Material Cost Reduction Approach to PLM Value

Abstract

Value can be derived from Product Lifecycle Management (PLM) Systems through improving speed to market, reducing quality costs, improving productivity and material cost reduction. In this session, we will discuss why material cost reduction should be addressed early in a value based PLM deployment and how to execute a material cost reduction strategy.

Many PLM systems are justified by the forecasted value obtained by reducing material costs through component rationalization and reuse. However, little provision is made for people being able to find and reuse components. After all, how can you reuse a component if you cannot find it?

Since material cost reduction has a direct relationship to profit and loss, it should influence the order in which process changes are deployed. Component rationalization and reuse requires classification and attribute data. Using this data, common components are identified, price variances calculated, data shared with supplies and prices negotiated resulting in lower material costs. A strategy for controlling new part number creation also must be deployed to prevent part proliferation after a component rationalization project.
Whirlpool is the #1 major appliance company leading a $120B industry.

$18+ billion in revenues in 2010

Products sold in more than 130 countries

71,000 employees

66 manufacturing and technology centers
We grew by acquisition...

**Acquisitions Drive Growth**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
<th>Acquisitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1942</td>
<td>$2.3M</td>
<td>JV Inglis (Canada) &lt;br&gt; JV Brasmotor (Brazil)</td>
</tr>
<tr>
<td>1970</td>
<td>$1.1B</td>
<td>KA Purchase &lt;br&gt; JV w/ Philips Roper Brand</td>
</tr>
<tr>
<td>1985</td>
<td>$3.4B</td>
<td>China JV’s &amp; Purchases &lt;br&gt; JV in Mexico &lt;br&gt; JV in India</td>
</tr>
<tr>
<td>1995</td>
<td>$8.2B</td>
<td>Acquired Maytag &lt;br&gt; Polar (Poland) &lt;br&gt; Whirlpool Mexico</td>
</tr>
<tr>
<td>2007</td>
<td>$20B</td>
<td></td>
</tr>
</tbody>
</table>
Many brands and associated products were integrated into one global company.

**BEDROOM(S)**
- Clothes revitalization
- Room air conditioning
- Dehumidifiers
- Air coolers

**KITCHEN / DINING**
- Refrigeration
- Dishwasher
- Cooking
- Ventilation
- Portables
- Cookware

**LAUNDRY ROOM**
- Washer, dryer, sink
- Clothes revitalization
- Laundry storage solutions

**BASEMENT**
- Storage
- Water filtration
- HVAC
- Freezers
- Air treatment

**OUTDOOR**
- Grills
- Cooking centers

**GARAGE**
- Storage
- Appliances
- Workstations
- Flooring

**A P P L I A N C E S**
- Refrigeration
- Dishwasher
- Cooking
- Ventilation
- Portables
- Cookware

**W A T E R F I L T R A T I O N**
- HVAC
- Freezers
- Air treatment

© March 2011
We have over 4000 people developing products in 26 countries.

Product Development Center Foot Print
Innovation is core to our corporate strategy.

From a sea of white…
To a field of innovation…
For example, continual innovation is essential to improving appliance efficiency.

ANNUAL AVERAGE KILOWATT-HOUR USAGE:

AVERAGE WATER USAGE IN GALLONS PER CYCLE:

Initiatives:

- 2000: Integrated Home Solutions; green building
- 2001: Front-load laundry; Low- and zero-energy homes and communities
- 2003: Energy monitoring; GHG reduction pledge
- 2004: Grid-friendly appliances
- 2006: Connected appliances
- 2007: GREENKITCHEN; LEAF House; revised GHG pledge
- 2008: Green Touch for Builders
- 2009: Thermally-connected appliances
  Smart grid-connected appliances

Clothes Washers:
- 69% Reduction

Dishwashers:
- 61% Reduction
Innovation and variation increases demand for new components which we now avoid with our material strategy.

**Forecasted Total Component Growth**

- **Component Count**
  - Total Components
  - New Components
  - New Features / Product
  - New Products / Year

**Actual Total Component Growth**

- **Component Count**
  - Total Components
  - New Components
  - New Features / Product
  - New Products / Year
Our PLM strategy was to apply information technology capabilities to materials, product architecture and products.

