An Integrated Approach to **New Food Product Development**

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8 Consumer Packaged Goods Product Development Processes in the 21st Century: Product Lifecycle Management Emerges as a Key Innovation Driver

Chip Perry and Max Cochet

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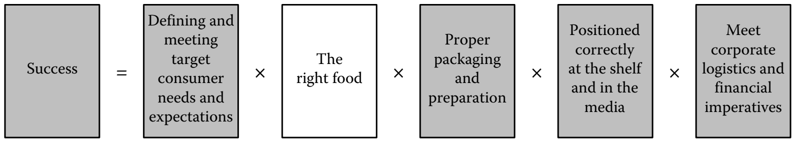

8.1 INTRODUCTION: THE CHALLENGES FACING CONSUMER PACKAGED GOODS COMPANIES

The increasingly competitive environment of the Consumer Packaged Goods (CPG) industry means more emphasis than ever will be placed on developing and sustaining new products. These must match both product functionality and consumer needs and desires in the most innovative way possible. Over the last decade, an accelerating number of challenges have influenced the way CPG companies approach new product development, pushing them to focus on innovation to maintain, or to gain competitive advantage.

At least four trends drive change and create new demands on product development:

Consumer requirements are becoming more elaborate. Consumers in today's developed countries are more educated than ever before about product quality and functionality. They require that the market offer them a greater choice from which to select and purchase. Today's demanding consumers no longer just want low-priced products, but also want them to be of higher quality and more enjoyable to consume or use. In today's innovation process, it is critical to identify key consumer insights at the front end of the product design cycle. It also requires reusing past insights and market research from existing, failed, or successful products. In a world where consumption is a primary activity, consumers, want to be able to choose the products that consistently meet their needs and desires.

Increased safety and traceability requirements. Government regulations are becoming increasingly stringent. An excellent example is the new Registration, Evaluation, and Authorization of Chemicals (REACH) regulation for managing chemicals in Europe. Both government agencies and public opinion now demand total traceability and responsibility in case a crisis arises with consumer products (e.g., lead paint, melamine in fish, *Escherichia coli*, etc.). Saying, "Sorry, our systems couldn't trace the issue" is an invitation to a lawsuit. Being able to not only contain, but also to avoid quality breaches, is going to be more important than ever. This is especially true because supply chains are becoming global. The media report will relish the latest product recall 24 × 7; all while many formerly loyal consumers punish brands that break their brand promises.

Fierce competition from private label brands and niche vendors. Private Label Brands (PLBs) or National Brand Equivalent (NBE) threaten consumer brands. Because of their flexibility and innovation capabilities, private label companies can innovate and adapt faster, with greater ease and flexibility, in response to changing consumer demographics and new trends. The result is simple—they can develop new products that are superior in meeting consumers' needs. These PLBs have abandoned the outworn strategy of competing just on price. Many of these retailer brands achieve hefty margins, particularly in the Food and Beverage sector, and have become more that just "equivalents" to national brands. Now they compete effectively against the higher-end national brands by delivering superior quality, while charging higher prices. In response, major manufacturers are starting to change their marketing strategies. For example, PepsiCo Inc. recently came up with a creative way to launch its new energy drink Fuelosophy in order to shake up traditional retailers and respond to niche vendors' ways of doing business. It initially launched the product through Whole Foods Market's retail channel instead of using a more traditional mass-market campaign and distributing the product through conventional retail channels.

Do more with less. In addition to the increasing competition of private labels and niche vendors, the recent rise of energy and commodity prices has shrunk top and bottom line growth potential in most segments of the Consumer Goods industry. This has forced consumer product companies to make budget cuts. In addition, their employees are required to increase their rate of innovation. For example, a leading CPG firm has an annual objective to increase innovation by 5% while holding their employee headcount flat. Due to the typical lack of organization of existing Research & Development (R&D) knowledge assets, which prevents any reuse of information, companies are constantly forced to reinvent the wheel. Most employees are limited to seeking product development information based on whom they know instead of searching their company's knowledge databases online. As a result, companies hoping to increase throughput and worker productivity face a daunting prospect.

8.2 THREE KEYS TO INNOVATION SUCCESS

All of these are common issues for CPG companies. Tomorrow's winning companies will be those that understand and accept these challenges, and find ways to address them through processes and solutions focused on new product innovation. New product success requires excellence in three areas: (1) reducing product development cycle time, (2) increasing product development innovation, and (3) reusing company knowledge assets. In the twenty-first century, the ability to innovate better and faster than the competition trumps all other areas of competitive advantage.

Cycle time or time-to-market determines how fast a company begins to recoup its investment in a new product. It also ensures competitive advantage by beating a competitor while seizing both market dominance and share. First-mover advantage often locks in significant profit margins for the life of the product.

Increased product development innovation determines the extent to which a product gains and holds its consumer base. It ensures that the company has the ability to build out the product franchise through successive product innovations, enhancements, and line extensions.

The ability to reuse knowledge assets drives product development costs down by reducing the costs of having to re-create knowledge that already exists. Reuse builds on existing knowledge, thus avoiding costly rework and repetitive mistakes. It is astonishing that how many companies continue to recreate insights and knowledge they have previously generated. One food company commissioned exactly the same consumer research project three times over 6 years as successive new brand managers took control of the brand. Each time the research resulted in the same insights!

