

# The Modern Supply Chain: Inventory Optimization Competitive Assessment

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## Supply Chain Strategies European Supply Chain Strategies

COMPETITIVE ANALYSIS #MI218001

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### **MANUFACTURING INSIGHTS OPINION**

The continued global recession impacting multiple value chains has placed enormous pressures on supply chain organizations. Business objectives have temporarily narrowed toward maintaining profitable customers and preserving cash and working capital. Dramatic changes in business have inevitable impact to a company's supply chain network, and the overall management of supply chain inventories across all tiers of the global supply chain has taken on ever more importance because of its direct relationship toward minimizing cash and improving the bottom line. Findings include:

- Inventory optimization (IO) technology has increasingly become an important tool to aid manufacturers in either managing their overall supply chain inventories more efficiently or having the capability to support decision-making processes with what-if quantification of the impact of certain business decisions on overall inventory investment.
- This technology has moved beyond its previous "black box" perceptions, and it has increasingly been adopted and deployed by leading-edge companies. Decision processes such as overall sales, inventory, and operations planning (SI&OP); "profitable proximity" sourcing; and new product innovation can all be aided by this technology.
- Manufacturing Insights survey of existing deployments among manufacturers indicates that depending on the existing inventory problem, ROI for this type of technology can be significant and meaningful. Usability across vendor offerings is improving, helping in more rapid adoption. Deeper functionality, broader integration with supply chain network design, demand aware, supply management, and planning workbenches have all helped in adoption and user acceptance levels.
- Deployment of this technology can be accomplished in four to six months for initial managed scope deployments, thus facilitating inventory and other benefits to the business in less than a year.

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## **IN THIS REPORT**

This research report presents our view of the current landscape of inventory optimization technology, its state of maturity, and key vendors that continue to provide competitive offerings in this technology space. This report is a follow-on to our previous report (see *Modernizing Your Supply Chain: The Execution Imperative*, Manufacturing Insights #MI212394, June 2008), which provided the context and value of IO technology in overall supply chain planning capability.

Specifically, we will look at:

- The overall context for inventory optimization
- Implications and decision criteria for the four distinct manufacturing value chains
- Key vendors in the space, both in terms of functionality and reach
- A "maturity matrix" balancing technical functionality with integration maturity
- Influencers on the decision-making process

## **SITUATION OVERVIEW**

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### **Introduction**

This Manufacturing Insights research report covers the technology known as inventory optimization or sometimes referred to as multi-echelon inventory optimization. Manufacturers today are dealing with a level of unprecedented business change and supply chain complexity. Revenue and profitability growth objectives require that business and product groups access newer, more growth-oriented geographic markets, resulting in supply networks that extend across many global regions. Customers, in turn, demand differentiation, continuous product innovation, and high service levels. Not only are the number of supply chain echelons and inventory-holding locations increasing, but the number of product stock-keeping units (SKUs) at each location has drastically risen as well.

