Summary

Whether you are in the process of re-evaluating your existing ERP application or planning to install your first packaged system, your success will be highly dependent on identifying ERP applications, with a strong process manufacturing foundation, that can support your unique requirements with minimum customization.

This practical guide links the unique operations of process manufacturing to specific ERP capabilities. The key system requirements as well as the most common functional gaps are explained in plain English. Case study references from food & beverage, life sciences, chemicals and other process industries provide insight into the value of ERP systems designed for process manufacturers and the costs associated with using the wrong systems.
Addressing the Unique Requirements of the Process Manufacturer

The vast majority of ERP systems on the market today were originally designed for generic use across a broad array of industries such as aerospace, public sector, banking, etc. The majority of these ERP systems incorporating capabilities for manufacturers were designed for discrete manufacturing. Over the years, process manufacturing “extensions” have been added to these systems in an attempt to address the unique needs of process manufacturers such as those in the food and beverage, life sciences, chemicals, metals and natural products industries.

Although these process manufacturing extensions may appear to address the unique needs of process manufacturers, when put into practice, many companies discover that they do not work effectively and create significant and unacceptable risk and overhead. The fact is that the underlying data model and functional capabilities of a process-oriented ERP application are inherently different than those of a generic, broad-based or discrete-oriented ERP application. Unfortunately, during the course of a typical software evaluation, it can be very difficult to identify the critical shortcomings without knowing exactly what to look for.

This “practical guide” examines these critical areas in terms of key ERP functional capabilities, data model characteristics and enabling technologies, specifically focusing on:

- The accountability (including actual SKU costs and profitability) and management of ingredients, raw materials and finished products, including co-products and by-products
- The ability to predict yields, scale production, cost products and perform product recalls
- The effect of variable product characteristics and inventory attributes, including multiple units of measure (UOM) and shelf life, on various ERP functions, specifically inventory management, order management, production scheduling, manufacturing management, quality management and product costing
- The impact of the ERP data model on the application’s functionality and its required customization overhead and ongoing maintenance
- The need to incorporate various technologies to improve visibility, collaboration and system interoperability

To further assist your ERP evaluation process, a summary of these critical areas is provided in the form of a Process Manufacturing ERP Checklist which can be used to facilitate side-by-side comparisons and ensure that no critical requirements are overlooked.

Your software provider’s industry experience, expertise and support should be considered, in addition to the product architecture and capabilities, during your ERP evaluation process. The companion paper “Essential Guide to ERP for Process Manufacturers: The Keys to Selecting Your Software Partner” offers additional insight and guidance into the importance of a software provider’s industry focus, its product adaptability and resulting total cost of ownership.

The Right Process Specification For The Right Type Of Manufacturing

The process specification is at the heart of all manufacturing processes. It specifies the required processes, the inputs and outputs, the required labor and instructions, and the required equipment and settings. One key difference between a process-oriented ERP application and a generic, broad-based or discrete-oriented ERP application is in its definition and usage of the process specification.
In discrete manufacturing, a multi-level bill of material architecture (BOM) is employed to produce one finished product in its base unit of measure, from one or more inputs. In process manufacturing, a recipe or formula specification is employed to produce one or more finished products in bulk quantities of a specific unit of measure (including expected co-products and by-products), from one or more ingredients.

When a process manufacturer chooses to employ a generic, broad-based or discrete-oriented ERP application to produce one or more finished products, based upon BOM’s, then that manufacturer will be challenged in these areas:

- Estimating the yields of co-products and by-products per job.
- Calculating available-to-promise and capable-to-promise of products with respect to production of co-products and by-products.
- Scaling production yields up or down based on ingredient levels or product output levels.
- Costing of co-products and by-products.

Why the challenges? An ERP application that uses a BOM simply does not properly account for and manage multiple finished products produced by many process manufacturers.

In a multi stage process, there are intermediate products that need to be managed as produced or consumed products or both (e.g. recyclables, such as energy or steam). For example, when steam from the one process stage is recovered and used as an energy input to a second job, it is a by-product of the first stage and an input to the second stage. The process-oriented ERP application should be capable of reducing the cost of the first stage by the value of the steam used in the second stage. In the event that the energy is sold to a customer to generate revenue, it is then classified as a co-product with its revenue taken into consideration during product costing.

Variable product characteristics, such as potency grade, pH, or moisture content, determine the ingredient proportions and equipment settings in certain process stages in process manufacturing. To effectively manage this variability, the process-oriented ERP application should allow manufacturers to make adjustments to their “base” recipe or formula specifications, in terms of ingredient proportions and equipment settings, without affecting the definition of the original “base” specification. Variations of recipe or formula specifications can also account for differences between plants, shifts, production lines and equipment, as well as customer requirements (e.g. private label products).

