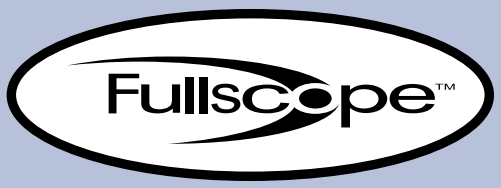

A WHITE PAPER

Organic Supply Chain Management

Issues and answers for process manufacturers of natural products (proteins/meats, agricultural)

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Executive Summary

It is a surprising fact that within the overall process manufacturing space, not all of the process enterprise resource planning (ERP) vendors offer solutions for each process sub-vertical industry. Most vendors specialize in food, beverage, chemicals, pharmaceuticals, pulp, paper or primary metals, but none compete successfully across the entire process manufacturing spectrum. The reason is that even within process, the planning, scheduling, costing, execution and distribution of products are extremely different. Paper mills work with block schedules; primary metals use metallurgy to determine correct formulas; and many food processors use organic methods to deliver products with correct shelf life.

In this white paper we'll take a closer look at one of these process sub-vertical industries, Organic Supply Chain (OSC) companies. Most of these organizations dissemble organic raw material (beef, pork, poultry, agricultural products and even petroleum) and have specific requirements that generic process ERP systems and certainly discrete ERP systems, designed to plan, schedule and manufacture items like toasters, cannot address.

Many OSC companies do not realize they fall into a special process category and simply feel they cannot find a packaged software solution suitable to manage their businesses. In many respects, they are correct on both counts: they are unique and different from discrete and other process manufacturers, and ERP vendors have not taken the time to deliver a solution with the flexibility to manage the variability of an OSC's processes.

This paper presents the unique issues and requirements found in this special market.

Organic Supply Chains: A Classic Example

Companies with an OSC deal with variability in every phase of their supply chains. Purchased ingredients arrive on their receiving docks with quality specifications that change from lot to lot. The manufacturing processes must be altered (formulas, routings and equipment settings to compensate for this variability, and the final yield of the process may change). The end product may vary from expectations; the quality may or may not be within specifications; and the quantity may be variable. Add to this the complexity of multiple packaging configurations, and you can begin to see why software packages designed to produce cameras and microwaves will not handle the special needs of an OSC company. In discrete manufacturing, it always takes "x" number of screws to make a certain component, and if you need ten components, simply multiply the parts by the x factor. Things are not so clear in the organic supply chain.

With the advent of advanced planning and scheduling (APS) products, new market requirements now exist and cause additional competitive pressures for OSC companies. It is no longer enough to produce the right product with the right quality. The baseline requirement is now to produce these products at the right cost or margin, at the right plant using the cheapest transportation route and deliver them to the right store with the correct shelf life. The key to this OSC model is to make sure that both the underlying ERP system and APS tool are process manufacturing oriented. If not, the process "trail" will be lost, and the supply chain involved will not be able to take advantage of the symmetry required between the two technology systems.

Inverse Bill of Material

An underlying foundation of a company with an organic supply chain is that the ERP system must be able to model a disassembly process. Most ERP packages use a traditional Bill of Materials (BOM) approach to build discrete products, which is totally unsatisfactory for process operations. A "formula" must start with a raw material (such as beef, pork, poultry, oranges or petrochemical products) and disassemble it to produce many co- and by-products. These formulas are then used by an APS system to model "what-if" scenarios. Let's use the example of a typical pork processor illustrated below in Figure 1:

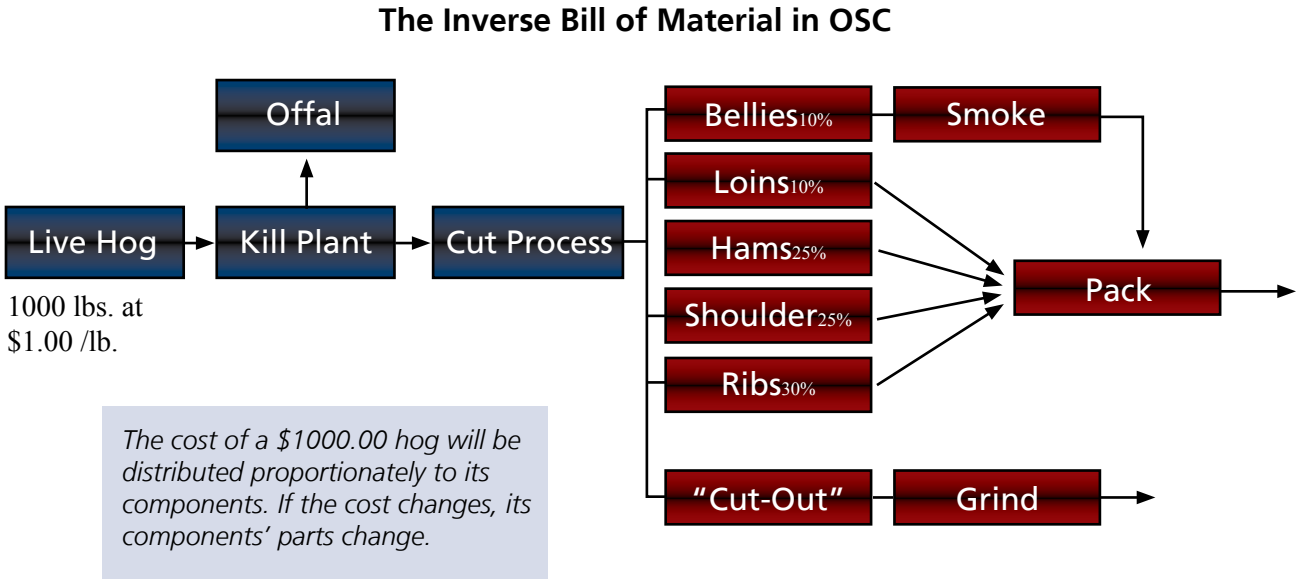

Figure 1: The Model for a Pork Processor

If the process formula can reproduce the disassembly of the live hog, it can also mirror the product flow, co- and by-products produced, waste and scrap, and all the associated costs for each item. The importance of modeling the costs is significant, since different cuts, packaging operations, and fresh or frozen decisions must be represented in the APS tool. Since BOM-based systems are designed to assemble, not disassemble, products, these APS decisions will be impossible if the underlying ERP system is a discrete-based one.

Example: If the price of a live hog is $1.00 per pound, then that factor relates proportionately to all of its components. Let's assume that one hog weighs 1000 pounds and each co-product should absorb a portion of that cost $1000.00 (1000 pounds x $1.00 /lb.) We can reasonably assume the following co-product costs:

Ham	*25% absorbed cost*	*250 pounds at /$1/lb.*	*$250.00 cost*
Loins	*10% absorbed cost*	*100 pounds at /$1/lb.*	*$100.00 cost*
Bellies	*10% absorbed cost*	*100 pounds at /$1/lb.*	*$100.00 cost*
Shoulder	*25% absorbed cost*	*250 pounds at /$1/lb.*	*$250.00 cost*
Ribs	*30% absorbed cost*	*300 pounds at /$1/lb.*	*$300.00 cost*

*For simplicity, things like scrap, offal (cut-out), etc., which would also absorb costs, are excluded.

The APS tool now has an accurate model for its costing and pricing scenarios. What if the cost of the live hog changes from $1.00 per pound to $1.20 per pound? The planner can quickly determine how that price change affects the cost of each of the co-products and use that new cost factor in determining pricing scenarios, packaging configurations, fresh or frozen decisions, transportation, and warehousing. The same scenario holds true if you are planning the manufacturing, sales and distribution of orange or apple juice, potato and agricultural products, or chemicals that rely on any type of distillation or breakdown into end items. For accurate modeling, the APS system must use the core data from the ERP package, and both solutions must be designed to support process manufacturing.

