Connected Vehicle and Connected Consumer: Redefining PLM/ALM/MBSE

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Global Connected Consumer Experience
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Unprecedented connectivity is driving a new set of consumer expectations.

Unprecedented Connectivity

- **GLOBAL DIGITAL STATISTICS**
  - **TOTAL POPULATION**: 7.357 BILLION (53% URBANIZATION)
  - **ACTIVE INTERNET USERS**: 3.175 BILLION (43% PENETRATION)
  - **ACTIVE SOCIAL MEDIA USERS**: 2.206 BILLION (30% PENETRATION)
  - **UNIQUE MOBILE USERS**: 3.734 BILLION (51% PENETRATION)
  - **ACTIVE MOBILE SOCIAL USERS**: 1.925 BILLION (26% PENETRATION)

**U.S. E-Commerce Retail Sales**

- **Source**: Retail Indicators Branch, U.S. Census Bureau
The Connected Consumer – a sea change in automotive retailing

- Ten hours spent on average by automotive customers on the web to search for information to support buying decision
- 46% of buyers willing to finance purchase online
- Europe’s AutoScout has 300 million views a month on cars available for sale
- 500,000 are sold a year on eBay Motors
- Number of dealership visits down from an average of 5 to 1 (one) prior to a car purchase
- More than one third of consumers would consider buying a car online
- Almost 90% of consumers use the OEM or dealer website when purchasing a car
The Connected Vehicle – a sea change in Customer Expectations

“Gartner Says By 2020, a Quarter Billion Connected Vehicles Will Enable New In-Vehicle Services and Automated Driving Capabilities”

- You can follow your favorite Netflix show from the living room to the back seat to your phone.
- People mod their cars with cool third party apps, and share tips and tricks with other drivers.
- Help the parents of teenagers sleep better at night.

Very large investments – changes in usage patterns – changes in Product Development, Service, and Sales. Where’s the ROI for the OEM? What’s the role of Analytics?

Sources: Business Insider, Wired, Gartner
The Connected Vehicle, Consumer, and Ecosystem enable deeper and more rewarding relationships between the customer and the OEM.
### Connected Vehicle and Connected Consumer: New models, new capabilities

<table>
<thead>
<tr>
<th>Steps</th>
<th>Customer Information</th>
<th>Vehicle Information</th>
<th>Environment Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive to the office</td>
<td>Driver identification&lt;br&gt;Driver preferences: Route and Vehicle Dynamics</td>
<td>Vehicle health check&lt;br&gt;Vehicle fault detection</td>
<td>Traffic&lt;br&gt;Travel time prediction</td>
</tr>
<tr>
<td>Vehicle identifies service is required</td>
<td>Customer driving behavior</td>
<td>Repair prediction&lt;br&gt;Vehicle location</td>
<td>Area dealership/service appointment availability</td>
</tr>
<tr>
<td>Service options presented to driver</td>
<td>Customer preferences for update on vehicle being picked up</td>
<td>Vehicle unlock&lt;br&gt;Repair diagnostics</td>
<td>Location-specific practices (garage, etc.)</td>
</tr>
<tr>
<td>Driver parks the car</td>
<td>Customer preferences for updates on vehicle service&lt;br&gt;Update customer</td>
<td>Vehicle location</td>
<td>Location-specific practices (garage, etc.)</td>
</tr>
<tr>
<td>Service provider picks up vehicle</td>
<td>Customer preferences for updates on updates on vehicle service&lt;br&gt;Update customer on vehicle location</td>
<td>Post-repair diagnostics confirming normal state</td>
<td>Traffic&lt;br&gt;Travel time prediction</td>
</tr>
<tr>
<td>Vehicle is serviced</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Vehicle is returned to spot</td>
<td></td>
<td></td>
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<tr>
<td>Owner drives back home</td>
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</tbody>
</table>
The Legacy Automotive Business

- Vehicle
- Dealer
- Service Parts

Key:
- “Product”
- “Eco System”

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How are companies changing?

