Driving Innovation in BioPharma:
Harnessing the Value of a Single, Compliant Product Record

Kalypso White Paper
by Frederic Pelletier, Dr. Horst Groesser and Scott Gibbard
Product innovation has never been as imperative as it is today in the biopharma industry. Companies must do more to drive innovation to produce novel medicines to satisfy unmet medical needs. Yet, the industry’s ability to discover, develop and launch profitable new products has been diminished by complexity within product development and innovation processes. In order to drive growth from innovation, biopharma companies must manage this complexity by improving visibility, traceability and collaboration for a wide range of business processes that create or use product information.

The first white paper in this series – Driving Innovation in BioPharma: From Discovery to Delivery with Product Lifecycle Management – explores how other complex industries such as aerospace, defense, automotive, high technology, medical devices, food and beverage, and consumer packaged goods have transformed their product innovation over the last two decades by managing product information throughout the entire product lifecycle with product lifecycle management (PLM) – reducing time to market and improving product development productivity as a result.

The lessons learned from implementing PLM in other complex industries are relevant and valuable to biopharma. PLM processes and technologies driven by a single, compliant product dataset succeed by putting a company’s most valuable information assets – the product data – at the center of their innovation efforts, rather than as a by-product to be managed by functional silos. This enables truly innovative products that generate real health benefits to patients and economic benefits to biopharma.

**Importance of a Comprehensive, Regulatory-Compliant Product Record**

**Current BioPharma Landscape**

The complexity intrinsic to drug development, multiplied by the myriad of mergers and acquisitions, and combined with the ever-increasing burden of meeting regulatory compliance requirements, presents a challenging innovation environment for biopharma companies. This requires more agile and integrated approaches to product development and commercialization.
However, too often the stakeholders in drug development, product packaging and labeling, quality, regulatory, technical operations, and manufacturing continue to manage processes and product-related data at departmental levels using homegrown, stand-alone applications and manual, file-based systems.

Consequently, product-related knowledge is fractured, widely dispersed and often unstructured leading to lack of traceability, inefficiencies and risk of non-compliance. For example, consolidating product information for disclosure to regional regulatory authorities in the product registration process repeatedly requires substantial effort, significantly increasing the cost of compliance and delaying new products to market.

“The majority of our products are failing to meet launch goals.”

“Our management of regulatory process and records is manual and not synchronized.”

“Traceability is not maintained throughout the product lifecycle.”

“It’s difficult to manage our complex global requirements.”

“Documents are managed using different approaches and technologies at each site.”

“We don’t have a common, trusted, company-wide database for real-time visibility, planning and decision making.”
Address the Complexity Challenge

It is not only the drug development process that drives complexity, the increasing variety of packaging types and sizes for biopharma products is another common source of costly rework, delayed product launches and compliance issues.

Consider how much faster a new drug product could be launched in multiple countries in various strengths or forms if product data was globally accessible in an integrated repository for core product and product packaging data.

Such a central repository would allow accelerated changes to the core product and its packaging while maintaining compliance in the different regional markets. It would also significantly reduce the cost of product launches and the regulatory compliance risk.

To accelerate product introduction, streamline global regulatory submissions and reduce the risk of non-compliance, biopharma companies must have:

- A central, comprehensive product data model with rigorous enforcement of product data generation and modification rules for improved data integrity
- Better cross-functional coordination of development and launch activities within drug development, product packaging and labeling, quality, regulatory, technical operations and manufacturing for more agile process execution
- Visibility and traceability of integrated product and process information for improved decision making

Leading companies in other complex industries facing similar challenges have established a central record of product data serving as a single source for product information in their development and commercialization processes – known as the Product Record.