Differences between an Organic Supply Chain and Other Discrete Supply Chains

OSC environments differ from traditional discrete supply chains in several ways:

Time: Many OSC companies cannot use the traditional "order due date" as the driver for their business processor because shelf life issues are so prevalent throughout the entire supply chain (raw materials, work in process and finished goods). The traditional APS package designed for durable goods does not consider "best before dates" on end items. For example, it is highly uncommon for a toaster to have an expiration date. An OCS' APS tool must not only consider when the order is due, but if the material it delivers to the warehouse, broker or retail outlet has the correct number of selling days for that individual customer. The underlying ERP system must be able to track both shelf life at the lot and sub lot level, as well as best before dates The APS tool can then search the ERP inventory for the best lot to ship.

Catch Weight: An ERP system must handle catch weight terms, which simply refers to transacting in nominal weight as well as actual weight for any product. The APS tool typically works with nominal weights, but the ERP backbone will ship actual weights.

Push versus Pull: Wouldn't it be great to ask an orange harvest to wait to mature until there are enough orders to fill supply? Or, maybe your dairy cows can produce milk when you need it, or your chickens can mature faster or slower, and so on. The reality of OSC companies is that actual sales orders to not drive production. In OSC environments, a push system is necessary to determine when the raw material will show up at the dock, and the OCS planner must very quickly decide how to process it. These decisions are driven by actual demand, but many times they are based on the quality of the raw material (i.e. butterfat content in milk), fresh or frozen, packaging, staging, and cost/margin decisions. The challenge of the APS tool is to balance the actual flow of raw material being pushed into the receiving area with the demand (actual sales orders), therefore "pulling" the finished goods through the supply chain.

Integrated Quality: Although an APS system will look at the quality control specifications of vendor lots, the ERP system must have a reliable quality control application to capture the actual specifications (i.e., brix in oranges) when the product arrives. Upon arrival, replanning can occur to try to optimize formulas based on actual quality received.

Procurement Issues: Many OSC companies are tied to one commodity exchange or another, and the price set by those markets changes continuously. To further complicate matters, purchasing agents often contract raw material many months in advance to lock in a price. The optimal price invariably depends on purchase price, holding costs and transformation costs. For example, potatoes are quite bulky in their natural state and the APS planner needs to weigh factors such as "Do I keep them fresh, convert them by dehydration, or bring them through the process completely and make frozen french fries"? When to buy, where to stock, how to stock, freeze or not, pack or not, are just some of the elements the APS system needs to consider in this market segment.

Tank and Line Scheduling: A common sight in any OSC plant are all manners of holding tanks, silos and pipes often connecting an entire manufacturing facility. Since discrete companies generally work with traditional warehousing space, all ERP and most APS packages have ignored the unique planning elements of this type of storage. Just consider what types of software solutions OSC companies who manufacture beer, soft drinks, juices, chemicals, pharmaceuticals and a host of other continuous flow products need to manage such constraints. Tank and silo capacities are measured in volume units, not run rates. The same holds true for pipeline capacity, which uses flow rates, which are impossible to model with discrete APS packages. A tank usually takes a period of time to fill and empty, depending on the flow in and out. In a bottling operation, a tank can be drawn against by several fill lines, each running a different rate. The APS package needs to understand that ten ounce cans draw product at a different rate that liter bottles, so the tank capacity is really dependent on the variety of end items that a bottler is filling during a given period.

Fresh vs. Frozen: Go to the supermarket and buy shrimp and you'll find that frozen shrimp costs a lot less than fresh. The margin that OSC companies make on frozen product is much less than fresh, so the APS tool needs to weigh that as a constraint. The decision ultimately comes between to "Do I lose the product by expiration; or freeze (or dehydrate) the product and gain shelf life but lose margin"? Juice manufactures wrestle with this predicament every season, and that's why juice is available for breakfast during winter's worst weather.

Sequenced Schedules: Most OSC products have product characteristics. Whether it is the onion flavor in soup, the size of the cut vegetable, or the elasticity or color of paint, these characteristics tend to complicate the scheduling of production on the shop floor. Some characteristics such as flavor or color tend to contaminate downstream processes. Onion flavor tends to permeate the next soup produced on that line if there isn't sufficient clean up. Black paint contaminates all the other colored paints and requires intensive cleanup. The issues require that products be "sequenced" through production to minimize set ups and clean ups between products. Characteristics tend to be ignored by many scheduling products, but are common in most all OSC companies.