To achieve success in these three areas, companies must look to the factors that drive innovation: people, knowledge, and systems. The types of employees working in innovation vary widely from visionary executive leaders, insightful problem solvers, and technical experts to product developers who ultimately design the product or formulate the detailed recipe. The knowledge that drives innovation comes from many sources—existing expertise in the company, individual experimentation, and discovery of what works and what does not. Additionally, there are ideas gained from external sources or knowledge that is documented and built upon, as a product is first developed and then managed during its life in the marketplace. Systems enable employees to efficiently leverage the company's expertise and knowledge, as well as effectively generate big ideas and profitable products.

In the twenty-first century, the innovation *status quo* is being disrupted as the marketplace requires ever-greater new product success rates and bigger, sustainable products. Yet, companies consistently delay or miss new product launch dates, over-promise business results, waste vast amounts of time and company resources, and undercapitalize on leveraging their existing product assets and knowledge. As leading companies come to terms with this, they are starting to make exponential changes to materially improve the business of innovation. As a result the practice of Product Lifecycle Management (PLM) is emerging as a key driver of innovation.

8.3 MOVING FROM PRODUCT CONCEPTION TO MANAGING PRODUCT LIFECYCLE

In order to understand how PLM has emerged as a key innovation driver, it is helpful to explore the history of product formulating and design to provide perspective. During the last 30 years, CPG corporations made huge productivity gains by utilizing powerful new business process software applications, starting in manufacturing. The leading example is enterprise resource planning (ERP) software (e.g., SAP, Oracle), which was developed to rationalize and better organize the core corporate functions of manufacturing, finance, and purchasing. Over time, HR, sales, and even marketing have benefited from the software that streamlined core functions, eliminated so-called siloed or individually isolated work processes, and built powerful databases that distribute standardized, accurate, and timely data and information to employees working in, and with, these related functions.

The last area of focus has typically been R&D—an area where the improvement potential of systems and processes supporting the product design or formulation is vast.

For over 30 years, designers of "discrete" products, i.e., products built from blueprints, have used powerful computer-aided design (CAD) software. The design and building of cars, planes, and electronics would be unimaginable today without the capabilities of CAD to rapidly design and share product specs across a wide group of collaborators located around the world.

In the CPG industry, product formulators have developed ideas through scientific experimentation. Many still use laboratory notebooks to record and document the experimental processes that led to a final formula, manually recording the endless trials to iterate a formula until the best combination of ingredients results in a winning product. Today, in addition to paper laboratory notebooks, companies still use spreadsheets as well as homegrown legacy systems for product formulation processes. Often these systems contain calculations or algorithms that have never been validated for accuracy. Yet, they continue to generate critical product data that the corporation believes to be accurate.

Importantly, data remaining in a paper form "dry dock" greatly hobbles the type of fast-paced, iterative, and collaborative bench-work necessary to remain competitive through innovation. The hard work of creating hundreds or even thousands of iterations of a product formula, then refining it until it is optimized, demands persistence, fortitude, and the adoption of processes that only today's software systems can make possible.

In the last 10 years, formula management systems, the process manufacturing equivalent to CAD systems, have emerged and matured. They offer sophisticated "management" capabilities to the product formulator as well as to others who interact with a formula, as it progresses from initial ideation to manufacturing. These systems, known as "authoring tools," are designed specifically to aid and enhance the design phase of product development. These software applications capture data as formula progresses from idea to final form, recording data that reflects the complete detail involved in each phase of work, as well as organizing the information so that all relevant data are linked to the final product.

The best authoring tools can eliminate recording in notebooks, enabling formulators to design, analyze, and iterate seamlessly until the right combination comes together to create or enhance a product that delights the intended consumer. Additionally, authoring tool applications open up the development process by encouraging cross-functional collaboration with specialists, which include, but are not limited to, raw material sourcing, regulatory, analytical testing, marketing, and many others.

Figure 8.1 shows a development idea progressing from concept to experimental to regulated states of product. Formulation designs mature as review and approval stages are archived. As the concept is refined and tested with consumers and customers during the experimental phase, samples, and prototypes are developed. These prototypes contribute to the increasingly complex data streams needed to track all changes made based on test results. Similarly, during the regulated phase, all formal tests are conducted and results studied and recorded to support regulatory approval of the final formula, which is then promoted to a production-ready state and handed off to manufacturing.

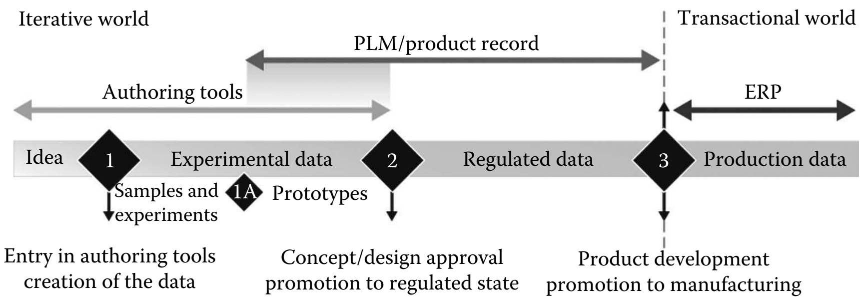

FIGURE 8.1 Formulated products and product lifecycle states.

Today, R&D organizational work processes focus on generating the final specification that is handed off downstream to manufacturing. This work generates the equivalent of 5% of the total information created. More importantly, 95% of the effort and knowledge created along the way, critically vital information, ends up being lost unless processes, systems, and databases are in place to capture these critical organizational assets.