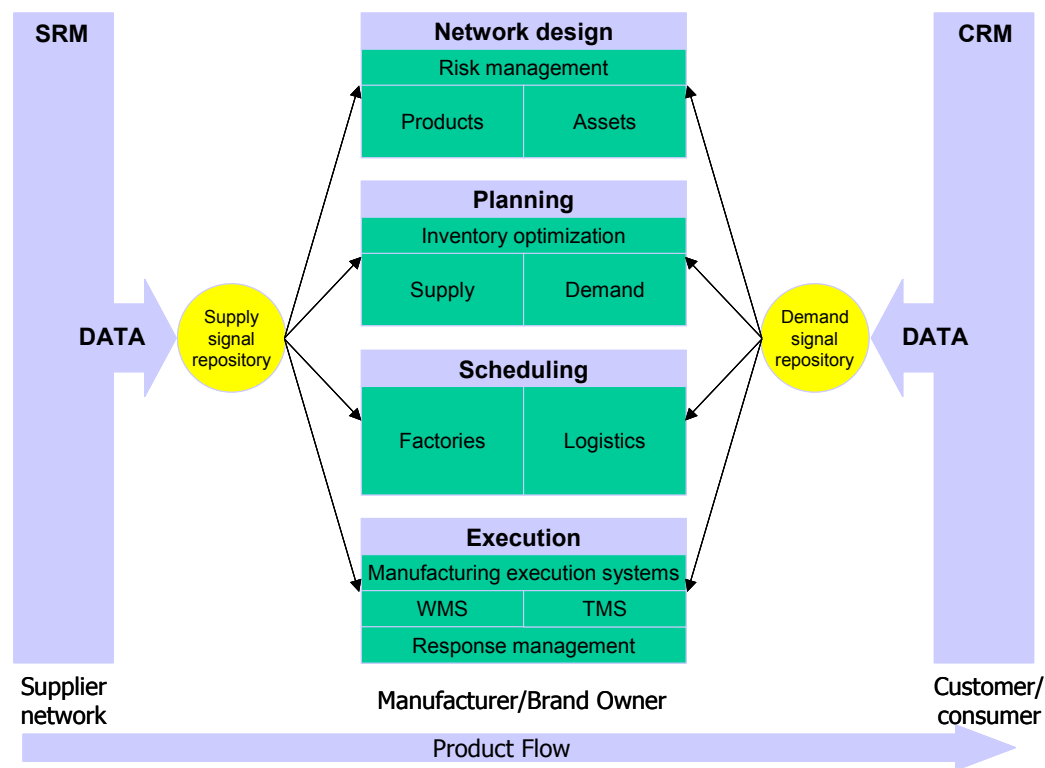
As the current global recession prolongs itself, cost containment and working capital optimization pressures have now risen to CFO and board-level visibility. Key customers must continue to be satisfied, and planners do not want to risk losing business because of a lack of or insufficient inventory. Within this challenging and delicate balance environment, manufacturers must, more than ever, leverage advanced and proven technology to provide better, faster, and more informed decisions regarding inventory deployment.

Although an overused term, "optimization" will, we believe, play a significant role in 2009 as, the global economies continue to struggle and companies look both to survive and best position themselves for the inevitable recovery. As we highlighted in *Worldwide Supply chain 2009 Top 10 Predictions* (Manufacturing Insights #MI215807, December 2008), we expect to see a focus on supply chain modernization, network "rightsizing," and asset optimization. In this context, inventory optimization resonates well with IT buyers.

In a previous report (see *Modernizing Your Supply Chain: The Execution Imperative*, Manufacturing Insights #MI212394, June 2008), Manufacturing Insights graphically outlined our view of the "modern supply chain." In Figure 1, we reintroduce this architecture.

**FIGURE 1**

The Modern Supply Chain



Source: Manufacturing Insights, 2009

Readers will note our outline of "planning" competency, and that we include inventory optimization as an overarching capability need for planning, including the ability to extract data and support decision making across demand and supply process needs. Even though it has

been positioned in this quadrant, this technology has also demonstrated increasing utility for supporting both network design and supply chain execution needs.

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## **Inventory Optimization Applications**

In the most simplistic sense, the overall management of any supply chain requires the ability to manage three constantly changing variables, customer service needs, overall capacity, and inventory. Inventory management remains a fundamental leg to this three-legged stool. Traditional inventory management planning processes and software applications tend to manage inventory with generalized calculations planned at the individual site level, often utilizing static variables related to changes in demand. Variability in supply tends to be planned on a static basis with fixed rules for lead or replenishment time. Capacity variability or constraints are not often factored for impact on inventory investment. Demand-side fluctuation is often managed by increasing or decreasing site level safety stock. Supply-side variability or uncertainty is usually compensated by increasing or decreasing raw material, work in process, or semi-finished goods inventory. With today's reality of supply chain complexity and constant variability, these traditional inventory management applications often fall short in results, fostering higher overall safety stock levels and improper inventory mix across all the various echelons of the supply chain, resulting in deteriorating customer service levels.