Formula Optimization: Depending on the quality of the product, or mix of raw materials that are expected, a planner often needs to change the formula or process to achieve consistent quality in the end item. By adding more catalyst, leaner meat, more dehydrated meat, OSC planners and schedulers can play with the blend of ingredients to optimize the formula. The percentage of protein in a sausage can be planned if you know the quality of the trimmings that will go into it, thus avoiding scrap and waste. In addition, the planner can substitute ingredients to make the product if he knows the purchase order for the original ingredient will not arrive on time.

ERP and APS Evaluation Check List

When evaluating supply chain solutions for organic supply chains, keep these check lists in mind:

For ERP Solutions:

[ ] Inverse Bill of Material
[ ] Multiple Formulas and Routings per Product
[ ] Potency at the item Level
[ ] Costing of Co- and By-products by Percentage Distribution
[ ] Lot Quality Specifications
[ ] Management of Yields, Waste, Scrap, and By-products
[ ] Integrated Quality Management
[ ] Catch Weight: the ability to transact in nominal and actual weight
[ ] Shelf Life
[ ] Best Before Dating
[ ] Integrated Picking Logic that Supports First Expire, First Out (FEFO)
[ ] Containerization (Producing Items in Multiple Pack Configurations)

For APS Tools:

Planning Models that support

- [ ] Inverse Bills
- [ ] Quality Specifications
- [ ] Push Supply Chains
- [ ] Fresh vs Frozen Calculations
- [ ] Variability of Raw Materials in Timing, Price and Quality
- [ ] Customer Service Levels
- [ ] Take into Account Shelf Life and Best Before Dates

Scheduling models that support/consider:

- [ ] Volume-based Constraints (i.e., Tanks)
- [ ] Sequencing Based on Product Characteristics
- [ ] Production of Earliest and Latest Schedules
- [ ] Shelf Life and Maturation Issues

Conclusion

It is a foregone conclusion that companies still using ERP's simple planning tools cannot compete with those who have made the leap to process-specific ERP and APS solutions.

Most major ERP vendors have purchased or partnered with APS vendors to help manufacturers take their supply chains to the next level. It is imperative that companies with organic supply chains choose ERP and APS solutions designed to specifically handle the nuances of process manufacturing in order to truly optimize their supply chains for financial and operational performance.

About Fullscope, Inc.

Fullscope, Inc. is a Gold Certified Microsoft business partner that offers a broad range of solutions and deep domain expertise for companies with process, discrete and hybrid manufacturing operations. One of the initial participants in the Microsoft Business Solutions Industry Builder ISV (IBI) program that enables Microsoft to market business management software solutions originally developed by independent software vendors, Fullscope developed and supports Process Industries for Microsoft Dynamics AX, and markets Microsoft Dynamics AX. For more information, visit www.fullscope.com.

About Process Industries for Microsoft Dynamics AX

Developed by Fullscope as part of the Microsoft Industry Builder initiative, Process Industries for Microsoft Dynamics AX is designed to help food and beverage, pharmaceutical, life sciences, pulp, paper, and primary metals companies optimize their process manufacturing operations for increased profitability and competitive advantage. It provides an excellent fit for companies with organic supply chains.

Process Industries for Microsoft Dynamics AX is designed to help manufacturers increase the speed and flexibility of their production operations; stay competitive by implementing industry best practices; increase efficiency through better communication internally and with trading partners; provide real-time insight into production processes and costs to manage resources more effectively; and respond faster to changing market conditions or new opportunities.

Please contact your Fullscope sales representative for a list of recommended APS partners.

About the Author

Gil Garcia is the director of process IBI channels for Fullscope, Inc. He has designed process manufacturing solutions and helped companies solve process industry-specific challenges for over 20 years.

Fullscope, Inc.
2500 Northwinds Pkwy #600
Alpharetta, GA 30004
(770) 754-5411 Main
(770) 772-3120 Fax