A compliant Product Record that supports the innovation processes results in:

- One set of product data created over the product lifecycle by many functions
- Accelerated product launches with reduced compliance risk through global collaboration
- Reduced process delays through simultaneous development and improved synchronization of development functions
- Improved decision making on product designs through increased collaboration in development and reuse of intellectual property (IP) and product information
The Product Record should be built upon a comprehensive product data model and contain all of the information required by the extended enterprise to develop, source, produce, supply, maintain and dispose of products. The Product Record should include current product data, the complete history of product changes and available information on future products. Not just limited to the definition of the core product and the product packaging, it should also contain information about the processes that generate, utilize or enrich product data. Figure 2 shows a sample Product Record for a biopharma product.

**Call to Action: Manage the Product Record with Product Lifecycle Management**

The Product Record is the core of the PLM system – a single source of truth for all product data. It is a structured repository of materials, equipment, processing information and documents.

As explored in the first white paper in this series, PLM processes capture both structured data and documents. In biopharma, PLM links the “world of science” with the “transactional world” of enterprise resource planning and manufacturing by transforming and enhancing scientific and experimental drug information into descriptive product master data. PLM puts a company’s most valuable innovation asset – product data, from concept through commercialization to end-of-life – at the center of innovation efforts.
Any data that describes the product and its properties can be an element of the Product Record. The product data that forms the backbone of PLM represents all types of data collected during the entire product lifecycle – including early concept ideas, market research, business cases, clinical trial results, description of key processes, phase gate reviews, clinical strategies and launch plans.

Yet PLM goes beyond solely providing a version-controlled source of product data for all of the business functions. It incorporates all processes that generate, modify or affect product data along the product lifecycle. PLM capabilities include formulation authoring for product discovery and development, collaboration, project and portfolio management, document management, registry management, packaging and artwork management and product quality management, creating an integrated set of capabilities and Product Record.
The Structure of the Product Record

The Product Record as the core of a PLM system combines descriptive data of the core product with product packaging and product processing information.

The first level of the Product Record in Figure 5 represents the physical constituents of the core product and its packaging. It is composed by representations of the physical entities of the product (e.g., drug product) and their relationships (e.g., drug product – drug substances). Level 1 of the Product Record has a bifurcated structure representing the core product in one branch of the structure and the product packaging in the other branch. This integrated representation of the packaged product provides significant benefits to cross-functional product and packaging development teams:

- A single repository for brand artwork and legal entity information that often varies by country and changes over time due to merger and acquisitions
- A comprehensive primary packaging data repository for pack development
- A clear relationship between changes to the packaging/exterior label and changes to the package insert/leaflet
- Alignment between printed product information such as ingredients list, manufacturing date, expiration date, number of doses and bar codes with actual product properties

Figure 5: Product Record Level 1 for a drug product
Additional special material types can be considered on the first level of the Product Record (not shown in Figure 5):

- Promotional material
- Manufacturing specific material (e.g., glue)
- Repackaging material

The model is flexible and can accommodate exceptions for specific material types, particularly with regard to the different ways of packaging drug products around the world.

The reference model shown in Figure 5 is a conceptual organization of data for biopharma products that is independent from specific business scenarios, product types, regulatory requirements, product naming conventions or software applications.

The second level of the Product Record in Figure 6 is the informational level. Materials can have associated informational entities like material datasheets, test reports and other documents, and can be linked with process-related datasets like dossiers, submissions and authorizations, change requests, charge orders, etc.
The third and fourth levels of the Product Record in Figure 7 represent the master data elements of the physical and informational entities and attributes, logically categorized in domain areas that identify and describe the Product Record entities.
Use Cases for the Product Record

The Product Change Process

The Challenge

Elements of the Product Record are subject to frequent changes along the lifecycle of a product from discovery, development, delivery and end of life. Reasons for changes include:

- Advancement through clinical development (e.g., protocol execution and results)
- Expansion into new markets (e.g., packaging and labeling)
- Additional safety data due to reported adverse events (e.g., package insert/leaflet, packaging)
- Post-market expansion into new indications or additional patient populations (e.g., package insert/leaflet, new informational assets)
- New formulations (e.g., package insert/leaflet, packaging, labeling)
- Changes to the manufacturing process of the product during a transfer to a different manufacturing facility or a change in supplier
- Change in legal entity due to a merger or acquisition