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To address this complex inventory management problem, a group of primarily operations research academics, who often consulted with manufacturers in addressing such problems, spawned a new category of advanced planning software. Inventory optimization applications are designed to plan inventory policy across multiple dependent echelons of a supply chain, in multiple planning periods. In a simplified view, an IO application will set inventory targets up and down the supply chain on a simultaneous basis. These applications can further optimize around value chain design, variability in product demand, production, or transport lead time, treating the entire supply chain as a single entity. Functionality often includes inventory item-level granularity, focusing on SKU, stocking, or customer location analysis. The algorithms employed can include deterministic and stochastic methods, or a combination of both. Many have the capability to support multiple scenario planning for optimizing the supply chain-wide inventory investment or what-if analysis related to a set of potential supply chain deployment business decisions. In some sense, IO is part of a collection of supply chain analytic applications, which support more timely decision making.

The majority of IO offerings in the current market have been built around unique optimization algorithms, and each will yield a different result. It is therefore important for prospective buyers to do their

homework in understanding the inventory or business planning problem needing to be addressed. Deployment of this type of application usually includes two types of approaches. In an interactive attended deployment, information inputs and outputs are depicted within the actual IO tool, and planners interact with the application to obtain inventory targets or perform analysis. In an automated deployment, the IO application itself sits in the background, with automated feeds of inventory or safety stock targets sent directly to the designated advanced planning system (APS). In this mode, planners continue to interact with the APS system but receive exception messages and certain analysis from some form of planning workbench fed by both the IO and the APS applications.

The technology itself is relatively new, mostly dominated by a small number of standalone best-of-breed vendors. While Oracle provides its own IO product offering, other major ERP vendors such as SAP and Microsoft have elected a partnership strategy for assisting their customers in selecting an IO application. Once viewed as a strictly "black box" technology that could only be understood and deployed by operations management (OM)-schooled professionals, these applications are becoming more universally understood and accepted by business and supply chain planning professionals. The addition of added usability and exception workflow features has helped in this overall acceptance, along with testimonials from the earliest corporate adopters. The IO application typically has direct interfaces to a resident ERP or an advanced planning system, offering sophisticated analysis of inventory deployment options. Despite the newness to the market, our research continues to find that companies continue to be attracted and achieve business benefits from these applications.

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### **The Business Problem!**

Although some software vendors persist in taking a "build it and they will come" approach to applications and technology, that is not the case with inventory optimization. The business challenges are quite clear and obvious. Typical business problems that an IO application tends to support include:

- How much inventory should I hold of each product, and where is the most cost-efficient point to store that inventory?
- My products are often seasonal or cyclical in terms of demand — how do I most efficiently plan and deploy overall inventory?
- What business policies are driving inventory investment across the entire supply chain?
- If I must improve service, how much incremental inventory investment will I need? Conversely, if I decrease service level, how much inventory can I free up?

- How will a change in a supplier or production location impact my overall inventory cost or customer service levels?
- Can I increase margins and improve service by holding inventory in a different location?
- How can I best deploy a combination push-pull supply chain or an inventory risk-pooling model?

IO applications have further been demonstrated to provide information, scenario, and decision-support capability for supply and demand balancing within sales and operations planning (S&OP) process and are proving instrumental in helping companies to expand their focus into the expanded dimensions of sales, inventory, and operations planning. Manufacturing Insights will be exploring this evolution in a future report focusing on the consumer goods industries.

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### **Application Operation: It's the Data, Stupid!**

An IO application requires certain data to perform its optimization and analysis of inventory. Typical input data for this application would include:

- Product forecast or demand plans in planning periods
- The overall design and layout of the value chain (suppliers, manufacturers, distribution centers, and customer locations), along with alternative routings
- Cost data (products, manufacturing, transportation, and storage)
- Service-level targets and/or penalty factors
- Budget constraints

Although we have made this observation countless times before, the performance of the inventory optimization application will only be as good as the quality of the input data.

Data is often extracted from the resident ERP, advanced supply chain planning, or other resident systems. Thus, for IO applications to provide value for manufacturers, there must be some sense of accurate and consistently updated data and a solid data integration mechanism between the IO application and other dependent systems.

