



White paper

Drive profitable growth with superior supply chain planning

8 best practices to overcome the complex challenges in beverage production

BEVERAGE PRODUCTION





Can you cope with rapidly changing trends and fluctuating demand?

A great formula and consistent quality are not enough to ensure beverage industry leadership. Alcoholic beverages, soft drinks, juice, milk and water are no longer just products. For consumers, beverages can be statements of style, mood, health outlook, even culture – far more than just drinks.

As the global expansion of brands continues, beverage producers must adapt their formulations to match the significantly different tastes of consumers in various countries. This leads to shorter production runs and frequent production line changeovers. Welcome to the world of demand-driven manufacturing.

Typically, profits depend on long production runs per product and less frequent changeovers. However, consumer preferences force shorter production runs and shorter product cycles. This results in a more challenging quality assurance process and increased costs. Shorter product

cycles demand manufacturing that is flexible and responsive.

Consumer demands are not the only challenge to the beverage industry. Rising commodity costs, price pressures (from consumers and retailers), and regulations are also forcing the industry to look beyond merely formulating routine products efficiently.

In order to meet shareholders' expectations – returns on investments, equity and assets – beverage manufacturers must look at product innovation, consumer acquisition and global expansion as key business forces.

For innovative products to reach consumers, manufacturers' supply chains have to operate at peak efficiency. The supply chains must be responsive to demand, networked to meet global and regional market realities, and be sensitive to demand, production and distribution constraints. Is your supply chain capable of supporting your business?



How do your supply chains fare?

Can you:

- Accurately forecast market and segment sales?
- Create accurate demand plans based on your sales forecast?
- Easily increase revenues by optimizing your product mix?
- Align your business forecast and production plans to satisfy all demands at all times?

Do you:

- Struggle with too much inventory?
- Keep the safety stock levels high so you don't get caught in out-of-stock situations?
- Complain about production manufacturing products you don't need?
- Complain about customers changing orders too close to the order fulfilment dates?

Are you:

- Apologizing for limited product availability?
- Explaining why your products arrived late at customer-agreed locations?
- Exceeding the capacity of contracted transport, warehouses, distribution centers and cross-docks?
- Expediting freight too frequently?



Wouldn't you like to do things better? The key to managing these complex challenges lies in mastering the supply chain planning process.



Superior supply chain planning increases the capabilities of beverage manufacturers



1 Overcome seasonal changes in demand

Accurate forecasts are fundamental to stable production and distribution planning processes. For most beverage companies, production plans reflect the “days of supply” or “cover period.” A stable demand forecast should cover a minimum of 12 months and, ideally, 18 months, to accommodate seasonal fluctuations in demand.

Produce-based beverages can be manufactured from frozen or preserved produce that is available year long. However, if your production relies on fresh-packed produce or a mixture of freshly-harvested and fresh-packed produce, an accurate forecast extending 12 to 18 months is essential. Without accurate forecasting, your company cannot use demand to drive the supply chain and manufacturing. Poor forecasting forces your company to maintain excessive safety stock.

If your supply chains and manufacturing aren't demand-driven processes, production and inventory-carrying costs will remain stubbornly high.

Most forecasting and demand planning tools are not designed to handle seasonal and intra-monthly variations that are characteristic of the beverage industry. Many offer only the barest of the statistical models that can be fitted to your data set. If you are still using spreadsheets to model your sales forecast and demand, you are likely to make a demand planning error on more than 80% of your planning attempts.

The majority of the demand planning tools available on the market are separated physically and logically from the supply chain planning and production planning tools. This separation prevents multiple departments from rapidly achieving consensus on the quantities of the supplies to be ordered and the output to be produced. Gathering market intelligence in a transparent and integrated way is key to achieving consensus.



