimal packaging (recycled paper)
Section II: Design for X

- Workshop exercise
- Evaluate each design criteria according to your product
- What have you already accounted for?
- Which areas still need work?
- Develop “Priority Score” and rank the 7 areas to determine design focus
Section I: Prototyping
Section II: Design for X
Section III: **Bill of Materials**
Section IV: Bill of Process
Section V: Lean Design
Section III: Bill of Materials

- Why is an **intelligent** BOM important?
  - Very detailed list of all components, including raw materials, purchased parts, commodity, consumables, packaging
  - Analysis/tracking: costs, cost trade-offs (vendor, material), critical dimensions/weight, revisions
  - Planning tool: cost by volume (minimum order, price breaks), lead times and impact on cash flow, COGS at scale
  - Intelligent part numbering to improve efficiencies, reduce errors
Section III: Bill of Materials

- Examples to demonstrate the concepts
  - Packing list
  - Recipe

- Key Questions:
  - What level of detail to include
  - Data management trade-off

- Resources:
  - Tools: Excel, ERP/MRP systems
  - Template: Contract Manufacturer RFQ

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Ingredients

1. 2 to 3 very ripe bananas, peeled
2. 1/3 cup melted butter
3. 1 teaspoon baking soda
4. Pinch of salt
5. 3/4 cup sugar
6. 1 large egg, beaten
7. 1 teaspoon vanilla extract
8. 1-1/2 cups of all-purpose flour
Section III: Bill of Materials

- Workshop exercise: BOM Template (Excel, customizable)
- Show minimum level of detail needed to be useful
- Multiple BOMs (different product variations, or prototype to production)

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<th>MATERIAL</th>
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Section II: Design for X
Section III: Bill of Materials
Section IV: Bill of Process
Section V: Lean Design
Section IV: Bill of Process

- Why is an **intelligent** BOP important?
  - Very detailed production map
  - Step-by-step sequence of work activities needed to fabricate and build your product
  - Each step has an associated cost
  - Reduce complexity, reduce opportunity for mistakes (avoid additional quality control efforts)
Section IV: Bill of Process

- Examples to demonstrate the concepts (recipe)
- Mapping symbols to visualize the process, make inefficiencies obvious

**Banana Bread**
1. Preheat the oven to 350F (175C), and butter a 4x8-inch loaf pan.
2. In a mixing bowl, mash the ripe bananas with a fork until completely smooth. Stir the melted butter into the mashed bananas.
3. Mix in the baking soda and salt. Stir in the sugar, beaten egg, and vanilla extract. Mix in the flour.
4. Pour the batter into your prepared loaf pan. Bake for 50 minutes to 1 hour at 350F (175C), or until a tester inserted into the center comes out clean.
5. Remove from oven and let cool in the pan for a few minutes. Then remove the banana bread from the pan and let cool completely before service. Slice and serve. (A bread knife helps to make slices that aren’t crumbly.)
Section IV: Bill of Process

- Key Discussions:
  - Workflow Analysis
  - Process Flow
  - Assembly Instructions
  - Supply Chain Mapping

- Resources:
  - Mapping Symbols

- Workshop Exercise:
  - Start mapping out BOP for your initial production units
Section I: Prototyping
Section II: Design for X
Section III: Bill of Materials
Section IV: Bill of Process

Section V: Lean Design
Section V: Lean Design

Combine:

- Prototyping (customer feedback)
- Design (priorities, easy to locate/fixture)
- BOM (minimize number of parts)
- BOP (minimize process steps)

Impact Cycle:

- Remove process steps → redesign components → update BOM → Etc.

Example: Reduce cost 75%
Section V: Lean Design

Exercise:
- Joining parts need to move relative to each other?
- Joining parts need to be different material?
- Remove non-essential parts, especially those that commonly fail?
- Eliminate multi-touch handling
- Standardize fasteners or replace with snap-together elements
- Consider purchasing sub-assemblies

Goal:
- Remove complexity to get to the best version of your product.
Build4Scale™ NY Membership
Build4Scale™ NY Results 2019

- Pilot program achieved the following:

130 PARTICIPATING COMPANIES
Hardware innovators and manufacturers trained

$60,000 IN PROJECT FUNDING
Direct and matched funds for Build4Scale projects

$175,000+ IN CONTRACTS SIGNED
With US-based supply chain manufacturing companies
Build4Scale™ NY Results 2019

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New for 2020, funding increased to $140,000
2020 Membership Program

More guidance, targeted approach to helping products get to the next stage of manufacturing

- Selective program, limited enrollment, membership fee
- Provides training, hands-on mentoring, resources
- Access to members-only funding

https://fuzehub.com/build4scale-ny/membership/
Build4Scale™ NY Requirements

- Start-up or early-stage companies
- Hardware device with working prototype
- Any industry, including cleantech
- MRL 4 or above
- Based in NY
- DUNS number
- Manufacturing NAICS code
Build4Scale™ NY Benefits

- Advanced level of mentorship and guidance
- Workshop fees waived
- Assessment Report with customized recommendations (which can act as the basis for project plans)
- Introductions to resources tailored to your needs
- Opportunity to apply for funding
Build4Scale™ NY Funding

- Members eligible after receiving Assessment
- Applications accepted monthly, through October
- Used for direct project expenses, including:
  - Design Services
  - Prototype refinement
  - 3rd Party Testing
  - Tooling/Equipment
  - Pilot Production
  - Patent Fees
Build4Scale™ NY Funding

- Award based on criteria including:
  - Alignment with product goals
  - Project readiness
  - Budget/Use of funds
  - Potential impact in NY State
  - Competing requests

- Amount based on project need (maximum $10,000)

- Awardees agree to participate in a Project Completion Interview and a 3rd party survey to report impacts

https://fuzehub.com/build4scale-ny/fund/
Innovative Products
Getting to Market

High-Potential Companies
Build4Scale™ Training
Expert Assistance
Funding for High-Impact Projects

Our Goal: Help Companies Succeed
Thank You

Eric Fasser
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DESIGN & ENGINEERING SOLUTIONS SPECIALIST

Eric is a product design engineer and product marketing expert, focused on smart product design, prototyping, and manufacturing. He currently manages the Build4Scale NY program for FuzeHub as the Design and Engineering Solutions Specialist.