An IO application utilizes all of this data to iterate a best service- and inventory-level scenario that satisfies constraints of production, transportation, inventory carrying, and other value-added costs. Optimization output can include inventory targets for every product or

*Although we have made this observation countless times before, the performance of the inventory optimization application will only be as good as the quality of the input data.*

item, at every echelon/location, over a defined planning period horizon. IO demonstrates its biggest value when a manufacturer has to balance different goals for different products, customers, or sales channels. Users can, in turn, run different scenarios with different constraints to ascertain what may be the best overall inventory management decision. As an example, overall inventory investment may be optimized by a postponement strategy that stocks inventory at an intermediate supplier or a contract manufacturer.

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### **The Importance of ROI in an Economic Recession**

The current global economic recession and constrained capital markets mean that the cost to borrow to support new investment is rising. Manufacturers have been in an intense review of their fixed asset portfolio, looking to decommission underperforming holdings while increasing utilization of good performing assets. Asset performance will be a front and center for manufacturing firms that will try to optimize what they have before they invest in anything new. At the same time, working capital, particularly inventory, must be increasingly productive.

As we observed in our top 10 supply chain predictions for 2009 (see *Worldwide Supply chain 2009 Top 10 Predictions*, Manufacturing Insights #MI215807, December 2008), constraints on capital are putting supply chain and IT budgets under the microscope. We are hearing with some frequency that companies are using zero-based budgeting techniques, going back to a blank sheet of paper and building spending backup rather than just assuming a growth rate that keeps IT within an acceptable percentage of revenue. Capital spending will therefore favor projects with fast implementation times and even faster benefit realization. Where they do decide to make investments, manufacturers we have spoken to lately say they are going to be much more pointed in their discussions with vendors on exact functionality acquired and expectations for savings.

In addition, the high 2008 year-end inventory levels are causing manufacturers to look at supply/demand rebalancing with a specific focus on strategic network optimization and multi-echelon inventory optimization tools.

In this context, it is useful to discuss the typical costs and benefits that can accrue from an investment in an inventory optimization implementation.

The cost of an IO implementation is quite variable, with vendors in the space pricing quite differently. Although the cost of software has been coming down, a typical implementation should be expected to be in the \$300,000–500,000 range for software, with a project timeline of

typically six to nine months. Implementation costs will also be variable, and are dependent upon the use of outsourced consulting resources and the size/duration of any internal resources, but should be considered to be in the same range as software costs. The benefits of an IO implementation can be significant. The magnitude of actual savings will depend upon the pre-implementation level of inventory control and the magnitude of supply network complexity, but it is not unusual for a global supply chain to see inventory levels reduced by as much as 15–25%.

Although clearly actual costs and savings for specific implementations are proprietary, the manufacturing companies we spoke to for this report have indicated that a one- to two-year payback is not unusual, with a discounted cash flow ROI above the 50% range. It is important to note that all implementations are different and will have different results, but in the current economic climate, the investment in inventory optimization is compelling.

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### **Value Chain Applicability and Support**

Today's IO methodology and design can be outlined within three different value chain problem areas:

- Optimization of overall inventory within a distribution-driven chain that is primarily driven from high customer service or demand requirements (Typically, there are few lateral movements and optimization requirements focus on finite modeling end-item demand, setting end-item parameters, and optimizing end-item inventory mix.)
- Optimization of overall inventory within a manufacturing-driven chain that is driven by a product's added value and transformation to a complete finished good (Typically, it includes a convergent product structure covering value-added activities spanning raw material through finished good, across many locations, with variables of time, cost, or contribution margin. Requirements include defining the inventory strategy, potentially setting the push-pull boundary between make-to-stock (MTS) and make-to-order (MTO) production, defining stocking policy for intermediate materials, or setting component and end-item inventory parameters.)
- Optimization of inventory within a forward or reverse distribution-driven chain, supporting service-related parts or serviceable products (Demand is typically driven by product failure or product maintenance cycles. Inventory is planned from point of consumption through multiple stocking and production echelons. There is often a reverse inventory flow, since certain failed components or products are shipped to a repair facility for overhaul or refurbishment, and then returned to the inventory pool.)

The first two business problem areas are typically those experienced within the purview of manufacturing, third- or fourth-party distribution, and some private brand retailing. The third problem area is one that is highly specialized and supported by a niche group of service parts planning application vendors and is not included in the scope of this research report.