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Summit Industrial Products, a synthetic lubricant manufacturer and a member of the Kluber Group, offers private labeling to its customers. Gear lubricants, hydraulic fluids and compressor lubricants are blended and stored in large volumes in tanks. The fluids are packed out based on color of container, size of container, and label on the container. Kluber can have an infinite number of private labels associated with one core part code. “For instance, our product is SH-46 is our lead compressor lubricant product. Well, I may have 200 private labels associated with that. The core recipe is still the same, but it gives me the ability to name it something unique in the system, to track it that way, to give it a unique color of pail, to give it a unique unit of measure—any other unique requirements that the customer requires. Some customers, for instance, may have three or four different names. They may have three or four different private labels of the same product, calling it different names”.

*Kelly Starr, EVP - Finance & Administration*
Flexible Specifications Supports Multiple Processes

Single stage assembly, multi stage assembly and packaging are the standard processes that are executed by discrete manufacturers. A generic, broad-based or discrete-oriented ERP application executes these processes based upon a multi level bill of materials (BOM) and a set of routing instructions. It's important to note that in a multi stage assembly job, a work order must be defined, planned and executed for each stage. In each stage, the work order must create inventory for the outputs, transfer the output inventory from this stage to the next following their associated routing instruction (defined in another file), and then consume the output inventory so that it can be used as input for the next stage. As a result, a great deal of time and effort can be spent on BOM and routing maintenance, and inventory management.

Batch reaction, mixing, blending, cooking, continuous flow as well as packaging, are just a few of the processes that can be executed by process manufacturers. A process-oriented ERP application employing a recipe or formula specification is capable of executing a one or more process stages in concurrent, convergent and/or serial fashion within a single process specification. The intermediate inventory between process stages are automatically transferred from one process stage to another in terms of both inventory adjustments and routing. The routing instructions are defined within the receipt or formula specification to ensure the routing is in sync with the defined process stages. Recipe or formula specification and routing maintenance, as well as inventory management are simplified.

Litehouse, a leading manufacturer of refrigerated dressings, dips and sauces, streamlined its manufacturing processes by linking recipe specifications together. For example, salad dressings are produced, using batch processes, which then feed a continuous process of cooking and packaging. With their process-oriented ERP application, Litehouse realized substantial cost savings in less than a year, increasing product fill rates by 10 percent, while simultaneously reducing finished goods inventory by 6 percent, saving considerably on carrying costs.

Disassembly is one process that truly distinguishes a process-oriented ERP application from a generic, broad-based or discrete-oriented ERP application. As mentioned before, a BOM is designed to produce a single output from a set of inputs. Process manufacturers who employ a BOM for a disassembly process find themselves performing certain "workarounds", such as entering negative values for the input quantities of the BOM inputs. By definition of its process specification, only a process-oriented ERP application employing a recipe or formula specification can accurately manage the disassembly process and provide full accountability of all finished outputs without the need of any "workarounds".

Discrete packaging is managed by a process-oriented ERP application using a recipe or formula. The ERP application should be able to link process specifications and packaging specifications together, but maintain them separately in order to

- Produce different finished products that are similarly packaged.
- Produce "brite" stock for future private labeling.
- Avoid process specification maintenance every time there are packaging changes, and vice versa
Planning a single or multi-stage production jobs based upon “rates” (i.e. quantity per unit of time) is a standard mode of production. The process-oriented ERP application should support a “time per batch” mode, and “input based” and “output based” disassembly modes. For example, a leading chicken processor employs a disassembly process that is based upon the chicken head count to be processed (“input based” disassembly), rather than the quantity of meat to be packed (e.g. produce a specific quantity of chicken breast packages following the traditional “output based” disassembly process).

Flexible recipes and formula specifications allow process manufacturers to model their unique manufacturing processes in a series of controllable and repeatable process stages.

**Better Accountability Results In Better Predictability and Scalability**

Predictability and repeatability enable manufacturers to accurately forecast yields, standardize business processes and improve customer service levels. Predictability and repeatability are dependent on how well an ERP application can manage material and process variability, and account for all raw materials and finished goods in the manufacturing process.

Production jobs are highly predictable and repeatable in discrete manufacturing because of the low degree of product variability. The expectations in discrete manufacturing are that only one finished product will be produced and that the produced parts will either be accepted or rejected. With a higher degree of product variability in process manufacturing, the tendency is to expect its projection jobs not to be highly predictable or repeatable. But in fact, a process-oriented ERP application that employs recipes or formulas can account for and manage all raw materials and finished goods, therefore can deliver a high level of predictability and repeatability.

Since implementing their ERP solution, NexGen Pharma, a leading contract manufacturer of pharmaceuticals, vitamins and other nutritional supplements, has achieved a 60 percent revenue growth while streamlining their manufacturing processes. The ERP application’s ability to manage raw materials in its formulas was a contributing factor in streamlining its processes. For example, in situations when a recipe calls for an ingredient with 10 percent potency but finds only ingredients of 20 percent potency in stock, the formula can be adjusted based upon this alternate ingredient. By directing operators to dilute the inventory to achieve the specified final potency, the desired potency can be achieved. In addition, the formula can be adjusted to maintain other key product characteristics, such as total volume or size of the final product. This ability to adjust formulas is of particular importance for the NexGen Pharma OTC products, since its pills and caplets must be produced to meet specific size tolerances, therefore the internal ingredients must varied to maintain a specific strength, and the expected yields.