Formula-based organizations serious about increasing innovation often begin by improving the primitive tools used by their formulators. The evolution beyond paper-based records and spreadsheets located on disparate, scattered laptops begins by improving the management of corporate knowledge and intellectual property assets. Effective authoring tools match the required underlying chemistry and formulation science expertise to the appropriate software vendors offering third-party formulation management tools. A number of authoring tools that possess industry-specific procedures have matured: they bring together industry standards and best practices, e.g., for the personal care and cosmetics, paints and coatings, and food and beverage industries, respectively.

Formulation software-specific functionality greatly increases productivity. For example, "where used" search capabilities scan across an enterprise to show the formulator who has worked with the ingredient of interest and what has been learned about it. The ability to compare a number of different formulas displayed in columns across the screen inspires the formulator to experiment, to learn, and to easily retrace steps, and determine exactly where the optimization occurs in a formula. Ultimately, sophisticated and powerful authoring tools deliver the right information to the right person at just the right time, regardless of time zone or location, enabling collaboration with peers, wherever they may work around the globe.

As an organization begins to advance its formulation and product design processes, the impact spreads beyond R&D. It becomes increasingly able to create connections and interactions across a broader array of business functions, such as packaging design, marketing, and manufacturing, in order to bring a new product to market. As a result, organizations begin to ask the questions that will lead, ultimately, to the PLM transformation such as

- How good are our processes?
- What are our strengths and where are processes underdeveloped?
- How does our company compare against the best in our industry?
- Which companies excel in organizing their product development resources and what benefits do they get as a result?

Asking these questions and benchmarking against other companies and industries have helped them to learn about and begin to value the discipline of PLM as a way to significantly improve their entire product development area.

8.4 EVOLUTION OF PRODUCT LIFECYCLE MANAGEMENT

Over the past decade, manufacturing companies in industries such as High Tech, Automotive, and Aerospace have aggressively adopted technology solutions to enhance the productivity and efficiency of their innovation and product development activities. They did so in order to respond to many innovation challenges caused by their competitive environments. Companies had to constantly reduce cycle times and time-to-market, increase throughput while improving product quality and safety, while ensuring that they were offering products that a customer would buy.

These technological solutions evolved over time from initial stand-alone product development authoring tools—such as CAD, file management, workflow, and collaboration organized around product data management (PDM). They developed into information technology platforms called PLM solutions. These solutions integrate complex networks of both point-solutions and collaboration work processes, supporting product development activities.

PLM solutions enable the management of product data from the early (and fuzzy) steps of ideation to the end-of-life of products on the market. The CPG PLM Platform comprises as many capabilities, applications, and work processes as are found in today's product development processes, functions, and work areas. A diagram of these different tools for the CPG industries appears in Figure 8.2.

Typically, the core areas represented in a general PLM model for CPG contain PPM (Project and Portfolio Management); Packaging, Artwork, and Labeling; Authoring tools (CAD/CAM tools for blueprint-designed products as used to design products like razors, blades and packaging); and Formula Management tools (tools for recipe/formula-developed products found in process industries). Other work capabilities such as regulatory approval, testing, claims, intellectual property, and patent management are included in more detailed depictions of PLM.

PLM data are much more complex and challenging to manage than the transactional data found in ERP systems. The assortment of activities is both structured (database structured in rows and columns, essentially the 1s and 0s of numerical depiction of data) and unstructured, that is, data and information created in tools such as Microsoft Office Word, Excel, and PowerPoint and other applications. This

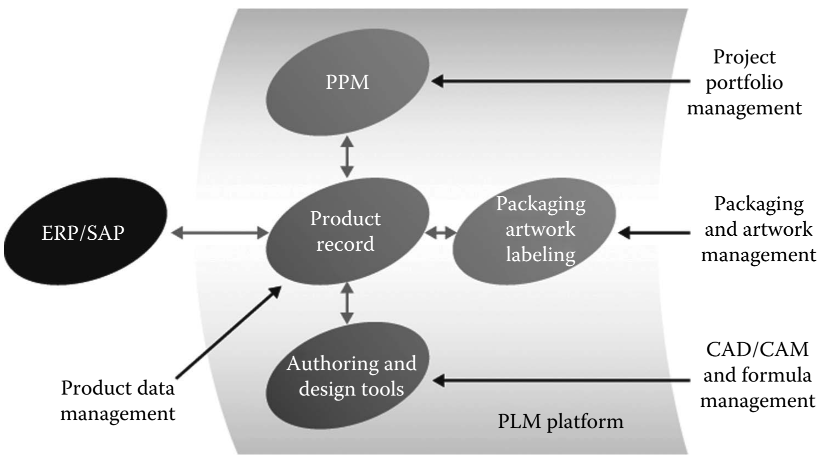

FIGURE 8.2 PLM defined for the CPG industry.

mix of data types always exists, so the PLM systems must be able to manage both types. In addition, the data generated within the PLM platform are also highly iterative, as later work builds on earlier versions until the final formula, package, or project plan is complete.

The key turning point in the evolution of PLM, and really the birth of PLM as a discipline, occurred when software vendors started building their solutions around a single concept. The concept was master data management for all data that relate to product development. Since all product development activities have at least one thing in common, namely they relate to a specific product, the data that they produce have been centrally organized by product in order to maximize access, reuse, and transfer of this information.