2 Model value chain processes and resource configurations to fully use resource capacities

No major beverage producer operates solely with a single plant. All operate multiple plants, many acquired through mergers and purchases of other brands. Each plant has distinct technological characteristics and operating requirements. Planning across many dissimilar plants to achieve specific production outcomes at similar production unit costs requires sophisticated planning, precise understanding of plant configurations and constraints, as well as planning tools that are flexible and adaptable enough to correctly represent the characteristics of each plant.

Few planning tools are flexible enough to meet the demands of modern beverage manufacturing companies. Many require that the characteristics of the plants adapt to the constraints of the planning tool and not the other way around. Compromises made in modeling each plant for the purpose of multi-plant scenario planning and execution are likely to cause inefficiency and economic loss.

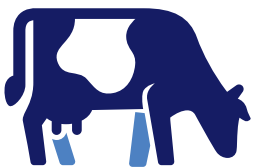




Achieving business goals across the supply chain with Quintiq

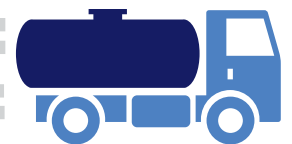
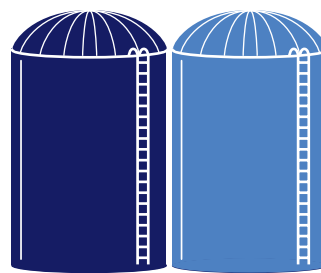
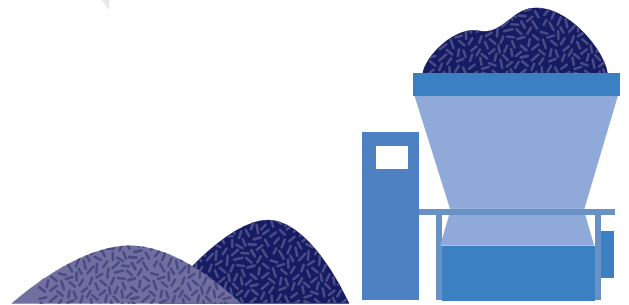
Plant/animal-source suppliers

- Having complete demand information while planning enables optimal use of temporary storage and primary processing
- Demand-based delivery plans reduce produce spoilage, storage overflow, and transportation costs



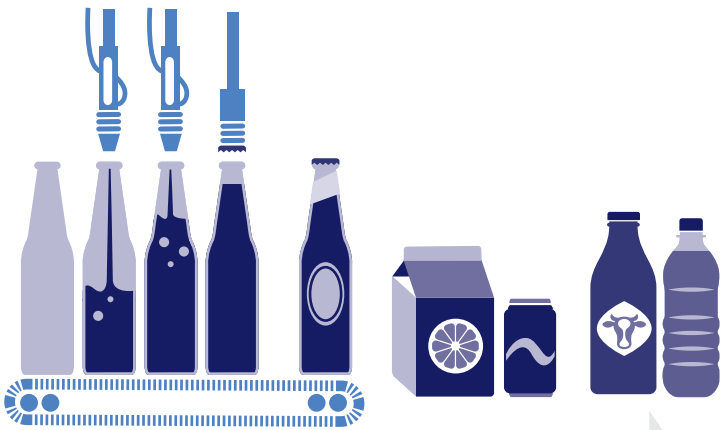
Malt house/Mill operations

- Having accurate demand forecast information when making decisions enables optimized planning for feedstocks, production lines, workforce, and logistics
- Planning for feedstock, inbound logistics and balancing output to demand optimizes inflows of raw materials, packaging materials, and minimizes the risk of supply interruptions
- Improved planning of raw material transportation and packaging materials supply reduces material logistics costs
- Improved production order planning increases machine use, tank utilization and workforce needs
- Improved planning of deliveries to downstream plants (breweries, bottling plants, filling plants) reduces the need for storage and reduces outbound transportation costs