Predicting and optimizing the yields of multiple outputs of a production job is very difficult for a process manufacturer that runs a generic, broad-based or discrete-oriented ERP application employing a bill of materials (BOM). By definition, a BOM can not model intermediate products, co-products and by-products. Only a process-oriented ERP application is capable of predicting anticipated yields by comparing planned inputs to the planned outputs, and plugging these values into a recipe or formula specification, prior to initiating a production job.

At a leading cheese and whey products manufacturer, a standard recipe to make 100 pounds of cheese must be scalable to make 1000 pounds. For example, a recipe that uses a linear yield calculation for producing cheese, calculates that 50 lbs of cheese will be produced from 100 lbs of milk having a butter fat percentage of 25 percent. At time of production, if the actual milk used has a butter fat content of 20 percent (a 20 percent drop), the recipe predicts that the 100 lbs of milk will produce only 40 lbs of cheese (a 20 percent drop). But if the production job actually produces 44 lbs of cheese, the actual yield would be calculated at 110 percent.
Recipe or formula specifications are designed to produce one or more finished products in bulk quantities. A batch run is expected to produce a quantity of finished products within a given range (i.e. between a defined minimum and maximum) in a given time period. For example, a chemical reaction within 10 liters of a solution (e.g. the minimum level) takes the same time as 50 liters (e.g. the maximum level) of the same solution in the same vessel. When batch runs are scaled up or down, the batch quantity ranges and the production times follow a “step” function rather than a linear function.

When process manufacturers scale production, they expect their ERP application to accurately predict finished product yields and deliver consistent results, in terms of quantity and quality. When these objectives are not met, quality management and real-time performance management functions can assist manufacturers in their evaluation of their manufacturing processes. These specific management functions provide the means to capture and analyze key production data, and quickly make the necessary adjustments to the manufacturing processes in question.

**Accurate Product Costing Increases Profitability**

Accounting for all material and operational costs in the manufacturing process is one of the biggest challenges facing a manufacturer. Without accurate and up-to-date cost information, manufacturers can not make informed decisions on key business issues, such as new product pricing strategies. Without the ability to link finished products to customer volume discounts, promotional rebates and incentives, a manufacturer can not determine product profitability.

An ERP application should capture, assign and compare actual and standard costs for all finished products. Waste products typically have the cost of disposal charged back to the primary product. As for unexpected off-spec products, they can be considered as waste or stored and held in a quality control status, then later sold for a given market value. By-products are typically assigned a straight cost, but in situations where the by-products, such as energy, are available for sales, their revenue can be credited back to the primary product. Co-products are typically assigned a cost, based on some percentage in the job or a specific product characteristic, such as quality, weight, potency or market value. For example in metal production, the co-products cost can be based upon the percent of total weight produced, as opposed to in a meat packing operation, where certain cuts of meat may receive a higher or lower percentage of cost, based upon their market values.

By capturing and analyzing the actual versus standard costs for co-products and by-products, process manufacturers are able to optimize their manufacturing processes.

Faced with rising prices from their chemical suppliers, LA-CO, a specialty chemical manufacturer, was concerned over keeping their costs lower than their competition. Their ERP application allows them to efficiently track and record raw material usage, which provides an accurate view of the true cost of raw materials, used to produce more than 2,000 of their specialty chemical products. “The ability to monitor chemical raw material prices is a significant advantage for the company, particularly in this day of rising material costs. While we have no control over the fluctuation of global costs, we now have intelligence about purchasing history, pricing and raw materials usage which allows us to extend lower prices to our customers than the industry standard. We have been able to turn many of our key chemical raw materials into commodities by certifying multiple vendors, giving us the ability to price shop.”

*Tom Wondra, Inventory and Production Control Manager.*
Process manufacturers who run a generic, broad-based or discrete-oriented ERP application employing a BOM, often experience difficulties in determining profitability by product and customer, as well as accurate forecasting and other cost analysis, due to the lack of accountability and tracking of all ingredients and finished products.

Fiorucci, a leading specialty meat producer, could not tag and track meat by-products and trimmings for use in its other products using its existing ERP application. Fiorucci required a new ERP application that provided enterprise-wide product tracking and costing analysis so that it could account for losses in its raw materials. “Since we did not have readily available detailed manufacturing information, it was extremely time consuming to make informed decisions about the profitability of products and customers. We had a real need to know when and how to be profitable at the customer and product level, but could not access the information easily using our previous ERP application. Now with our new ERP application, we are able to track products through their long curing processes, at a granular level, eliminating all errors related to manual processes. As a result, Fiorucci has increased overall operational efficiencies and significantly improved the bottom line.”