- **Processes**
  - Materials: Component rationalization, New item creation and reuse, Data development, Collaborative Classification
  - Architecture: Module and interface and role governance, Item classification
  - Product: Bill of material creation for CAD, parts, assemblies

- **Capabilities**
  - Materials: Managing classification, attributes and data, Search & find, Workflow
  - Architecture: Managing architecture, Managing roles
  - Product: Managing BOMs, Managing Costs

- **Benefits**
  - Materials: Component cost reduction
  - Architecture: Complexity reduction
  - Product: Predictable costs, Sustained cost control

- **Timeline**
  - Architecture: 2009 - 2010
  - Product: 2010 - 2013
Material management resulted in reductions in platform and component count and improved components per product.

**Materials**

- Component rationalization
- New item creation and reuse
- Data development
- Collaborative Classification

**Managing classification, attributes and data**

- Search & find
- Workflow

**Component cost reduction**

**2008 - 2009**

**Measurements**

**Product Platforms**

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Targets**

- 40% reduction

**Total Components**

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**# Components / Product**

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Goal</th>
</tr>
</thead>
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<tr>
<td>Goal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Material cost reduction contributed to actual savings to fund the rest of the PLM strategy.

Results:
- 40% reductions in platforms
- 35% reduction in Components
- 25% improvement in # components / product
- 20% average reduction in component cost

Net Cash from Operating Activities

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$1.5B</td>
</tr>
<tr>
<td>2010</td>
<td>$1.1B</td>
</tr>
</tbody>
</table>
Using our component rationalization approach we lowered material costs and reduced the total number of components.

Materials

Component rationalization
New item creation and reuse
Data development
Collaborative Classification

Managing classification, attributes and data
Search & find
Workflow

Component cost reduction

Component cost count, volume by supplier

Glass component cost by diameter analysis

Changes to Supply Chain
Changes to New Product
Changes to Existing Product

Total Components

2008 - 2009

2007 2008 2009 2010 2011 2012 Goal
Indentifying similar items was essential to determining PO cost change opportunities.

**Similar Component Cluster Analysis**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Qualifier</th>
<th>Neighbors</th>
<th>Distance</th>
<th>Diameter - Inside</th>
<th>Diameter - Outside</th>
<th>Height</th>
<th>Form - Bearing Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>356426</td>
<td>Part.0</td>
<td>0</td>
<td>16.134</td>
<td>0.008640</td>
<td>0.013720</td>
<td>0.010920</td>
<td>Full Diameter</td>
</tr>
<tr>
<td>8557878</td>
<td>Part.0</td>
<td>0</td>
<td>13.000</td>
<td>0.006454</td>
<td>0.009457</td>
<td>0.014685</td>
<td>Full Diameter</td>
</tr>
<tr>
<td>8519359</td>
<td>Part.0</td>
<td>0</td>
<td>16.000</td>
<td>0.006454</td>
<td>0.009457</td>
<td>0.014685</td>
<td>Full Diameter</td>
</tr>
<tr>
<td>92211117</td>
<td>Part.0</td>
<td>0</td>
<td>17.706</td>
<td>0.006400</td>
<td>0.015400</td>
<td>0.015700</td>
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</tr>
<tr>
<td>9703560</td>
<td>Part.0</td>
<td>0</td>
<td>19.011</td>
<td>0.009040</td>
<td>0.014923</td>
<td>0.014224</td>
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</tr>
<tr>
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<td>0</td>
<td>19.224</td>
<td>0.009040</td>
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<td>0.016015</td>
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<tr>
<td>2207471</td>
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<td>0</td>
<td>19.689</td>
<td>0.008305</td>
<td>0.010445</td>
<td>0.019050</td>
<td>Full Diameter</td>
</tr>
</tbody>
</table>
Addressing material costs resulted in an average savings opportunities of 10%.

