Predictive Analytics: Accelerating & Enriching Product Development

While product developers are familiar with predictive analytics, they often lack clarity when it comes to understanding how these tools can contribute to the success of new product concepts.

Executive Summary

Product development is all about accelerating innovation, strengthening quality, speeding time to market, and keeping costs in line. By incorporating predictive analytics into the process, companies can sharpen their forecasts; better predict product performance, failures, and downtime; and generate more value for the business and its customers.

A digital mock-up of 3D geometry is no longer enough because products are no longer just 3D mechanical creations. While new aspects of product development (“idea to launch”) continue to garner a lot of attention, integrating predictive analytics into the process can be challenging – requiring companies to thoroughly assess their strategic goals, their appetite for investment, and their willingness to experiment.

This paper explores scenarios that are relevant to predictive analytics in product development and presents an approach for applying them.
DERIVING MORE VALUE FROM DATA

Today, companies must rely on insights gleaned from the massive amounts of data they accumulate from various channels. While the Internet of Things (IoT) offers a trove of real-time information via smart, connected devices and “things,” challenges (detecting failure patterns, modeling correlations, predicting failures, prescribing remedies, and prioritizing recommendations against cost constraints, for example) remain.

While organizations worry about the cost of new products and the expected ROI, consumers care about a product’s value/price ratio, its level of innovation and, of course, its quality. Predictive analytics can help mitigate these concerns and meet the expectations of both the business and its customers.

Questions for Executives

Executives responsible for product development face a bevy of critical questions every day. Among them:

• What factors and attributes will determine the company’s success in product development?

• What external dynamics (customer needs and behaviors, market and technology trends) and internal considerations (capabilities and culture) will contribute to our products’ performance in the marketplace?

• How do we leverage the technologies, skills, and knowledge that will optimize customer-centric product breakthroughs?

Aside from these concerns, many companies have limited tools at their disposal, and must rely heavily on experience, guesswork, and trial and error.

ANALYTICS IN PRODUCT DEVELOPMENT

Organizations have long relied on traditional product-development tools and approaches, including FMEA, CAD simulations, design of experiments, and value stream analysis, to heighten efficiencies, eliminate waste, and optimize costs.

However, given the ever-increasing volumes of data that flow into and through companies, conventional product-development technologies and tactics are no longer sufficient. (See Figure 1).

Traditional Tools & Approaches

3D Computer-Aided Simulation (CAE), Virtual Reality
Products are becoming more complex with the inclusion of software

Failure Mode & Effect Analysis (FMEA)
Based on experience rather than data

Design of Experiment (DOE)
Analysis of influences and responses methodologies can produce sub-optimal results

Value Stream Analysis
Gives a retrospective, rather than predictive, view

Figure 1
Although product developers continually look for better ways to handle the abundance of data at their disposal, most don’t have the right tools to manage it, make sense of it, or apply the insight it provides to support future product initiatives.

Innovative companies know that data-driven insights and decisions can help improve all aspects of product development. According to McKinsey’s global survey, many are already applying big data/analytics to:

- Improve research and development (R&D)
- Develop new product strategies
- Identify new market segments
- Deepen customer knowledge/relationships
- Improve customer segmentation and targeting
- Develop differentiating and dynamic pricing strategies

**Making the Case for Predictive Analytics**

Predictive analytics applies across the product-development value chain. (See Figure 2).