Chris Maze, CFO

With real-time visibility to production rates, yields, utilization, overall equipment effectiveness (OEE) and per-unit cost data, real-time performance management can assist process manufacturers optimize their processes, and increase their performance and profitability.

Variability Must Be Consistently Managed

With many raw materials being supplied by farms, mines, and other natural sources, material variability is a primary concern of process manufacturers since it affects the consistency and quality of their finished products. It stands to reason that a higher degree of variability will affect a broader number of functions in an ERP application, and therefore will require deeper support capabilities in these affected functions.

A good indication that an ERP application may be capable of properly managing product variability is that the Item or Product Master supports an unlimited number of product characteristics for a product, both raw material or finished product types. A process-oriented ERP application should not only support user-definable product characteristics, but contain predefined industry standard characteristics, such as pH, potency, and moisture or fat content. These product characteristics play a critical role in various ERP processes, including inventory management, order management, production scheduling, manufacturing management, quality management and product costing.

Managing variability starts with a purchase order for raw materials with specific product characteristics. At the time of receipt, these raw materials are inspected and product characteristics validated against a set of tolerances. For some suppliers, their payment is based upon the characteristics or quality of their delivered materials. During receiving, lot numbers may be assigned to raw material inventory, based upon product characteristics, so that the raw material can be tracked throughout the manufacturing process.

Tafisa Canada and Company, a leading manufacturer of particleboard and thermofused melamine panels, purchases a variety of wood materials from its suppliers, based on specific target characteristics of their finished wood products. With self-regulated and government regulated environmental requirements, such as Scientific Certification Systems (SCS) in place, Tafisa tracks raw materials to ensure that 100 percent of the raw materials were recycled. During the verification process, Tafisa captures specific product characteristics, such as quality and moisture, of the raw materials. Tafisa then pays its suppliers based upon the “dry content” of their delivered raw materials.
Scheduling production based upon product characteristics or by product groups (i.e. a group of materials that share common product characteristics) is one scheduling method employed by many manufacturers. Without proper consideration of product characteristics, a manufacturer will perform an excessive number of changeovers that negatively impacts their resource utilization, inventory levels, and unit costs.

A.C. Legg, a leading producer of seasonings and custom blends, used to re-run five to ten production jobs per week due to inaccurate tracking of allergens with their old ERP application. The excessive equipment cleaning and sanitizing activities lead to increased product costs. And with only four days available to fulfill orders, these re-runs taxed the company’s already-overburdened production schedule. Today with their new ERP application, production jobs that contain the same food allergen can now be automatically grouped and scheduled in sequence, significantly reducing equipment changeovers, increasing equipment utilization and plant efficiencies.

Being able to deliver finished products that meet customer requirements has become a requirement for manufacturers to remain competitive in the marketplace. When raw materials are allocated to a production job, a certain material may be acceptable in one process specification, but not in another. The reason is that the raw materials’ product characteristics will not produce finished products that meet specifications. With full visibility into available raw material inventory and their product characteristics, manufacturers can promise and produce finished goods that meet their customers’ requirements.

Oxford Frozen Foods, a producer of specialty fruit products, complies with the Federal School Lunch Program requirements, by tracking the country of origin (COO) of its ingredients to their finished goods. When taking customers orders, Oxford can assure certain customers that their ordered products will contain only berries grown in the US. Their process-oriented ERP application’s management of inventory, based upon product characteristics, in conjunction with its full lot traceability capabilities helped Oxford rapidly comply with all FDA, USDA, HACCP, American Institute of Baking and international security regulations.

When process manufacturers employ a generic, broad-based or discrete-oriented ERP application that can not effectively manage and track the variability of their raw materials and finished products, they often experience difficulties with inventory accuracy and visibility, which impacts the planning, execution and reporting functions in several key ERP processes.

**Expired Inventory is Lost Profits**

Shelf life can be a daily concern for process manufacturers, especially for food processors, where perishable goods can go bad within the week. In addition to the basic inventory rotation methods (e.g. LIFO (last in first out), FIFO (first in, first out)), a process-oriented ERP application should support additional inventory rotation methods, such as 1. shipping only the freshest or newest goods to certain customers and 2. shipping products that will have a specified number days of shelf life remaining once received by the customer.

SeraCare Life Sciences, Inc., a manufacturer of quality control products for infectious disease testing, manages some 40,000 lots of blood related inventory. “Our ERP application enables us to manage inventory based on expiration dating of products for effective replenishment planning. The system calculates an expiration date based on the batch-creation date and typical shelf life. We can define re-test dates, because products can change as they sit on a shelf over time and their characteristics may need to be re-validated. We can even specify distribution days - the minimum number of days of shelf-life that must remain when an order is shipped.”