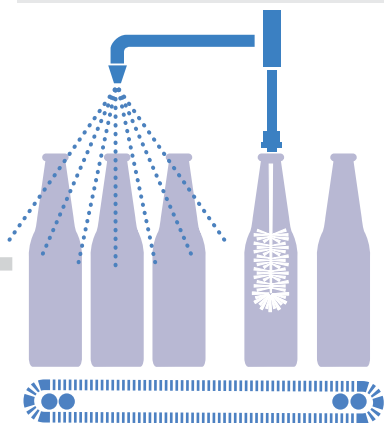
Storage

Having complete demand information when planning storage minimizes the risk of supply volatility



Brewery operations/Bottling plant operations/ Filling plant operations:

- Having accurate demand forecast information when making decisions enables optimized planning for product mix, feedstocks, production lines, workforce, and logistics
- Planning for feedstocks, inbound logistics and balancing output to demand optimizes inflows of feedstocks and packaging containers, and minimizes the risk of supply volatility
- Improved production order planning increases usage of plants, production lines, equipment/machinery, and workforce needs
- Optimal detailed scheduling sequences campaigns based on expected batch formulations, equipment flushing on changeovers, outbound logistics capabilities. Prevents bottlenecks on the production lines due to planned or unforeseen maintenance events.
- Improved planning of deliveries reduces the need for storage and cuts outbound transportation costs

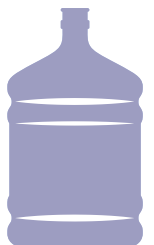


Inbound reverse logistics

- Planning the optimal flow of returned re-usable containers
- Scheduling container recovery and cleaning activities
- Planning the delivery of containers to production/filling operations

Logistics to/from wholesalers and retailers:

- Optimal planning of transport needs based on expected product fulfillment rates reduces costs of finished goods inventories, warehouse space, and transport assets.
- Optimal transport scheduling allows optimization of mid-term/long-term transportation contracts
- Planning for the lowest-cost transportation scheme ensures delivery is always made on time and in full (OTIF).
- Optimal scheduling of each shipment allows load consolidation based on delivery routing, delivery costs, transport capacity and functionality, and customers' stock levels
- Improved customer satisfaction reduces the possibility of losing customers due to late or non-delivery (ATP, CTP, PTP functionalities)





3 Plan across multiple time horizons to prevent inadvertent negative impacts of operational decisions on tactical decisions and vice versa

Supply networks of beverage manufacturers are intricately linked and sensitive to events occurring in any segment of the network. If the manufacturer is able to quickly detect and interpret a supply signal, supplies can be rerouted, production can be realigned, and the distribution redirected to maintain the speed and volume of order fulfillment.

What is often lacking is the ability to identify and measure the impact of events occurring in one time horizon on the key performance indicators (KPIs) of another time horizon. For example, a forecasting solution predicts a ramp up of demand in a period of typically lower demand, assuming ongoing production capacity and stock replenishment will be sufficient to meet that demand. Unknown to the demand planners, in the operational (short-term) horizon, the line maintenance planners scheduled downtime of the production lines to perform necessary line upgrades and long overdue maintenance.

Loosely integrated planning tools do not allow manufacturers to analyze demand, supply and production resources in one step.

The Quintiq planning platform combines the analysis of demand, as well as supply and production processes. It allows the testing of the service delivery levels and line capacity constraints against the hypothetical swings in demand and hypothetical availability of the production lines.

Unlike typical planning and simulation tools, Quintiq analyzes, in real time, the impact of any planning decision on corporate KPIs. It then propagates, in real time, the impact of decisions made for one time horizon across other time horizons. This prevents planners from making decisions that look great within one planning horizon, but are disastrous for the overall performance of the company across all other time horizons.





4 Plan raw materials, container inflow and inventories to ensure uninterrupted production

Accurate forecasting allows the development of scenarios for raw materials inflow, inventory stocking and allocation of demand to individual plants.

Master production scheduling (MPS) in demand-driven manufacturing promotes the establishment of inventory levels for finished goods at each plant location, according to the demand fulfillment strategy.