Figure 8: Different types of change affect the product along its lifecycle

Changing a product or data elements of a product, particularly post market launch, can cause a complex chain reaction of additional changes to data elements of the same product (e.g., a safety profile change results in leaflet and pack changes) or other products that share components, suppliers or production facilities (e.g., packaging material change).
How the Product Record Helps

To support the change process, a comprehensive global Product Record:

- Reduces the cost of changes by providing instant visibility to the impact of a change on the affected product and related data elements
- Increases the efficiency of the evaluation and execution of a change by enabling cross-functional collaboration and providing centralized access to all affected data elements
- Improves regulatory compliance by providing traceability of product changes and auditability of the change execution process
- Enables the reuse of company knowledge and IP in pre-launch lifecycle phases of new products by providing development teams access to detailed information of successful previous product development and launch processes

Figure 9: Changes to data elements
The Regulatory Submission Process

The Challenge

Regulatory submissions are critical milestones in a biopharma product lifecycle, as regulatory standards are higher than ever and differ from country to country. Product applications and other submissions have a significant influence on time to market, and the ability to rapidly and cost-effectively establish and maintain a compliant set of product information is paramount in these processes.

How the Product Record Helps

The Product Record is an essential source of information for submissions of new or modified products to regulatory authorities in international markets:

- Component “where used” data supports the assessment of filing requirements in case of changes to components used in multiple products
- Centralized product data accelerates the process of compiling required product information for submissions
- Submission process data in the Product Record enables real time tracking of the progress of the new drug application (NDA)
- Historical submission information stored in the Product Record allows the extraction of lessons learned for improved planning of future submissions
The CAPA Process: Closing the Loop

The Challenge
Corrective Actions Preventive Actions (CAPAs) usually result from complaints, deviations, recalls or observations in audits, and their outcomes translate into product or process improvements. Frequently, CAPA processes are not directly tied to product information, but managed in stand-alone systems and repositories. This leads to:

- Disconnected product issue resolution and improvement implementation processes
- Increased CAPA processing cycle times
- Limited reuse of issue resolution knowledge in future failure investigations and root cause analyses

How the Product Record Helps
Quality information like historical product defects, failure modes and root cause analyses in the Product Record enables closed loop CAPA processes. This includes identifying and containing product defects; analyzing failure modes and root causes; determining and implementing product or process changes (corrective actions); reusing issue resolution knowledge for future failure investigation; and analyzing historical product failures for long-term product improvements (preventive actions).

Figure 11: Closed Loop CAPA Process
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Six Steps to Get Started with the Product Record

Establishing the Product Record is the first step to implementing PLM. The first white paper of this series outlined six tips for getting your PLM journey started. Here is how these tips apply to establishing a comprehensive Product Record:

1. **Assess Your Current Capabilities**

   To assess your current product data model and product data management practices and capabilities, a Product Record maturity model, as illustrated below, can serve as a starting point. It helps position current practices and benchmark them against peers and leading practices.

   **Increased Capability in Sustaining**
   - Rapid and successful product launches
   - Efficient management of development projects
   - Product regulatory compliance

   **Basic**
   - Inconsistent and redundant product information acknowledged
   - Lack of metrics
   - Recognition of high cost to the business to enter product data multiple times
   - Product data interfaces managed by people

   **Formal**
   - Product information managed at departmental level
   - Data and business processes remain separate, slowing innovation
   - Limited product data reuse
   - Product data management roles emerging

   **Advanced**
   - Some enterprise views of product data available but not throughout the entire product lifecycle
   - Business systems connected
   - Product data leveraged in development
   - Product change process automated
   - Well-established roles of data custodian and product information providers

   **World-Class**
   - Real-time, multi-enterprise collaboration
   - Repeatable, automated business processes
   - Integration of program and product data
   - Multi-enterprise IP control and visibility
   - Enterprise knowledge leveraged for reuse
   - Full history of all product record activities
   - Metrics and audits used to continuously improve product data quality

*Figure 12: The Product Record “Maturity Model”*
2. **Align on a Vision**

The gaps between current product data management practices and capabilities and those of world-class distinction lay the foundation for the case for change. Clearly identify the innovation, compliance and productivity benefits of closing the gaps for the leadership team and define a communication strategy and plan to mobilize the organization.