*Richard D’Allessandro, Vice President of Information Technology*
“No inventory will be used before its time” may be one philosophy shared by process manufacturers. For these manufacturers, inventory is managed by its aging date - before, during and after production. For intermediate products that are produced in-between multiple process stages, a process-oriented ERP application should be capable of automatically placing this intermediate inventory on hold until their aging period has concluded or matured, at which time the next stage in the process is automatically initiated. For finished goods with associated aging dates, such as meat, wine, and cheese, this inventory is not considered for sale until their aging dates have matured.

Premium Brands, a holding company for high-end deli and specialty meat producers, date-codes every individual item to the unique requirements of each customer. Special consideration must be given to the proper curing of its meats, as both ingredients and as finished products. “Our ERP application allocates product out of the warehouse to ensure the best rotation of product. With 39,000 sales units ordered and 252,000 kilograms being processed for shipment daily, the task is sizeable. The company is on track to slash lost revenues from returns by fifty percent in the next twelve months. This will add another two to three percent directly to the bottom-line company performance.”

*John Christiaens, Director of Information Technology*

By ensuring that the best rotation methods and quality standards of inventory are met, a process-oriented ERP application can significantly reduce customer chargebacks and improve customer satisfaction levels.

**Greater Variability Requires Greater Quality Functionality**

With little variability in discrete manufacturing, quality decisions are rather black or white. A received part or manufactured part either passes or fails to meet a specification, and therefore is either accepted, rejected, scrapped or reworked. With the high level of variability in process manufacturing, its shades of gray when it comes to making quality decisions. Therefore, process manufacturers who employ a generic, broad-based or discrete-oriented ERP application typically can not effectively track the various quality conditions of raw materials and finished goods.

*Fiorucci, a specialty meat producer, defines its quality requirements for authenticity in its recipes, including required curing lengths and standard procedures for producing the meats, in order to guarantee top quality products to its largest customers. “As an American company, we must guarantee that our products meet strict quality control standards regulated by the federal government. However, equally important, as an Italian company, we must ensure our product meets the quality standards of Italy as well as the standards of our loyal customers. With the vast functionality and flexibility of our process specific ERP application, we’ve been able to exceed all of these requirements.”*

*Chris Maze, CFO*

In a process-oriented ERP application, quality checks of raw materials and finished goods should be able to be defined in the recipe or formula to ensure that they are executed in proper sequence in a certain process stage. By collecting and analyzing quality data, a manufacturer may identify problems with certain raw materials, finished goods and equipment.
To further reduce quality issues tied to production startup losses, manufacturing processes, and scrap and rework activities; manufacturers need real-time visibility into overall plant performance, including product quality and equipment performance trends. By collecting relevant real-time data from plant operators and existing automation, real-time performance management measures rates, yields, utilization, overall equipment effectiveness (OEE) and per-unit cost data. With real-time visibility of these key metrics, operators can quickly see where the optimal levels for a product or piece of equipment are not being met. By correlating the collected real-time performance data, operators can quickly identify the root causes of performance issues, so that repetitive problems can be eliminated and unexpected issues can be quickly resolved.

A leading food manufacturer of brand and private-label condiments, found themselves giving away large quantities of condiments, due to an overfilling problem that was costing the company thousands of dollars per year. The overfilling problem was tracked down to an ingredient with a specific product characteristic; its viscosity was dependent upon the temperature. This product characteristic affected the rate of flow through the machinery, which subsequently affected the amount of fill. Without an accurate view of relevant production data, operators were forced to constantly adjust settings to avoid over-filling the containers, which affected production times, yields and costs, and did not fix the overfilling problem. With the implementation of performance management, all relevant product characteristics and equipment settings were captured during production. Following a continuous improvement process, performance data was analyzed to determine the relationships between product characteristics, equipment settings and environmental conditions, and the process specifications for the products containing the specific ingredient were modified. As a result of their continuous improvement process, the food processor recognized a significant increase in production efficiencies and reduction in costs, and the near elimination of all giveaways.

The level of quality control (QC) and quality assurance (QA) functionality required by a manufacturer, in terms of operator initiated and system directed quality checks during various physical operations, can be directly tied to the variability of their products and processes. Greater variability requires more robust quality management capabilities, as well as lot management capabilities.

**Bi-directional Lot Tracing Speed Recalls**

Lot control is a standard ERP feature in terms of assigning a lot number to a raw material or finished product, validating a lot number during receiving or order selection, and generating a variety of reports or queries based upon lot related parameters. In process manufacturing, lot numbers are assigned to raw materials and finished products, including co-products and by-products, based upon their quality levels and production jobs.