Consistent fulfillment of the customer service targets hinges on the integration of inventory planning (safety stock levels, reorder points and reorder batch sizes) with distribution planning. This integration plays a key role in preventing the volume of goods produced from increasing above the handling capacity of the warehouse and the transportation network. Beverage companies using returnable containers can derive additional benefit of such integration, as the containers must be returned from the market in time to fulfill the production plans.

Typically, production planning tools and transport planning tools do not communicate with each other and must rely on a manual integration process. Planning transportation independently of production output planning results in higher costs for transport, warehouse/distribution center space and cross-dock operations.

Quintiq's integrated planning platform ensures that the raw materials inflow and inventory positions build upon the forecast demand. The planners can visualize trade-offs between promised order fulfillment requirements, inbound warehouse capacity, and inventory costs. Planning decisions to increase or decrease inventory levels are immediately reflected in the KPIs within the planning dashboards.

Quintiq's optimization ensures that customer service levels are met, while the manufacturer holds minimum inventory levels. When returnable containers are involved, optimization ensures that the production requirement is met with minimal purchases of additional containers.

5 Plan production to balance the costs of inventory against the line/machine setup costs

Efficient lot sizing represents a challenge for beverage production planning. A critical component of lot sizing is demand. Imprecise forecasting and demand planning undermines effective lot sizing. Further along in the planning process, material resource planning (MRP) or rough-cut capacity planning cannot determine the most efficient lot size because they do not factor in setup, direct costs or storage costs.

Too often beverage manufacturers have relied on a combination of MRP and gut feeling to produce an order fulfillment plan. However, lot sizes and production sequences must be solved simultaneously. When inaccurate plans become data input for detailed production line scheduling, the feasibility of the entire production outcome is compromised. Frequently, related data processing activities are done using separate IT systems, so defining lot size that is both correct and economically efficient is not possible.

Quintiq's advanced master production scheduling (MPS) solution enables planners to efficiently determine the optimal lot size and production sequence by taking into account demands (forecast, safety stock and pre-build), supply capacity constraints (production and warehouse) as well as supply chain costs (production, warehouse and financial).

The Quintiq planning platform supports multiple methods of optimal lot sizing. It can also perform demand variability analysis and determine the best production leveling (smoothing) approach, for example, comparing Optimal Product Quantity (OPQ) against Heijunka.

Seasonality, accentuated by swings in production capacity, can cause individual product volumes at each site to vary significantly over time. By including optimal lot sizing logic within the Quintiq planning system, the feedback loop is cut out. Hence, production allocation and optimal lot sizes are calculated simultaneously to attain the lowest costs.



6 Schedule production to keep service-level promises made to your customers

Production line performance is integral to beverage manufacturing. Repetitive seasonal demand patterns can be mastered and managed with the accumulation of stock in inventories. However, this is done at great risk if the product is constrained by freshness requirements and “best before” dates.

Within food-related industries, beverage production plans change more often because frequent promotions and unseasonal events cause demand to fluctuate. Meeting demand is complicated further by two stages of production: preparation of the liquid and the subsequent bottling of the liquid.

Some planners use material requirements and rough-cut capacity plans with infinite capacity – this practice is not even capable of recognizing the need for seasonal production. As such, this leads to the creation of unrealistic plans and time-consuming re-planning in the event that production orders change.

With the use of traditional production planning tools, it is impossible to account for a limited or unstable supply of raw materials.

Quintiq’s advanced liquid scheduling solutions enable the modeling of production lot sizing and scheduling decisions with batching rules, setup logic, sequence-dependent setup costs and times, and alternative routing and recipes.

Leveraging on lessons learned from production planning and scheduling in complex process and discrete manufacturing, Quintiq has developed a solution that easily models to:

- **accommodate multiple production stages with dissimilar activities**
- **synchronize scheduling across each stage**
- **factor in bottlenecks alternating between stages of production.**

This sophisticated approach ensures optimal production plans and schedules. Quintiq uses advanced optimization algorithms to produce good initial schedules automatically, saving the scheduler time and allowing the scheduler to run scenarios to find even better options.