### Small Sample of Material Savings

<table>
<thead>
<tr>
<th>Material</th>
<th>Consolidation Lever</th>
<th>Complexity 2009</th>
<th>Complexity 2011</th>
<th>Savings Opportunity (hard savings only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valves</td>
<td>Flow Rates, Brackets</td>
<td>141</td>
<td>36</td>
<td>12-18 %</td>
</tr>
<tr>
<td>Steel Coils</td>
<td>Gages, Grades, specs</td>
<td>1008</td>
<td>402</td>
<td>3-5 %</td>
</tr>
<tr>
<td>Resins</td>
<td>Colors, Filler, Specs</td>
<td>384</td>
<td>233</td>
<td>4-8 %</td>
</tr>
<tr>
<td>Tier II Electronics</td>
<td>Mounting, Ratings</td>
<td>2901</td>
<td>754</td>
<td>10-12 %</td>
</tr>
<tr>
<td>Wire Harness Components</td>
<td>Wire Gage, Terminals Housings</td>
<td>2743</td>
<td>1783</td>
<td>9-12 %</td>
</tr>
<tr>
<td>Brand Badges</td>
<td>Common Technology, Adhesive</td>
<td>326</td>
<td>76</td>
<td>10-20 %</td>
</tr>
</tbody>
</table>
Component rationalization benefits are sustained by reinforcing reuse which requires search and find capability.

**Materials**

- Component rationalization
- New item creation and reuse
- Data development
- Collaborative Classification

**Reuse**

**Robust Attribute Search and Find**

- Managing classification, attributes and data
- Search & find Workflow

- Component cost reduction

2008 - 2009
Most companies load existing components into their PLM which results in inadequate search and find and limits reuse.

In most PLM implementations, try finding a bearing that meets specific requirements: outside diameter, race, material, etc.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Type</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4619-640-39641</td>
<td>part</td>
<td>released</td>
<td>FC BALL BEARING ASSY JET CHEF</td>
</tr>
<tr>
<td>4619-640-49541</td>
<td>drawing</td>
<td>released</td>
<td>BEARING SUPT&amp; THERMO ASSY(SERVI)</td>
</tr>
<tr>
<td>4619-640-49541</td>
<td>assembly</td>
<td>released</td>
<td>BEARING SUPT&amp; THERMO ASSY(SERVI)</td>
</tr>
<tr>
<td>4619-641-89271</td>
<td>part</td>
<td>released</td>
<td>TT BEARING</td>
</tr>
<tr>
<td>4619-641-89272</td>
<td>part</td>
<td>released</td>
<td>TT BEARING A6</td>
</tr>
<tr>
<td>4619-644-174</td>
<td>drawing</td>
<td>released</td>
<td>BEARING SUPPORT</td>
</tr>
<tr>
<td>4619-644-17481</td>
<td>drawing</td>
<td>released</td>
<td>BEARING SUPPORT</td>
</tr>
<tr>
<td>4619-644-17481</td>
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<td>released</td>
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</tr>
<tr>
<td>4619-656-98011</td>
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<td>BALL BEARING</td>
</tr>
<tr>
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<td>part</td>
<td>released</td>
<td>BALL BEARING</td>
</tr>
<tr>
<td>4619-670-03651</td>
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<td>BALL BEARING HOLDER</td>
</tr>
<tr>
<td>4619-670-03652</td>
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<td>released</td>
<td>BALL BEARING HOLDER</td>
</tr>
<tr>
<td>4619-670-03652</td>
<td>part</td>
<td>released</td>
<td>BALL BEARING HOLDER</td>
</tr>
<tr>
<td>4619-670-03741</td>
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<td>BALL BEARING HOLDER 1</td>
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<tr>
<td>4619-670-03741</td>
<td>drawing</td>
<td>released</td>
<td>BALL BEARING HOLDER</td>
</tr>
<tr>
<td>4619-670-04821</td>
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<td>released</td>
<td>BEARING HOLDER</td>
</tr>
<tr>
<td>4619-670-04821</td>
<td>part</td>
<td>released</td>
<td>BEARING HOLDER</td>
</tr>
<tr>
<td>4619-677-40381</td>
<td>drawing</td>
<td>released</td>
<td>TT BEARING PF</td>
</tr>
<tr>
<td>4619-677-40381</td>
<td>part</td>
<td>obsolete</td>
<td>TT BEARING PF</td>
</tr>
<tr>
<td>4619-677-40391</td>
<td>drawing</td>
<td>released</td>
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<tr>
<td>4619-677-41671</td>
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<td>4619-677-50061</td>
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<tr>
<td>4619-677-50061</td>
<td>drawing</td>
<td>released</td>
<td>BEARING</td>
</tr>
</tbody>
</table>

People can’t reuse what they can’t find!
A new item creation process enabled by a workflow limits component proliferation.