Lawrenceville Bricks, a manufacturer of custom bricks, required the ability to partition an order within a single lot. The company faced difficulties with their previous ERP application when customers wanted to place an order one time, but then draw from the same lot throughout that order over an extended period of time. Their current ERP application has the ability to reserve elements of the same lot, which enables the manufacturer to have multiple releases and shipment dates within the same lot. As stages of the order are released, the rest of the lot remains on reserve status and is shipped as specified during the life cycle of the order.
Lot inheritance is a critical ERP function that is responsible for tracking and tracing the lineage of all raw materials and finished products, including their characteristics and lot numbers. Due to the batch run quantities produced in process manufacturing, a process-oriented ERP application should be capable of tracking and tracing an ingredient that may be only present in minuscule amounts in a finished product, a critical capability for those manufacturers in chemical and life sciences.

Lot traceability in many ERP applications is limited to a "one up and one down" snapshot, meaning information on a product is generated for its current state, one step before its current state and one step after its current state. Full lot traceability requires the merging of a series of these snapshots, which can take days to complete. Although some ERP solutions automate the merging or linking of these snapshots, these automated jobs can still take almost a day to complete. Adding to the processing time is the possibility that there may be a large amount of historical lot tracking data that requires processing (e.g. private labelers with large quantities of year old "Brite" stock on their shelves).

Leading process-oriented ERP applications are optimized for lot traceability. With bi-directional or "end to end" lot tracing of its historical database, these ERP applications can quickly track raw materials from receiving into production, track finished goods from production to shipping, and identify the raw materials and resources that produced the finished products. As regulatory agencies continue to pressure process manufacturers to deliver 100 percent accurate lot traceability within shorter and shorter periods of time, bi-directional lot tracing enables process manufacturers to respond to product recalls in a matter of hours rather than days.

Integrated regulatory management capabilities help streamline compliance requirements by providing detailed quality assurance records and complete certificate-of-analysis information for all finished goods. With these ERP capabilities, process manufacturers can have a competitive advantage over their competition when seeking new business.

Baldwin Richardson Foods, a specialty food producer of brand name toppings and sauces significantly reduced the time required to conduct mock recalls from up to two days to within two hours with their process-oriented ERP application. Without this level of lot traceability, the company would be in danger of losing its major accounts, including McDonald’s and Kellogg’s. “With our ERP solution’s automated lot tracing procedures and integrated bi-directional lot tracing capabilities, Baldwin Richardson Foods was able to improve the turnaround time on lot traceability. As a result, the company was awarded the prestigious Silliker Labs - Gold Certification For Food Safety And Quality Practices.”

Michele Salva, Director of IT and Project Management

The Need To Simultaneously View Multiple Units Of Measure

The units of measure (UOM) hierarchy defined for raw materials and finished products serves as the basis for tracking inventory, as well as converting one UOM to the next level of UOM (e.g. First UOM: a bottle; Second UOM a case, ten bottles in a case; Third UOM: a pallet, twenty four cases on a pallet).

Multiple UOM’s are used in several ERP business processes. A process manufacturer can purchase goods in one unit of measure (UOM), stock inventory in a second UOM, and issue finished goods in a third UOM, and perhaps even sell finished goods in a fourth UOM. But what if management wants to simultaneously view a specific product’s inventory by quantity and weight? A process-oriented ERP application should allow process manufacturers to manage inventory in terms of bulk UOM’s (e.g. gallons or pounds), packaging UOM’s (e.g. six packs of 12 oz cans or large drums) and random attributes (e.g. catch weights and potencies) - all at the same time. In addition, inventory can be costed by potency units, color units, percentage solid or any other unit.
A leading steel manufacturer produces a variety of hot-rolled steel coils, which are used in the manufacturing of construction products, including welded profiles, hollow sections, cold rolledformed sections and steel pipe piles. By tracking its hot-rolled steel coil inventory by quantity, weight and grade, the manufacturer can quickly and easily fulfill its customer orders with the “right” number of coils that meet the weight and grade requirements.

Product variability can play a role in UOM conversions. In addition to standard measurements conversions (e.g. US to metric), a process-oriented ERP application should support user-defined and automatic UOM conversions (e.g. liquids to solids, gases to liquids), which can be initiated from events within the manufacturing process, as well as from specific changes in inventory attributes.

From purchasing through inventory, order management through shipping, the ability to work with multiple UOM’s simultaneously improves performance and customer service.

The ERP Data Model – Focused and Aligned

Standard ERP data library utilities found in most ERP applications allow the ERP software provider or the manufacturer themselves to “personalize” the existing ERP transaction field names, titles and other related labels. An industry specific ERP application that is based upon a strong manufacturing and engineering foundation should come delivered with predefined labels that reflect industry standard terminology. Process manufacturers expect to see recipe or formula, ingredient, co-product and by-product naming conventions reflected in the labels and parameters used in user screen transactions and reports. These predefined labels can reduce both the initial system configuration and on going maintenance costs.

Generic, broad-based ERP software applications are quite flexible in accommodating a majority of businesses without significant modification. To accomplish this, these applications require a fairly large number of configuration parameters and data tables. A process manufacturer’s IT staff must not only deal with a large, complex database, but with the cryptic data table names and field names in the database. As a result, a generic, broad-based ERP application presents a number of challenges to a process manufacturer’s IT staff in the areas of program customization, data conversion, report generation, and system integration.