7 Optimization allows users to manage exceptions

Too many companies rely on planners to input the entire plan into rudimentary planning tools. Beverage companies have multiple supply chains, diverse products, and many storage locations. Manual planning of all supply chain components at the same time, each with their own set of constraints, is time consuming and error-prone.

The calculations performed by planners often require multiple checks, so there is no time for the planner to think and decide which plan is optimal, let alone produce multiple plans for “what-if” or “compare and contrast” scenario analysis.

Planners are inherently reluctant to trust computer-based planning, as they tend to consider every decision, simple or complex, against the merits of their accumulated experience.

Quintiq's optimization technology is designed to give the planner full control and visibility, allowing him to amend the optimized plan where needed. The planner can choose to optimize the entire plan or just parts of the plan. Often, planners leave calculations to the machine-

based optimizer, while they focus on handling exceptions and trade-offs highlighted by the optimization.

At any time, the planner can refer to real-time analytics, calculating the KPIs with every plan-editing decision.

Multiple optimization technologies form a significant part of Quintiq's optimizer and these are instrumental to the software platform generating optimal plans.

In beverage manufacturing, particularly in production and supply chain scheduling, constraint programming is highly effective in solving optimization puzzles where identifying a solution is difficult. It works by continuously eliminating potential solutions according to the constraints, even when the constraints are non-linear.

Another technology, unique to Quintiq, is the path optimization algorithm (POA), a proprietary large-neighborhood-search (LNS) technology. LNS explores much larger neighborhoods than a local search would and as such, is less likely to be limited to delivering a locally optimal solution that is far from being globally optimal. The POA is incredibly effective in solving manufacturing scheduling and vehicle-routing puzzles.





8 Plan end-to-end supply chain on one platform, not in multiple silo tools

The antithesis of the best practice in planning and scheduling is the use of multiple, loosely integrated IT systems. Typically:

- Your forecast is done using one tool.
- Your demand plan is done using the second tool.
- Your supply plan is done using the third tool.
- You define the initial lot size against the filling line capacity using the fourth tool.
- You adjust lot sizes based on tank capacities with the fifth tool.
- You define the detailed production schedule with the sixth tool.
- You plan movement of the finished goods inventories with the seventh tool.
- You plan the transport fleet movement using the eighth tool.

If your chain of IT systems consists of those eight tools or more, not counting numerous supporting spreadsheets to make adjustments based on resource availabilities, machine maintenance and unplanned product demands, you are wasting your company's valuable resources: materials, plant and equipment capacity, workforce, and capital.

Imagine if you could use the latest discoveries in mathematical optimization and harness its power to significantly improve the operational and financial metrics of your company.

Where would you apply optimization in the chain of the legacy planning applications? If you were to apply the optimization at the start, how would you recognize bottlenecks downstream? If you were to use it with downstream planning applications, you would increase the risk of optimizing using data that has been distorted and compromised in earlier planning applications. One way or another, your investment in optimization will fail.

Inefficient planning can be attributed to the number of systems planners need to use to:

- **collect inputs for plans**
- **collaborate with all business areas to achieve consensus**
- **produce plans.**

Every time data moves between disparate planning systems, opportunities for transmission errors increase exponentially and the quality of planning decisions diminishes.

Quintiq's planning platform removes the risks associated with planning in numerous silo systems. Common optimization architecture is shared by planning solutions fit for the planning purposes of each business area in the value chain.

From forecast creation to establishing viable demand scenarios, to selecting the optimal production execution plan, to balancing the distribution and transportation requirements, the same data set is used by all planners. Online KPI calculations allow planners to view the financial impact of every planning decision they make. Visual cues show real-time occurrence of conflicts and undesirable events, so that the planners can assess the possible remedial steps and select the most optimal decision and execution plan. That is the power of platform-based supply chain thinking.

To find out more about the unrivaled advantages a singular planning system can offer your business, visit www.quintiq.com or contact us today.



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