• Re-examining business relationships
• Re-examining business processes
• Putting in place change initiatives
• Putting in place new infrastructure
New Paradigm for Product Development

Customer-personalized Vehicle Attributes

Historically derived requirements

Requirements from communicated usage

Nominal Vehicle Attributes

Analytics Needs

Personalized Vehicle Attribute Customer Satisfaction Model

Actual vehicle usage binned against PD requirements structure (Descriptive Analytics)
New Paradigm for Vehicle Service

Service is reactive

Service is Owner Initiated

Service is predictive and preventative

Service is Vehicle/OEM Initiated

Analytics Needs

Predictive failure / predictive maintenance

Customer interaction propensity models
New Paradigm for Customer Service

OEM analytics drive Dealer actions

Dealer Centric

Walk in Service

Concierge Service

Analytics Needs
- Dealer action optimization models
- Customer service engagement propensity models
New Paradigm for Dealer⇔OEM interaction

Customer-centric decisions

Dealership-centric decisions

Isolated Customer Data in DMS

Shared customer and vehicle data assets

Data and Analytics Needs

Decision support maximizing value to the customer, OEM, and dealer

Sharing of customer-in-dealership information with OEM

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Current State Customer Journey: Plagued by Fragmentation

Enterprise

Marketing
Sales
Service

Aware
Research
Choice Reduction
Purchase
Onboarding
Operation
Disposal & Repurchase

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Integrate Customer Journey maximizes value to customer and profitability to OEM – a win-win
Enterprise Strategy

Analytics Change
- Sales Optimization
- Touch Point Attribution and Action Optimization Framework
- Customer Lifetime Value Model
- Analytical Data Assets
- Data and Analytics Infrastructure
- Eco-System Relationships Change Management
- Organizational Change Management

Data Change

Business Change
So What??

• How Broad is ALM – Application Lifecycle Management?
• What does it all mean to Product Development?
• What does it mean to PLM?
  • More and more Systems Engineering?
• Should PLM leaders do anything different?
Current State: Product Development Process

- Concept of Operations
- Requirements & Architecture
- Detailed Design
- Implementation
- System Verification & Validation
- Integration, Test, & Verification
- Operation & Maintenance

Concept Validation
Product Development Process: Challenges

Concept of Operations
- Data from consumer preference (social, usage); Design Range; Personalization

Requirements & Architecture
- In field operating conditions and usage

Detailed Design
- Data mining & ML for Design

Implementation

Integration, Test, & Verification

Machine Learning failure production in context of variety

Operation & Maintenance
- In situ analytics for validation

System Verification & Validation
- Machine Learning failure production in context of variety

Machine Learning failure production in context of variety

Data from consumer preference (social, usage); Design Range; Personalization
Top Five PLM Predictions

• Companies will export PLM data to the corporate data and analytics infrastructure, creating a new dynamic around PLM data.

• There is a window of opportunity to leverage PLM knowledge to organize product information in the D&A environment (as designed, as built, as maintained) – but it is closing.

• There is a window of opportunity to leverage CAE and simulation models, before pure Machine Learning methods completely take over – rapidly closing.

• Data from the connected customer and connected product will test PLM environments and may present an entry point for new vendors.

• Opportunities to improve the core electrical and mechanical products using D&A techniques are emerging and may present an entry point for new vendors.
Whither PLM?

“The Legacy Automotive Business

Vehicle

Key
"Product"
"Key System"

Dealer

Service Parts

“The New Automotive Business

Vehicle

Key
"Product"
"Channel"

OEM-led Connected Services

Third Party Connected Services

Dealer

Service Parts

“PLM is the master of the company’s products, services, and their interdependencies”

“PLM is just for the stuff that comes out the plant door”
Imperatives for PLM Leaders

• Engage in your company’s data and analytics initiatives – you have valuable data to bring to the table.

• You are an expert in organizing product information – work with the data and analytics team to leverage that expertise for the betterment of the company.

• You know a lot about product behavior – get that knowledge to be re-used in the data and analytics initiatives instead of being recreated.

• Your PD customers will be asked to leverage new information as they design the product – get ahead of it and figure out how to make it available in the PLM environment.

• Upskill your team on analytics methods and how they can improve the product and PD process.

• Don’t wait for the PLM vendors to do your job leading through this change.