In leading process-oriented ERP applications, industry standard terminology extends from its label naming conventions down to its database table and field naming conventions. At this level, the industry naming conventions reduce the time to perform those before mentioned IT activities, as well as reduce the risks in performing the activities.

SI Group (formerly Schenectady International, Inc.), a privately-held, global chemical company, discovered a significant difference in the number of data model tables, when replacing a large, leading generic ERP software application to an industry specific ERP application. “Our initial ERP solution had approximately 12,000 database tables that were difficult to decipher, whereas our current ERP solution has approximately 2,500 tables that have very intuitive names. Through simplification and focus, Schenectady now has a robust, functional system which has greatly streamlined the global IT deployment and maintenance of its Enterprise Systems.”

Alien Lock, Director of Global Information Technology
At a more granular level, the difference between a generic, broad-based and an industry specific ERP data model can be recognized at the field definition level. For example, tracking very minuscule amounts of an ingredient in a finished product requires certain data fields to be defined with the right number of decimals.

This was the tipping point for Wellington, a custom contract formulator, manufacturer and packager of nutritional supplements, who could not meet the mandated track and trace requirements of a regulatory agency with their initial ERP solution. “For example, the formula for a batch of any given liquid product may be over one thousand gallons, but require only several pounds of ascorbic acid. To maintain inventory accuracy when we manufacture that product, our system needed to know the amount of ascorbic acid contained in each bottle of finished product, which for instance, could be in milligram quantities. Our initial ERP system couldn’t provide the level of accuracy required to avoid rounding errors. In our current ERP solution, the appropriate number of places after the decimal point allowed us to build product accurately, and avoid inventory inaccuracy due to rounding errors. The ERP’s data model characteristics and lot traceability capabilities, as well as management of organic and nonorganic products, helped us earn an organic certification through QAI (Quality Assurance International).”

Tony Hamack, II, President

With a generic, broad-based ERP application, many process manufacturers find their IT staff spending a fairly large amount of time on ERP configuration and maintenance. On the other hand, a process-oriented ERP application reduces the administrative costs associated to ERP configuration and maintenance, and enables process manufacturers’ IT staff to focus on corporate IT objectives.

The management of units of measure was important at Summit Industrial Products, a synthetic lubricant manufacturer and a member of the Kluber Group. “In our previous ERP solution, we had a part data model of roughly 6000 parts because we had every private label, every product, and every unit of measure in there as a unique stock ID or SKU. We took that original 6000 part data model and we took it down to 200 parts in our new ERP part master database because of its private label, packaging UOM and conversion capabilities. Look at the administration savings associated with that. That was huge for our company, to be able to go from a very complicated part structure down to a very simple part structure.”

Kelly Starr, EVP - Finance & Administration

A Technology Driven ERP Application Enables Growth

With innovative and evolving technologies in the areas of software and hardware, a process-oriented ERP application can help process manufacturers improve their visibility into their manufacturing operations, improve collaboration amongst their trading partners, and improve interoperability between existing and planned software solutions.

Whether process manufacturers are tracking inventory, orders, or assets within their plants or across their enterprise, their users are looking for more ways to get more data out of their ERP application – in the office, on the road or from home. To achieve these objectives, several software technologies should be incorporated into the ERP application, including

- Software object technology to expand desktop usage.
- Web based clients and mobile client interfaces, built for fast access.
- The next generation of smart clients, built for on-click deployment.
- Web Portals to aggregate enterprise data, organized for the users’ specific knowledge needs, with links to related system functionality and capabilities.
Workflow technologies are becoming a standard feature in leading ERP applications. These technologies improve collaboration between business departments, suppliers and customers. With greater visibility, consistency, accountability and control over their business processes, process manufacturers can increase production efficiencies and achieve higher customer service levels.

Process manufacturers are looking for quicker and easier methods to integrate their various software applications in order to reduce integration, maintenance and overall cost of ownership. A few of the latest technologies that should be employed by the ERP application to increase connectivity and performance include the following:

- Service-Oriented Architecture (SOA), a set of modular business services upon which the ERP product lines should be built.
- XML, an industry standard data interchange format, which enables ERP application API’s to communicate to third party applications, regardless of platforms and technologies.
- Web Services, which offer data and functional capabilities that can automatically update ERP data from third party applications, with the benefit of being insulated from application changes and upgrades.

As process manufacturers grow through mergers and acquisitions, integration issues between multiple software applications become more prevalent. Without the right technologies, these manufacturers may find it difficult and costly not only to merge software applications, but to adapt and standardize on new business processes, especially at the plant level. Therefore, when evaluating an ERP software provider and their application, it’s important for a process manufacturer to understand the software provider’s integration technology, data model and development platform, in order to determine their impact on future software upgrades, replacement or consolidation.