The heart of successful PLM is PDM, enabled by a data model called the Product Data Record (PDR). Whereas PDM does not have the scope and the capabilities of PLM, it contains the PDR, the building block which "pumps" essential information from and to the different applications composing the PLM platform. PLM is not possible without first creating a single version of the "truth" for all product data through the PDR.

8.5 AT A CROSSROADS: PLM AND THE CONSUMER GOODS INDUSTRY FINALLY READY FOR EACH OTHER

CPG companies lag discrete industries such as aerospace and automotive in terms of PLM adoption by about 10 years. But CPG companies have taken note of the vast improvements PLM has brought into discrete industries. CPG companies are beginning to understand how they can also benefit from such solutions to help them drive product innovation. PLM implementations can greatly enhance an enterprise's bottom line by delivering a potential 5%–10% revenue uplift* as well as considerable savings and productivity improvements in product development activities.

Typically PLM benefits are:

1. Condense product time-to-market and time-to-profit by at least 30%: CIMdata cites an example where the development time for a household product was reduced by 75%—from 18 to 4 months.† This equates to more revenues due to improved market penetration (e.g., in food and beverage, a 3 month difference in product launch can equate up to 30% in market share) but also frees up R&D capacity to work on other new product development projects and improve innovation throughput.
2. Reduce product development costs by 10%–40%: The building of prototypes can be reduced by 15%–30%. Pratt & Whitney Canada reports saving $500,000 per engine by eliminating maintenance prototypes due to PLM.‡ Boeing affirms that it was easier to assemble the first 777 plane than it was

* CIMdata Report "Product Lifecycle Management: Empowering the Future of Business," 2002.
† CIMdata Report "Product Lifecycle Management: Empowering the Future of Business," 2002.
‡ "V5 PLM in Aerospace: Enabling Innovative Products for a Better Future" by Alain Houard, Dassault Systèmes.

to assemble the 747 after 20 years of production, traceable in part to a 90% decrease in engineering changes.* The aerospace giant's new plane, the 787, will be designed completely virtually, using a PLM platform linking more than 300 suppliers.

3. Improve innovation workers' productivity by 20%–30% and augments collaboration: For instance, PLM systems can reduce the engineering review process by more than 80% or from 12 to 2 days.† Because of improved collaboration, projects spend less time in idle. Virtually no time is wasted doing the thankless process of reviewing and modifying out-of-date data.
4. Guarantee compliance and allow traceability back and forward from any lifecycle state of a product, ingredient, process, or idea from concept to commercially available product: Tyco Healthcare improved its new products compliance with the Food & Drug Administration's 21 CFR Part 11 regulations by 30%.‡ A recent Aberdeen report§ points out that companies that put in place PLM technologies can identify and meet compliance requirements early in the product design process and achieve significant results, such as a 27% product-recall reduction and a 31% improvement in the number of products in compliance.
5. Facilitate the reuse of existing knowledge assets (Knowledge Management): Managing all product data generated during development is a tremendous way to sustain innovation goals, while reducing development costs and risks. Furthermore, knowledge management helps a company stop "reinventing the wheel."
6. Rationalize IT infrastructure: Dell realized a 30% reduction of their global PDM infrastructure.¶ Industry research typically cites 15% reduction in IT support.

The six benefits identified above have been validated by multiple PLM implementations in the automotive, aerospace, and high-tech industries. In comparison, there are still very few large CPG companies that have "implemented" PLM to the same scale. Part of the reason is that the CPG industry is still a technologically reactive industry, as shown by its late adoption of ERP and other technology enabling solutions. But PLM solutions have improved so much, particularly in terms of virtualization (enabling modeling, testing, visualization, etc.) and data integration (making cross-functional data exchange and reuse, and traceability a reality), that significant possibilities are now achievable for CPG companies. Importantly, best-in-class PLM solutions have matured in their architecture, and now have a unique data model at their core, centrally defining and managing product data.

* "V5 PLM in Aerospace: Enabling Innovative Products for a Better Future" by Alain Houard, Dassault Systèmes.

† CIMdata Report "Product Lifecycle Management: Empowering the Future of Business," 2002.

‡ Oracle Agile Web site (http://www.agile.com/customers/index.asp).

§ Aberdeen Report "The Product Compliance Benchmark Report: Protecting the Environment, Protecting Profits," September 2006.

¶ Oracle Agile Web site (http://www.agile.com/customers/index.asp).

In the meantime, as discrete industries reach maturity in PLM, growth for software solutions sales is maturing and PLM vendors are looking for new industries to penetrate. They are just starting to understand the unique challenges to the CPG industry and are developing CPG-specific solutions as a result.