3. **Pick Your Leader... Carefully**

The Product Record serves as a data repository and source of information for a number of corporate functions, including R&D, technical operations, manufacturing, supply chain, regulatory and quality, to name a few. The leader should not only be well respected and connected in the organization, but also have a deep understanding of all aspects of drug product development and operations across these functions.

4. **Develop a Roadmap for a Phased Approach**

Though the Product Record is a cohesive and comprehensive data set, establishing it allows for prioritization and a phased approach. Typically, the first step is to create a data model for the physical (parts) and informational (documents) entities, often referred to as a Bill of Information (BoI), that includes at least the information required for continued manufacturing of a compliant in-market product. Additional domains like clinical and preclinical research, regulatory filings, quality and cost can be added incrementally over time.

5. **Utilize Rapid Prototyping and Iterative Design**

To effectively prototype the Product Record, a product data management application with advanced part and document management capabilities is required. ERP or manufacturing execution systems often lack the document management capabilities, but most enterprise-level PLM applications have been specifically designed for the management of product data. They include product change control and workflow capabilities to support the most critical use case of the Product Record – the product change process.

6. **Focus on Quick Wins**

Quick Wins can be achieved by focusing on the heart of the Product Record first: a “Bill of Material” (BOM) that integrates core product with product packaging data based on the bifurcated structure shown above. Though, the BOM alone does not contain all the information required to source and manufacture the product, it addresses one of the most frequent sources of compliance issues. It provides visibility to data dependencies between core product characteristics – for example, drug substance and excipient – and related characteristics of packaging components – in this case label and leaflet.
Summary: PLM Supports a Compliant Product Dataset

Today, global biopharma organizations are operating in an increasingly complex regulatory compliance environment with squeezed development budgets to bring more products to more markets. Fortunately, recommendations and tactical approaches exist to ease their pain.

By providing companies with a comprehensive Product Record, PLM can accelerate innovations while ensuring enforced and cost-effective compliance. Highly complex industries have already implemented a single system of record for their product information, improving time to market, product quality and ease of compliance.

These business benefits are perfectly suited for biopharma organizations following the same path. Now is the time for biopharma companies to break silos and transform into more product-centric organizations that are more efficient in launching products, more responsive to changing products and ultimately more able to deliver better health benefits to their patients.
About the Authors

Frédéric Pelletier has over 17 years of professional consulting experience specialized in full scale product lifecycle management (PLM) implementations, in the pharma, CPG, retail, and high technology industries. He holds an MS in Information Systems Management from the ESSEC Graduate School of Management of Cergy, France and a Diploma in Electronics & Computer Sciences Engineering from the EFREI school of Paris, France. frederic.pelletier@kalypso.com

Dr. Horst Groesser has over 20 years of experience in product lifecycle management (PLM) and supply chain management in the biopharma, medical device, high technology and manufacturing industries. He holds a PhD in Mechanical Engineering and a Diploma in Industrial Engineering from the Technical University of Darmstadt, Germany. horst.groesser@kalypso.com

Scott Gibbard has over 20 years of experience in engineering, product development, strategic planning, performance management and change management in biopharma and other science-driven industries. He holds an MBA from Cornell University, a Master of Applied Science from the University of Toronto Institute for Aerospace Studies (UTIAS) and a Bachelor of Applied Science in Engineering Science from the University of Toronto. scott.gibbard@kalypso.com

Additional PLM in BioPharma Publications from Kalypso

Driving Innovation in BioPharma: From Discovery to Delivery with Product Lifecycle Management

Topics to be explored in future publications include:

- Product change control
- Packaging, labeling and artwork
- Managing new product submissions and international registrations
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