**Recommendations**

As a process manufacturer, if you are actively searching for the right ERP application for your company or in the process of re-evaluating your company’s current use of its ERP application, then you should focus on those ERP applications that have a strong process manufacturing foundation. These ERP applications support many inbuilt industry “best practices” that you can align your business processes to.

By going “under the covers”, you will discover that a process-oriented ERP application, not a generic, broad-based or discrete-oriented ERP application, can successfully manage the variability of products and processes, accurately account for all raw material and finished products, and significantly improve product costing, production predictability and scalability. With baseline functional capabilities, data model structures and enabling technologies, a process-oriented ERP application can support your business requirements with minimal customization and software vendor professional services.

As these customer stories attest, a process-oriented ERP application will enable you to standardize upon and accelerate your business processes, while reducing your operating costs and improving your customer service levels.
Process Manufacturing ERP Checklist

To further assist your ERP evaluation process, this Process Manufacturing ERP Checklist supplements the key points made in this “Essentials Guide” paper. The checklist can be used to facilitate side-by-side comparisons of the ERP applications.

**Improving production through recipe/formula management**

- When stages within a process specification are linked together, can the output of one stage become the input for the next stage, without having to perform an intermediate inventory transaction or having to define an unnecessary intermediate product?

- How does the system handle "conversion," where the actual output is converted from the planned / scheduled output? (During the manufacturing process, unforeseen variables can affect output products. At job completion an output might be a valid product, but with different characteristics than the planned product. If so, it would be converted to the new product.)

- Can yield analysis be performed by operation, ingredient or user-defined calculation?

- Does the system support different units-of-measure throughout the process specification (e.g. weigh in drums, process in pounds and package in cases)?

- How does the system support input-driven as well as output-driven process specifications? (Input driven process specs allow for the primary input material to determine what quantity of product can be produced; output driven process specs consume materials to meet demand).

**Improving product costing**

- Does absorption-based costing perform costing of direct activities as they occur as well as during the recording of manufacturing costs based on predefined formulas?

- Can the system support allocation of multiple in-direct costs such as energy, water, plant management, maintenance and depreciation?

- How are the costs for reclaimed by-products credited back to the original job/batch, based upon the values and quantity of that product?

- Can the estimated cost of a process specification be compared to the actual cost of a job/batch?

**Managing multiple units of measure simultaneously**

- Does the system support different units-of-measure for receiving, producing, storing and selling the same item?

- Does the system provide visibility of all package units for a given bulk item without having to maintain substitution tables or logic (such as total inventory for red paint with package units of pints, quarts, gallons or barrels under “red paint”) and without having to define every packaging type as a unique item code?

- How does the system support formula-based conversions, which allows the definition and use of generic and item-specific units-of-measure and associated conversion formulas (e.g. automatic weight and volume conversions relative to a base unit-of-measure)?

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Process Manufacturing ERP Checklist (continued)

Managing the variable characteristics of products

• Can the system update actual product characteristics based upon QC values recorded during manufacturing (e.g. highest, lowest and average QC test readings)?

• How does the system use potency or other product attributes to dynamically adjust formulas, based on variances in attribute or potency values?

Meeting regulatory compliance and speed product recalls through lot traceability

• Can product characteristics be used to force or limit the selection of specific lots/batches based on matching the actual characteristic values to a specific customer request?

• Does the system maintain full forward and backward lot/batch integrity when product is converted during manufacturing without losing any audit or trace linkages?

• Are lots be tracked at every step in the process (from receiving to manufacturing to shipping), capturing materials, production resources, people, processes, step and time?

Reducing customer chargebacks and inventory write-offs with expiration date management

• Can distribution days (minimum days of shelf life that must remain when product is shipped) be defined separately from standard shelf life?

• Can the system net the quantity of product reaching expiration from available quantity if demand does not consume all available inventory of that lot/batch by its expiration date?

For clarifications on these functional questions or to inquire about CDC Software’s expanded list of critical functions for process manufacturers, please contact us via the Ross Enterprise website, www.rossinc.com. CDC Software wants to ensure that you do not overlook any critical process manufacturing requirements during your ERP evaluations.

About CDC Software

CDC Software, The Customer-Driven Company™, is a provider of enterprise software applications designed to help organizations deliver a superior customer experience while increasing efficiencies and profitability. CDC Software’s product suite includes: CDC Factory (manufacturing operations management), Ross ERP (enterprise resource planning) and SCM (supply chain management), IMI warehouse management and order management, Pivotal CRM and Saratoga CRM (customer relationship management), Respond (customer complaint and feedback management), c360 CRM add-on products, industry solutions and development tools for the Microsoft Dynamics CRM platform, Platinum HRM (human resources) and business analytics solutions.

For more information about the Ross ERP solution being used by today’s leading process manufacturers, please visit www.rossinc.com.