Figure 2 reiterates the four Manufacturing Insights distinct value chains, each operating with a different set of supply and demand complexity, cadence, and process emphasis. For more detail on these value chains, see *Modernizing Your Supply Chain: The Execution Imperative* (Manufacturing Insights #MI212394, June 2008).

While IO applications can support most of these value chains, their business value is especially differentiated when the inventory management problem is described as the first or second item (either distribution or manufacturing-driven value chains) in the list provided previously. Some of the very early adopters of this technology were brand-oriented consumer products manufacturers that had to overcome high demand variability, high service level, and supply complexity challenges for more efficient management of overall inventory.

Technology-oriented, and to some extent, consumer electronics-focused value chains present a more complex problem involving numerous and frequent new product introductions, many intermediate value chain partners, and high customer service requirements, complicating overall inventory management and proper placement. High-growth industries such as medical electronics and pharmaceutical also experience higher product and geographic expansion variability.

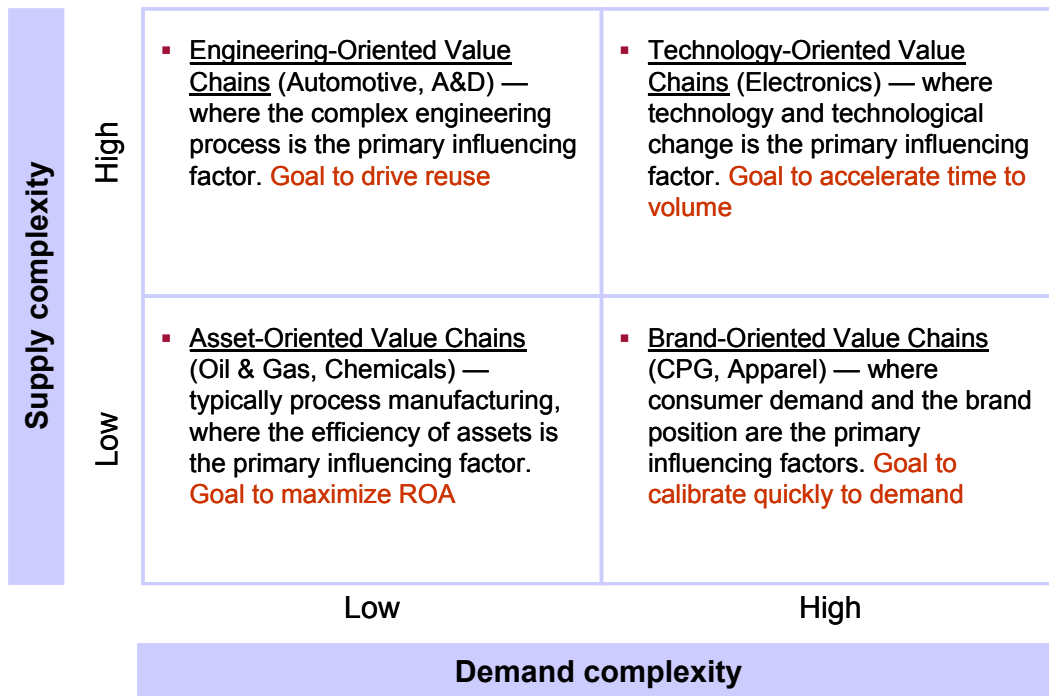
Engineering-oriented value chains, in turn, have become more geographically extended and interdependent with geographically outsourced semi-finished goods suppliers and are also showing interest level in this technology. And in the asset-oriented value chain, semiconductor fabrication and packaging manufacturers have shifted toward supplying more brand-oriented value chains, with cyclical product cycles, servicing greater numbers of geographic customers.

It is therefore important for the prospective IO buyers to be able to both understand and layout their organizational or company value chain structure and be able to source data related to cycle time, product cost, penalty, and transportation cost trade-offs. It has long been the contention of Manufacturing Insights that optimizing one part of the supply chain cannot be done in isolation from the others. When discussing inventory optimization, it is critical to also consider the supply network and its critical constraints. This becomes increasingly true as supply networks continue to become more distributed and complex. It is, therefore, encouraging to see that many IO deployments now link to supply chain network design applications and other systems that are custodians of key data. The various IO vendor

offerings in the market demonstrate certain strengths in fully supporting either a distribution-oriented or a complex manufacturing-oriented IO problem.