Materials

- Component rationalization
- New item creation and reuse
- Data development
- Collaborative Classification
- Managing classification, attributes and data
- Search & find
- Workflow
- Component cost reduction

New Item Creation Workflow

1. **Engineer Needs Part**
   - Consult part catalog
   - Attributes: Involute, Pitch Dia, # teeth: 12 mm

2. **Part Preference**
   - Yes: Preferred Part Found
   - No: Part Doesn't Exist

3. **Engineering Notice**
   - BOM Release
   - Approvals based on Preference Level

4. **ECR**
   - Request for Change
   - Global EN Part Complete with Attributes
   - Design Part
   - Approval by Global Module Owner

5. **Global EN W12345678 Part Release**
   - Global EN

2008 - 2009

WHIRLPOOL CORPORATION • CONFIDENTIAL 6/16/2011
A data development process with classification and attribute management is required for component rationalization.

### Classification Structure

Data is extracted from drawings and entered into the database.

#### Materials

- Component rationalization
- New item creation and reuse
- Collaborative Classification
- Managing classification, attributes, and data
- Search & find Workflow
- Component cost reduction

### 2008 - 2009

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Status</th>
<th>Create User</th>
<th>Create Date</th>
<th>Update User</th>
<th>Diameter - Inside</th>
<th>Diameter - Outside</th>
<th>Drawing Number</th>
<th>Drawing URL</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUSHING-HINGE</td>
<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
<td>dfr_api_p</td>
<td>6.4540 mm</td>
<td>9.4565 mm</td>
<td>8557878</td>
<td><a href="http://idesr">http://idesr</a></td>
<td>14.6650 mm</td>
</tr>
<tr>
<td>BEARING - SLEEVE</td>
<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
<td>dfr_api_p</td>
<td>6.2550 mm</td>
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<td>32.2500 mm</td>
</tr>
<tr>
<td>BEARING - SLEEVE BRONZE</td>
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<td>stratpd</td>
<td>6/1/2009</td>
<td>dfr_api_p</td>
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<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
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<td>8577253</td>
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<td>14.6750 mm</td>
</tr>
<tr>
<td>PLASTIC BUSHING</td>
<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
<td>dfr_api_p</td>
<td>6.4000 mm</td>
<td>15.4000 mm</td>
<td>92211117</td>
<td><a href="http://idesr">http://idesr</a></td>
<td>15.7000 mm</td>
</tr>
<tr>
<td>BUSHING AGITATOR SHAFT</td>
<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
<td>dfr_api_p</td>
<td>19.1150 mm</td>
<td>25.4400 mm</td>
<td>92312913</td>
<td><a href="http://idesr">http://idesr</a></td>
<td>33.3200 mm</td>
</tr>
<tr>
<td>SLEEVE BEARING - FGA</td>
<td>In Work</td>
<td>Admin</td>
<td>6/13/2008</td>
<td>dfr_api_p</td>
<td>0.6305 in</td>
<td>0.8145 in</td>
<td>9703278</td>
<td><a href="http://idesr">http://idesr</a></td>
<td>0.6230 in</td>
</tr>
<tr>
<td>BEARING - UPPER, CENTER</td>
<td>In Work</td>
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<td>6/1/2009</td>
<td>dfr_api_p</td>
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<td>9703368</td>
<td><a href="http://idesr">http://idesr</a></td>
<td>0.5700 in</td>
</tr>
</tbody>
</table>
Collaborative classification and attribute management is used to facilitate organization agreement.

**Basic Functional Requirements**

- Controlled, yet flexible classification structure development
- Simple process and workflow
- Role definition
- Status and security
- Inheritance

**Materials**

- Component rationalization
- New item creation and reuse
- Data development
- Collaborative Classification

Managing classification, attributes and data

Search & find

Workflow

Component cost reduction

2008 - 2009
Our strategy was to apply information technology capabilities to materials for a value based approach to PLM deployment.

Processes
- Component rationalization
- New item creation and reuse
- Data development
- Collaborative Classification

Capabilities
- Managing classification, attributes and data
- Search & find
- Workflow

Benefits
- Component cost reduction

Timeline
- 2008 - 2009

Architectures
- Module and interface and role governance
- Item classification

Managing architecture
Managing roles

Timeline
- 2009 - 2010

Product
- Bill of material creation for CAD, parts, assemblies
- Target costing
- Cost modeling
- Change management
- Managing BOMs
- Managing Costs

Timeline
- 2010 - 2013

Predictable costs
Sustained cost control