8.6 INNOVATION CHALLENGES MAINLY ARISE FROM THE DIFFICULTY IN ACCESSING AND REUSING EXISTING, PRODUCT-RELATED KNOWLEDGE

CPG companies characteristically lack internal product data organization. Whereas companies invest heavily in branding to ensure that the consumers can easily find their products in a crowded market, their internal product data are decentralized and scattered, making it impossible to find and reuse. This situation is exacerbated when data "creators" are transferred across brand assignments, functions, and geographic locations. As such, today's CPG search methods are ineffective, with employees seeking critical product data by looking for those who did the work, or possibly by a search of intranets and local file systems. When it becomes impossible to find critical knowledge assets quickly, employees default to recreating the data they seek, or alternatively, plunge forward based only on intuition. In fact, a recent study reveals that up to 77% of employees search for data in multiple places, then manually combine the results.*

The lack of information technology systems and formal processes to manage product information creates gaps between existing knowledge in the company and the amount of information needed to be created. Product development activities require specific expertise, resulting in the tendency for information to reside in silos. In the least technologically advanced CPG companies, this tendency toward silos means information is stored on people's hard drives, in handwritten notebooks, or even in their heads. For more advanced CPG companies, the multiplication of best-in-class IT systems has created new silos of information, and data reside in point-solutions. In such cases, integration between systems is only partial, even when it exists the infrastructure is inadequate for managing product development information.

Clearly, in all cases, employees cannot find information when they need it—either because they do not know it exists, they cannot find it, or they do not have access to it. With industry research indicating that engineers spend as much as 30% of their time searching for data,† the consequences of lost time and opportunities to reuse valuable information assets are significant. If they can address this problem, then CPG companies will be able to increase reuse of existing knowledge, increase traceability of information, reduce inaccuracies, and eliminate the manual rekeying of data. All of these benefits will lead to the reduced cycle-time, increased throughput, and information accuracy, and, therefore, help companies to better respond to the challenges they face.

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*Kalypso Report "Advanced Information Access: The Application of Search Technology in Product Development," May 2008.

† Tenopir/King: Communication Patterns of Engineers, 2004.

8.7 PRODUCT DATA RECORD: THE HEART OF PLM

PLM solutions help tackle the challenges of managing product information, but only if they are guided by a vision and strategy leading to the adoption of a true technology platform. For CPG, developing a PLM strategy is the prerequisite for achieving substantial results comparable to those in other industries. The first step in defining a PLM strategy is to understand, define, and map the data needed and produced across the development lifecycle of a product. Some activities are done similarly across the CPG industry—e.g., testing or regulatory and safety analysis—but there is no one-size-fits-all solution. Companies have to map their processes and data individually. This begins with creating the PDR. The different constituencies who must be involved in the creation of this information map are shown in Figure 8.3.

A CPG company's most valuable innovation asset is its product development data. These data consist of not only information defining the product, but also all of the knowledge that was created during the development of the product, from ideation, to launch, through end-of-life of the product—even experimental iterations that either led to a final product or remained at an idea, concept, or semideveloped state.

The PDR is the single version of truth for a company's product data and associated product-related data. The PDR defines all the data elements and their relationships needed to fully describe a product lifecycle. As the single version of truth, the PDR is the heart of PLM, and successful product management is not possible without it.

In order to maximize the reuse of product data and take advantage of its value as a source of innovation, companies should manage product information as one data model. The PDR serves as a powerful information management tool that helps companies regain control of, and manage their product data. With the amount of information increasing as a project progresses through product development phases, it is crucial to manage the information lifecycle in order to keep track of all valuable product knowledge created (Figure 8.4). Additionally, there is a great value in keeping track of data from earlier stages, in order to go back and reuse these data for future development initiatives. Both successful and failed experiment results have to be captured and placed in searchable databases. Unused discoveries and conclusions for

Business Function	Business Function
Analytical	Microbiology
Artwork	Modeling/simulation
Brand	Nutrition
Claims	Packaging design
Consumer relations	Packaging development
Engineering	Process development
Formulation	Procurement/purchasing
Health, safety, and environment/sustainability	Quality assurance
Initiative and portfolio management	Raw materials management/specifications
Intellectual property/patent	Records management
Market research/consumer insights	Regulatory affairs/product stewardship

FIGURE 8.3 The different constituencies who will use the PDR.

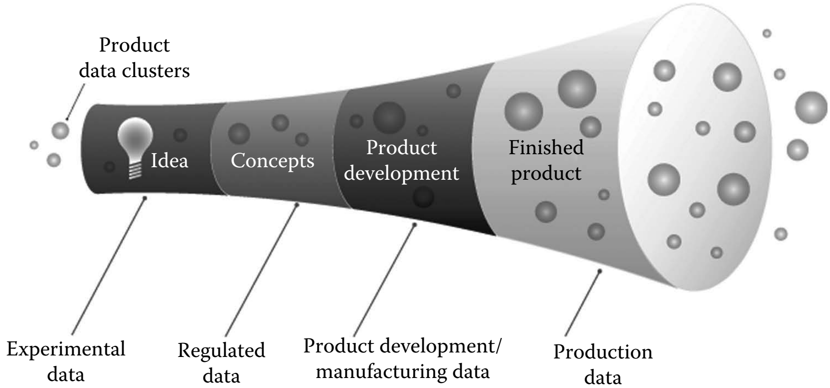


FIGURE 8.4 The nature of data that emerge during the development of a product.

one project can be extremely valuable jumping-off points for a new product concept development project, saving tremendous amounts of time and money.

The challenge for companies is to make sure that the single version of the truth—the most up-to-date, accurate information—is available at all times within R&D functions and beyond. The key to effectively organizing the product data is to organize it by product—a simple organizing principle that was overlooked for too long. Many companies, including leading innovators, have not found a successful way to organize product development information assets because they never considered this data management problem holistically. The PDR requires an enterprise-wide view of all innovation processes, which is a paradigm shift from organization by business units or functions to a true product-centric hierarchy.