**FIGURE 2**

Manufacturing Value Chains



Source: Manufacturing Insights, 2009

**Application Assessment**

**Vendor Landscape**

Although there is one notable exception, the inventory optimization vendor landscape is characterized by smaller, best-of-breed providers. In Table 1, Manufacturing Insights provides an overview of what we believe are the primary IO application vendors, along with some essential information such as customer profiles and geographic penetration. This is not meant to be an inclusive list of all vendors, but rather those that we believe will shape the direction and overall adoption factors within this market and offer capabilities to support the proliferating global supply networks. Also, please note that the key customers listed for each vendor are just a sampling — many of the vendors maintain a non-disclosure agreement with their customers.

**TABLE 1**

## Inventory Optimization Vendor Profiles

| Vendor              | Web Site   | Years of Experience in IO | FTEs                | Primary Product  | Estimated Customers | Regional Spread (NA/EMEA/AP/ROW %) | Manufacturing Related | Retail Related      | Supplier/LSP Related | Key Customers  |
|---------------------|--|---------------------------|---------------------|--|---------------------|------------------------------------|-----------------------|---------------------|----------------------|--|
| Axxom Software AG   | <a href="http://www.axxom.com">www.axxom.com</a>     | 7                         | 42                  | Orion-PI Business Planner  | 50                  | 30/60/10/0                         | 80%                   | 5%                  | 15%                  | Adidas, Avon, Bayer Schering Pharma, Nexan, Siemens  |
| IBM/ILOG/LogicTools |  | 6                         | Declined to respond | ILOG Inventory Analyst consisting of four modules: Inventory Analyst, Supply Planner, Product Flow Optimization, and Demand Profiler | Declined to respond | Declined to respond                | Declined to respond   | Declined to respond | Declined to respond  | Declined to disclose   |
| i2 Technologies     | <a href="http://www.i2.com">www.i2.com</a>           | 10                        | NA                  | i2 Inventory Optimization  | 50                  | 70/20/10/0                         | 95%                   | 5%                  |                      | Mercedes-Benz USA, ON Semiconductor, Texas Instruments, Pepsico                              |
| Optiant             | <a href="http://www.optiant.com">www.optiant.com</a> | 8                         | >20                 | PowerChain Inventory and Planner   | 65                  | 75/20/5/0                          | 82%                   | 7%                  | 21%                  | Black & Decker, HP, Intel, Kraft Foods, Microsoft Consumer & Entertainment, Procter & Gamble |

**TABLE 1**

## Inventory Optimization Vendor Profiles

| Vendor     | Web Site   | Years of Experience in IO | FTEs | Primary Product                                       | Estimated Customers                | Regional Spread (NA/EMEA/AP/ROW %)       | Manufacturing Related             | Retail Related                   | Supplier/LSP Related            | Key Customers   |
|------------|--|---------------------------|------|---|------------------------------------|--|-----------------------------------|----------------------------------|---------------------------------|---|
| Oracle     | <a href="http://www.oracle.com">www.oracle.com</a>         | 7                         | NA   | Oracle Inventory Optimization                         | IDC estimates in the 225–275 range | IDC estimates in the range of 65/20/15/0 | IDC estimates in the 85–90% range | IDC estimates in the 8–12% range | IDC estimates in the 2–4% range | Agilent Technologies, Source Photonics  |
| SmartOps   | <a href="http://www.smartops.com">www.smartops.com</a>     | 8                         | 60   | Multistage Inventory Planning and Optimization (MIPO) | 70                                 | 90/10/0/0                                | 80%                               | 10%                              | 10%                             | Bayer Cardinal Health, Caterpillar, Johnson & Johnson, Lexmark, Monsanto, Schering-Plough, Unilever |
| ToolsGroup | <a href="http://www.toolsgroup.com">www.toolsgroup.com</a> | 7                         | 55   |   | 141                                | 55/40/0/5                                | 64%                               | 16%                              | 20%                             | Colgate-Palmolive, Cadbury Schweppes, Dixons Group, Georgia-Pacific                                 |