---

**Predictive Analytics Across the Value Chain**

<table>
<thead>
<tr>
<th>Ideation &amp; Concept</th>
<th>Engineering &amp; Design</th>
<th>Development &amp; Validation</th>
<th>Pre-Production/Commercialization</th>
<th>Launch &amp; After-Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crowdsourcing and social media play a significant role in collaborative product development. Insights from suppliers’ manufacturing processes and materials can aid in better design and accelerate time to market. Insights from previous product performance help in maintaining the right product portfolio. Analysis of intellectual property provides crucial information to design a legally sound product.</td>
<td>Product data provides information about how a particular component was designed, plus insights into challenges that were encountered. Logics and rules from this data will help design new parts and assemblies and promote standardization by harvesting old parts from existing databases. Insights from manufacturing equipment and processes help improve “Design for Manufacturing.” BOM (bill of materials) analysis helps set the right product cost.</td>
<td>Insights concerning hazardous materials, legally restricted substances and small components, for example, help assure regulatory compliance and aid in faster product development. Data on transport conditions (weather, humidity, etc.) helps in developing the right packaging contents. Insights from quality inspections and third-party lab testing can provide vital information for product design.</td>
<td>Information on local laws helps assure appropriate product/packaging/labeling specifications. Insights from local markets help in launching customized variants and fine-tuning products to suit various consumer segments. Cost insights from product development aid in launching the product at the right price. Customer data analytics help refine existing designs and develop specifications for new models and variants.</td>
<td>Best-in-class manufacturers can capture the data generated from warranty claims, spares, and service, and use it to develop better products. Product recalls, although very expensive, provide crucial insights into flaws in the product development process and provide opportunity for correction.</td>
</tr>
</tbody>
</table>

---

**Figure 2**
Quick Take

The Potential of Predictive Analytics in Product Development

Predictive analytics brings together advanced analytic capabilities spanning ad-hoc statistical analysis, predictive modeling, data mining, optimization, machine learning and more to help companies:

• Transform volumes of data (internal and external) into measurable, action-able information
• Improve the speed and quality of decision making
• Develop forward-looking – rather than retrospective – strategies
• Evolve into a data-driven, insight-based organization
• Shift decision making from an executive-level task to an all-employee pursuit
• Use digital capabilities to deliver insights and knowledge across the organization.
Navigating Critical Phases of Data Modeling

Data modeling in the concept and feasibility stages of product development incorporates the following steps:

1. Gather past and present product attributes and properties.
2. Model the relationship and correlation between the above.
3. Capture product performance from market and test data; identify features that are most desired/in demand.
4. Establish an algorithm to determine the performance of future products based on these attributes. Let the model predict the combination of attributes.
5. Balance the above with business logic and organizational capabilities.

Figure 3 illustrates the phases of high-level data modeling.

The Stages of High-Level Data Modeling

<table>
<thead>
<tr>
<th>DESCRIBE</th>
<th>INTEGRATE</th>
<th>ENRICH</th>
<th>ANALYZE</th>
<th>VALIDATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNDERSTAND THE BUSINESS PROBLEM</td>
<td>COLLECT DATA ON PRODUCT PERFORMANCE (KPIs)</td>
<td>MINE THE HISTORICAL DATA ON INTERNAL/EXTERNAL FACTORS</td>
<td>CREATE A MODEL TO PREDICT PERFORMANCE</td>
<td>USE THE BUSINESS LOGIC TO OPTIMIZE AND FINALIZE THE MODEL</td>
</tr>
</tbody>
</table>

It is important to note that data modeling is a highly collaborative process that engages all stakeholders, including design partners and component vendors. Given that predictive analytics is applicable at every stage of product development, “one-step, one-stop” approaches are likely to fail. Hence, data analytics capabilities should be embedded in every phase of product development to gather insights and drive innovation from various perspectives.

Data models should remain in sync with product models to ensure that simulation and testing reflect real-world scenarios at every stage of development, and build confidence that a product will meet customers’ expectations.

**Predictive Analytics & Product Lifecycle Management**

Predictive analytics speaks to the key aspects of product development: time to market, cost, quality, and compliance. By embedding this capability in Product Lifecycle Management (PLM) systems, companies can significantly enhance innovation by using quantitative data to shape decisions and outcomes and sharpen their competitive advantage. Lately, many PLM service providers have started to build robust predictive analytics capabilities. PTC (formerly Parametric Corporation) acquired big data machine learning and predictive analytics leader ColdLight. Siemens released Simcenter, an end-to-end simulation platform.
There are numerous areas where predictive analytics can play a significant role in PLM:

- Feature-based search
- Cost analytics
- Regulatory compliance
- Program management
- Configurable dashboards
- Organizational KPIs
- Environmental compliance
- Product portfolio analysis
- Product quality

Incorporating predictive analytics into PLM systems helps derive and deepen insights during the product development process across multiple functions. (See Figure 4).