The PDR is built on a conceptual data model, a map of information elements (*data entities* or *entity classes*) and their interrelationships (Figure 8.5). Specifically, the PDR describes data elements that are inputs or outputs of a work process, the characteristics that define them (*attributes*), and their relative interactions (*relationships*).

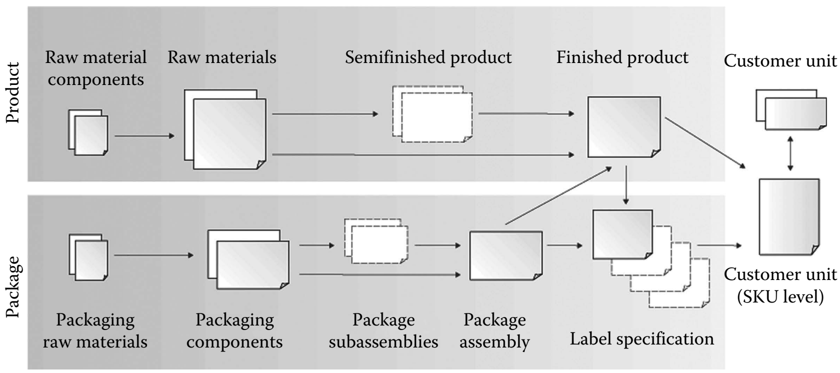


FIGURE 8.5 Product Data Record.

The Master Data model (or Level 2) shows all structured (information captured in a database) and unstructured (documents) data elements related to each Level 1 physical element.

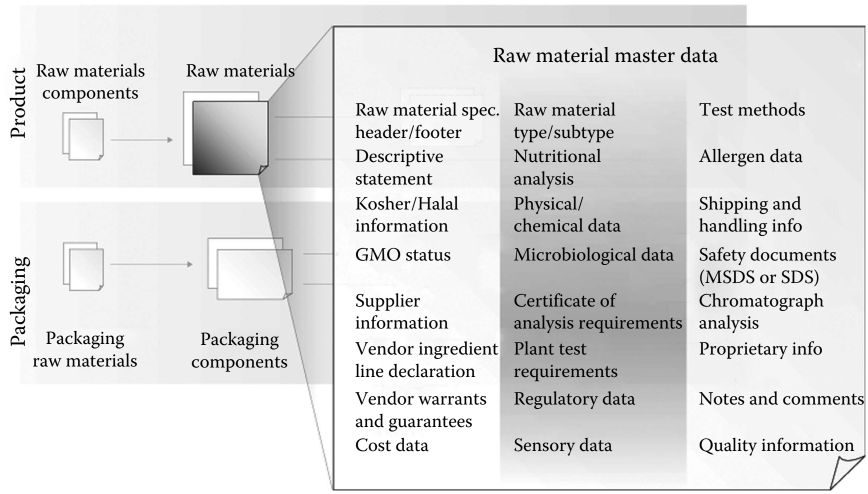


FIGURE 8.6 PDR Level 2: Master data elements.

It also documents the lexicon of an organization and its activities. This data model forms the basis of the central product database at the core of an implemented PLM system.

A PDR describes the high-level structural components of a finished product also called "Product Architecture" (e.g., raw materials, packaging subassemblies, formulation, and final packaging assembly) as we see in Figure 8.5. The PDR breaks down each of these physical Level 1 items into data entities. Figure 8.6 depicts an example of an exploded Level 1 and describes the data standards for defining raw materials information. The PDR characterizes the master data relating to each of the physical constituents of a product. At the lowest level of detail, the Data Field model, Level 3, references data fields associated with data elements and defines their standards as we see in Figure 8.7. Level 3 is where the PDR is translated into PLM software.

The first step in implementing a PLM system consists of defining the PDR, which is the foundation for a PLM strategy. The PDR forces companies to go back to the basics in terms of data management by defining (or redefining) data ownership or control of IT projects, how they fit within the overall strategy and how they answer true business requirements. This step offers an opportunity for IT and business managers to work together and understand each other's requirements, constraints, and strategies in terms of product development.

A list of what the PDR is and is not appears in Figure 8.8.

Once built, the PDR should be the documented "single version of the truth" for product data, acting as a reference for all current and future iterations of the product across the organization, work processes, and technology solutions. A best practice is to implement a PDR "sanity check" prior to going forward with any product data-related projects. Because the PDR and the PLM strategy must be synchronized, this

The data field model (or Level 3) references data fields associated with data elements and defines their standards. It helps the translation of the product data model into an application landscape

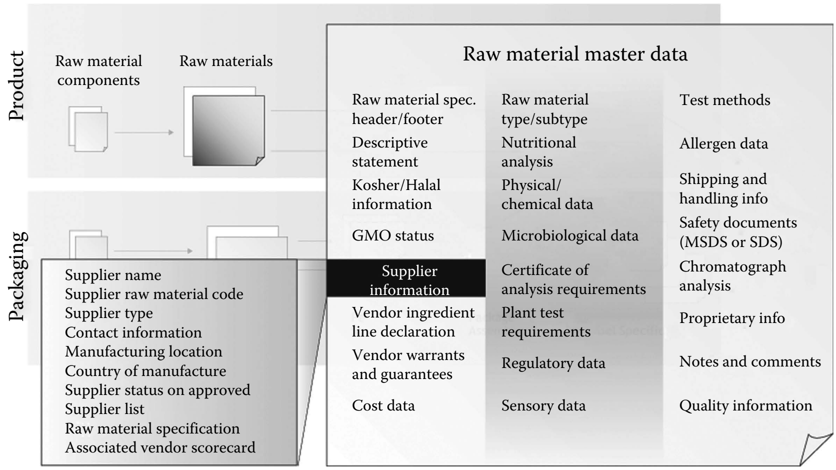


FIGURE 8.7 PDR Level 3: Data fields.