Source: Manufacturing Insights, 2009

## Evaluation Criteria and Assessment

Manufacturing Insights has summarized in Table 2 our outline of key IO functionality areas, along with our rating assessment of how each of these vendors currently provide for the outlined functionality. The following are the rating values outlined:

- **Competitive:** Functionality or coverage equal to all existing vendors in this group
- **Average:** Good functionality or coverage, but not equal with all existing vendors in this group
- **Marginal:** Functionality or coverage that is neither average nor competitive

**TABLE 2**

Inventory Optimization Vendor Comparison Chart

| IO Vendor Comparison Points                       | Axxom       | IBM/ILOG/LogicTools              | i2 Technologies   | Optiant     | Oracle                   | SmartOps    | ToolsGroup                   |
|---|-------------|----------------------------------|---|-------------|--------------------------|-------------|------------------------------|
| <b>Functionality support highlights</b>           |             |                                  |   |             |                          |             |                              |
| Multi-echelon/multistage optimization capability  | Competitive | Competitive                      | Competitive   | Competitive | Competitive              | Competitive | Competitive                  |
| Global network capability                         | Competitive | Competitive                      | Competitive   | Competitive | Competitive              | Competitive | Average                      |
| Short-term S&OP process integration capability    | Competitive | Competitive                      | Competitive   | Competitive | Competitive              | Competitive | Competitive                  |
| Longer-term network design integration capability | Competitive | Integrates to ILOG LogicNet Plus | Integrates to i2 supply chain strategist or other offerings | Competitive | Integrates to Oracle SNO | Competitive | Integrate to other offerings |
| Holistic supply chain view                        | Competitive | Competitive                      | Competitive   | Competitive | Competitive              | Competitive | Competitive                  |
| Operational synchronization                       | Competitive | Competitive                      | Competitive   | Competitive | Competitive              | Competitive | Competitive                  |

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## Inventory Optimization Vendor Comparison Chart

| IO Vendor Comparison Points                                | Axxom                         | IBM/ILOG/LogicTools                                  | i2 Technologies                                    | Optiant                       | Oracle                        | SmartOps   | ToolsGroup                    |
|--|-------------------------------|--|--|-------------------------------|-------------------------------|--|-------------------------------|
| Demand signal integration capability                       | Integrates to other offerings | Integrate to ILOG demand profiler or other offerings | Integrates to i2 demand manager or other offerings | Integrates to other offerings | Integrates to other offerings | Integrates to other offerings, primarily SAP APO demand planning | Integrates to other offerings |
| Logistics costs considered as part of IO                   | Competitive                   | Average  | Competitive  | Competitive                   | Competitive                   | Competitive  | Average                       |
| Strategic sourcing decision support — profitable proximity | Average                       | Competitive  | Competitive  | Competitive                   | Average                       | Average  | Marginal                      |
| Production costs considered as part of IO                  | Competitive                   | Average  | Competitive  | Competitive                   | Competitive                   | Competitive  | Average                       |
| Supply capacity constraints considered as part of IO       | Competitive                   | Average  | Competitive  | Competitive                   | Competitive                   | Competitive  | Competitive                   |
| Process capacity constraints considered as part of IO      | Competitive                   | Average  | Average  | Competitive                   | Competitive                   | Competitive  | Competitive                   |
| What-if scenario analysis                                  | Competitive                   | Competitive  | Competitive  | Competitive                   | Competitive                   | Competitive  | Average                       |
| <b>Optimization method support</b>                         |                               |  |  |                               |                               |  |                               |
| Linear programming   | Yes                           | Yes  | Yes  |                               | Yes                           |  | Declined to respond           |
| Stochastic programming                                     | Yes                           | Yes  | Yes  | Yes                           |                               | Yes  | Declined to respond           |
| Nonlinear programming                                      | Yes                           | Yes  | Yes  | Yes                           |                               |  | Declined to respond           |
| Mixed-integer programming                                  | Partial                       | Yes  | Yes  | Yes                           | Partial                       |  | Declined to respond           |