**CONCLUSION**

Increasingly, product developers rely on analytics to improve every stage of product development — from concept to launch. Incorporating predictive analytics in the process can enrich the quality and delivery of information, minimize mistakes, sharpen efficiencies, and inform better decisions. By embedding predictive analytics in advanced PLM systems, organizations can create a “one-stop shop” for product development — with more confidence, better information, and better results.

**Predictive Analytics in Business Processes**

**COST MANAGEMENT**
Provide cost estimates and cost rollups for different configurations and BOMs. Help simulate, analyze, and optimize product costs to assure that the right decisions are made at the right time and to ensure product profitability.

**CHANGE MANAGEMENT**
Analyze change requests to identify deviations and to assess the impact on design and manufacturing. Provide insight on historical changes to help effect changes in a faster and more efficient manner.

**SUPPLIER MANAGEMENT**
Improve visibility into supplier data (approved suppliers, quality, performance, delivery mechanism, material availability, cost, etc.) by combining silos of data from multiple sources.

**REGULATORY COMPLIANCE**
Perform what-if analyses on product variants to understand how design changes affect compliance status. Provide methods and controls to ensure regulatory compliance.

**SERVICE ISSUE MANAGEMENT**
Resolve customer complaints by obtaining a 360° view of issues and performing root cause analyses.

**QUALITY MANAGEMENT**
Analyze quality data from manufacturing, customer support, adverse events/non-compliance issues to gain insights for initiating corrective and preventive actions.

**PROJECT MANAGEMENT**
Set up and utilize multiple KPIs to understand project performance. Analyze schedules, costs, and resources to ensure optimal product development.

**PRODUCT DATA MANAGEMENT**
Find and reuse existing parts and data to accelerate innovation and time to market.
REFERENCES

1. Lana Klein, “Predictive Analytics as an Engine of R&D and New Product Launches.”
2. Tom Davenport and Andrew Spanyi, “Improve New Product Development with Predictive Analytics.”
5. Stefan Rudolf and Christian Doelle, “Predictive analytics boosts product development.”

ABOUT THE AUTHOR

Amit Joshi
Associate Director,
Cognizant’s Intelligent Products & Solutions Practice

Amit Joshi is an Associate Director in Cognizant’s Intelligent Products & Solutions Practice. He has over 14 years of experience in new product introduction, quality, and manufacturing transformation programs. Amit has advised various organizations on the development and implementation of strategic, technology, and process improvement initiatives. Amit is a Six Sigma Black Belt, a Lean Manufacturing professional, and holds an MBA from the Indian Institute of Management. Amit can be reached at amit.joshi2@cognizant.com | www.linkedin.com/in/amitjoshi01

Hardik Kansupada
Senior Director,
Cognizant’s Intelligent Products & Solutions Practice

Hardik Kansupada is a Senior Director in Cognizant’s Intelligent Products & Solutions Practice. He has over 20 years of experience in leading and managing strategic engagements, working with C-level executives and end users. Hardik has a master’s degree in computer information systems from the University of Houston. He can be reached at hardik.kansupada@cognizant.com | www.linkedin.com/in/hardik-k
ABOUT COGNIZANT

Cognizant (NASDAQ-100: CTSH) is one of the world’s leading professional services companies, transforming clients’ business, operating and technology models for the digital era. Our unique industry-based, consultative approach helps clients envision, build and run more innovative and efficient businesses. Headquartered in the U.S., Cognizant is ranked 205 on the Fortune 500 and is consistently listed among the most admired companies in the world. Learn how Cognizant helps clients lead with digital at www.cognizant.com or follow us @Cognizant.