The PDR is...	The PDR is not...
The key to identifying information assets	A one-size-fits-all solution
The way to identify and understand the work that gets done between functions	A giant database
A framework for knowledge reuse	A system or application
A methodology to standardize types of information	A replacement for existing programs
The blueprint for PLM processes and systems	A process reengineering effort

FIGURE 8.8 What the PDR is and what the PDR is not.

verification keeps everyone in the company moving in the right direction, restating every initiative's tactical intentions as part of the higher-level objective.

PLM evolves into a framework that combines technology solutions with organizational and work process concepts and designs. The combination of diverse information integrates capabilities and further enables product development. This concept is sometimes hard to grasp for various functions dispersed across the company. Yet the PDR is a powerful tool that allows one to concretely document the PLM "blueprint" and map its scope, capabilities, and objectives. And very much like a building's plans, the PDR has different levels of details. Whereas the architects use a blueprint to build the house in detail, the owner just wants to make sure that the kitchen and the dining room are next to each other. Similarly, the PDR should be used as training materials for IT and business resources, because it draws a complete picture of how intellectual property assets are created and used in a company.

8.8 KEY FUNCTIONAL BENEFITS OF THE PRODUCT DATA RECORD

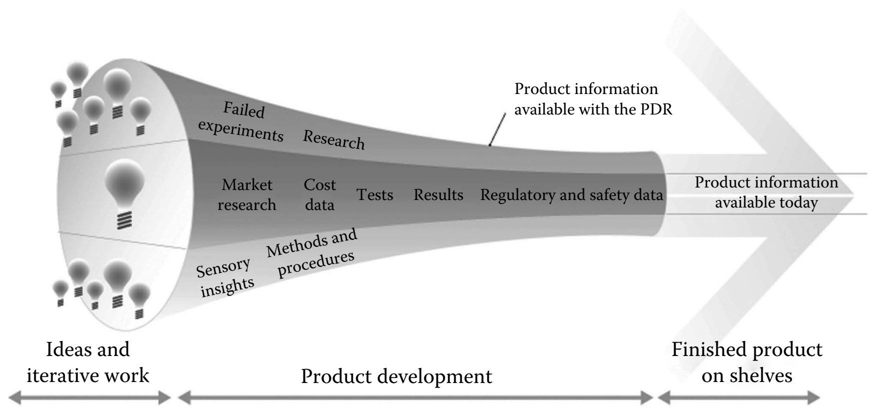
The information that the PDR provides is schematized in Figure 8.9.

Whereas there are many benefits to the PDR, here are a few from different business activities in the product development process:

Product design: The data contained in a formula or engineered product blueprint are the essential DNA sequence that describes what a product is and how to make it. Although preserving the final design is essential, it is of tremendous value to the organization to assess and learn from the iterative design work generated during the entire design process. This historical information often provides the raw materials and the toolbox for designing the next new product.

Packaging: The information on a consumer product's packaging comes from multiple locations. Best-in-class CPG companies have integrated their packaging activities downstream, from the package design to manufacturing. Most companies, however, still lack the upstream information from product development to package design. Although ingredient information comes directly from the finished product's formula, some information comes from suppliers. This information varies from allergen information for food products to controlled substances in personal care products. Product claims can also come from marketing or other dedicated departments. One of the major benefits of the PDR is integrating the two information branches of product development and packaging development to identify and characterize the business requirements, and as a result, document the best way to create those data linkages.

Product claims: The data supporting a claim, necessary to its defense, often reside in different places, and target different functions (e.g., project documents for Project and Portfolio Managers, recipes for formulators, design files or key lines for package



Each successful product launch takes the most superb innovators dozens of product ideas and an inconceivable number of iterations. But it does not mean that companies have to lose all this valuable knowledge and have to keep reinventing the wheel again and again. The PDR helps track this information back and re-use it for future product development work.

FIGURE 8.9 The types of information available in the PDR.

designers, etc.). The PDR creates the links between these functions, maps the information, and links it to the development of a product. The happy outcome is that information can flow between functions and changes can cascade quickly and effortlessly. Workflow can generate a robust claim justification and route the documentation for legal review.

Traceability: Traceability is an essential requirement for CPG companies. They must manage product data with the objective of consistently meeting or exceeding regulatory standards to avoid or quickly manage any crisis that could damage their brand, like *E. coli* outbreaks, or the recent Chinese pet food crisis. Because the PDR manages data across the full product lifecycle, from idea to manufacturing, it ensures compliance by enabling full traceability throughout the development phases and manufacturing, through to suppliers. This gives companies a process to react quickly during product recalls.

Figure 8.10 illustrates an example where a company receives a consumer complaint signaling the potential presence of an allergen in a candy bar, despite the label claim that the product is "allergen free." With the help of the PDR, the company can quickly identify which plant was involved in the manufacturing of this particular final product, as well as identify all the parties involved in the supply chain. The final and intermediate formulas link to ingredients, which trace back to suppliers. In a matter of minutes, the company can require all involved suppliers to confirm that none of their products contains the allergen.

Regulatory, environmental, and safety: A product Material Safety Data Sheet is an example of a document that contains information that is dispersed in different

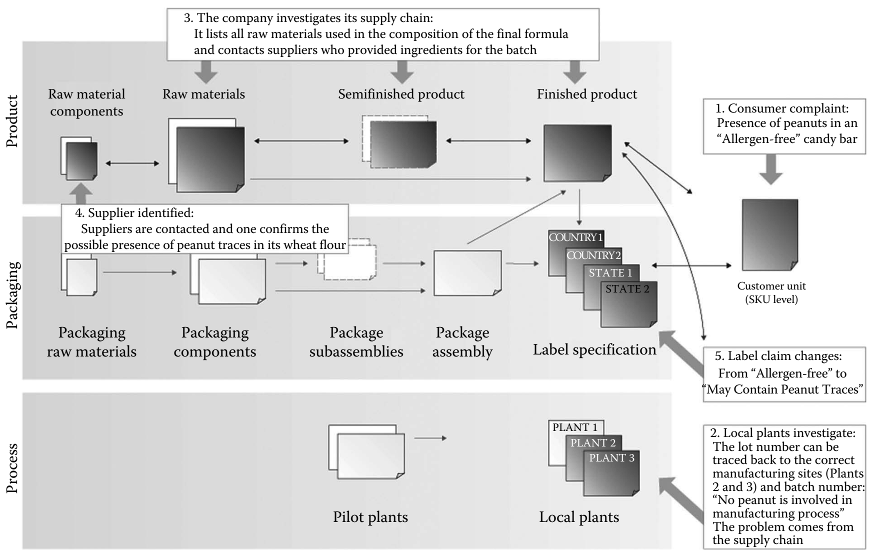


FIGURE 8.10 Course of a consumer complaint using the PDR.

locations and formats across the company and its customers. Data come from various sources, such as formulators, analysts, toxicologists, microbiologists, and procurement. Without central management, data exchange cannot be efficiently enabled, causing data duplication, version control, and data accuracy issues. The PDR drives standardization and classification of these data and builds a unique, evolving, and traceable data record.

Procurement: The PDR is the blueprint to understand what data can and should be shared across functions to improve the procurement process and maximize economies of scale and other savings. Examples of such savings include version control of purchasing forms, guaranteeing accuracy, and allowing reuse of existing purchasing knowledge. Most importantly, the PDR enables the delivery of real-time raw material costs to the formulators at the point when they select the supplier from which they will source the ingredient for this product formula. By selecting the lowest ingredient cost when the product is first formulated, formulators lock in the cost for the life of the product.

Project and portfolio management: Leading innovative companies in the CPG industry focus their efforts on innovation projects that are driven by market needs, with their actions driven by their product strategy. To attain this level of strategic planning, companies prioritize projects through sophisticated portfolio management. Companies anticipate needs and outcomes via technology roadmapping. The PDR allows companies to improve resource planning by seamlessly integrating information for product and packaging development, ingredient and materials selection, and production planning. The PDR also improves the vision of current and past product development projects, and links them to portfolio management. This linkage helps companies define clear development strategies that leverage product platforms and core competencies.

Knowledge management: All too often, employees cannot access information easily and on a timely basis. Many employees working on managing new product development projects consider it easier to start over than try to find past concept and project information. The PDR links existing knowledge with in-context product data. The PDR structure offers a way to track back to previous relevant initiatives by searching by-product characteristics, specifications, concepts, or just key words. This integration encourages greater reuse of information/design and increases general knowledge of what has been done in the past (i.e., company's knowledge assets) as well as ensures and maintains knowledge during typical team member transitions and personnel turnover.

8.9 SUMMARY

Building and managing the PDR is a prerequisite to PLM initiatives targeted at improving innovation. The PDR improves the innovation productivity and becomes the core of a PLM strategy for the following four reasons:

1. It contains all critical information necessary to design, produce, and modify the product, helping as a result to define a PLM strategy.
2. It defines the product hierarchy by using this concept as a key logical construct for the classification and management of product data. The PDR defines relationships between data elements as well as integrates structured and unstructured types of data.
3. It contains linkages to the authoring tools used for the conception and development of a product. The PDR allows traceability to previous iterations of the concept, and to previous lifecycle states of a product in development.
4. It identifies areas of opportunity to streamline, standardize, and integrate systems and processes to help accelerate speed-to-market, reduce costs, increase knowledge reuse, and guarantee data integrity.

The CPG industry has the opportunity to improve innovation productivity by adopting PLM solutions, following the proven example of other industries. By identifying the areas wherein they can make significant process improvements and by integrating their initiatives through the PDR, CPG companies can generate significant innovation gains and increase the likelihood of success in new product development. The most innovative CPG companies have already embarked on the PLM journey and will likely reap similar or greater productivity and cost savings benefits than companies in precursor industries because of three reasons:

1. They have access to proven PLM technologies (including virtualization, collaboration, and data management capabilities).
2. They will benefit from the lessons learned by discrete companies during their adoption of PLM, and concept similar to the PDR. The knowledge of "what works, and what doesn't" coupled with state-of-the-art models about data use will advance the design and potential of PLM implementations in process manufacturing.
3. PLM vendors are committing to tailoring their solutions to specifically meet the needs of CPG companies.

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