**TABLE 2**

## Inventory Optimization Vendor Comparison Chart

| IO Vendor Comparison Points                      | Axxom                     | IBM/ILOG/LogicTools | i2 Technologies | Optiant       | Oracle               | SmartOps    | ToolsGroup      |
|--|---------------------------|---------------------|-----------------|---------------|----------------------|-------------|-----------------|
| Other methods                                    | Quant-based Combinational |                     |                 |               | Nonlinear heuristics |             |                 |
| <b>Industry/value chain support</b>              |                           |                     |                 |               |                      |             |                 |
| High-tech industry                               | Competitive               | Average             | Competitive     | Competitive   | Competitive          | Competitive | Average         |
| Chemicals/metals industry                        | Competitive               | Average             | Average         | Average       | Average              | Competitive | Marginal        |
| Automotive/A&D industry                          | Average                   | Average             | Average         | Average       | Average              | Average     | Competitive     |
| Consumer product goods/apparel industry          | Competitive               | Competitive         | Competitive     | Competitive   | Competitive          | Competitive | Competitive     |
| Other industry                                   |                           |                     | Semiconductor   | Life sciences |                      |             | Wholesale/Dist. |
| <b>Integration to other system support</b>       |                           |                     |                 |               |                      |             |                 |
| Compatibility with VMI/SMI relationships         | Competitive               | Average             | Competitive     | Average       | Average              | Average     | Competitive     |
| Master data/data management interface capability | Use of Orion-PI Modeler   | Average             | Average         | Average       | Competitive          | Average     | Average         |
| Pre-integration to SAP ERP platform              | Average                   | Average             | Average         | Competitive   | Average              | Competitive | Average         |
| Pre-integration to Oracle ERP platform           | Use of Orion-PI Modeler   | Average             | Average         | Average       | Competitive          | Average     | Average         |
| Pre-integration to "other" ERP platform          | Use of Orion-PI Modeler   | Marginal            | Average         | Marginal      | Average              | Average     | Average         |

Source: Manufacturing Insights, 2009

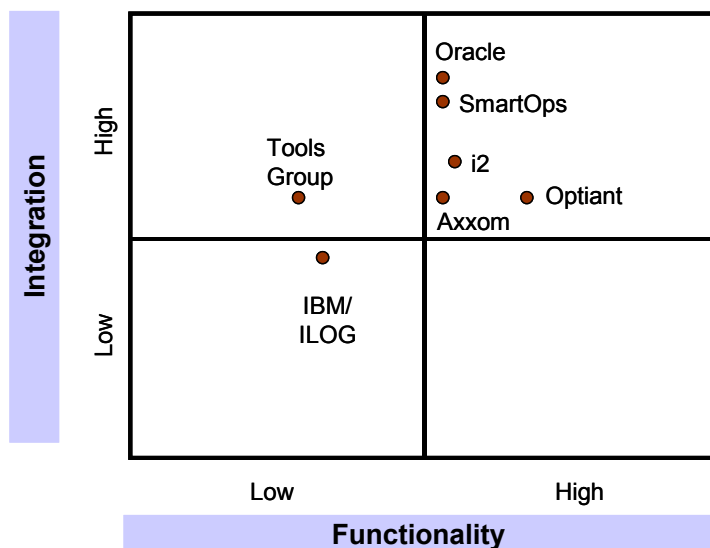
We have looked at the evaluation criteria across two dimensions, functionality and integration. The latter gets a bit tricky as ease of integration will depend upon the ERP platform. Obviously, for example, the Oracle IO application integrates most completely with the Oracle ERP but much less so with the SAP ERP. Similarly, SmartOps, a strategic SAP partner, integrates well with the SAP ERP but less so with the Oracle ERP. The integration axis, therefore, must be viewed through the lens of the end-user resident ERP (see Figure 3) as well as the extent to which integration is likely to become an important factor.

It is also important to keep in mind that the vendors we have included in the assessment all bring significant capability to their IO application set and differences highlighted may be more or less relevant given industry vertical or specific business challenges. We have, therefore, not attempted to assign "value" to each of the vendors as this will vary dramatically for specific implementations based on acquisition and integration costs, complexity, and actual benefits realized. The assessment is really just a relative starting point tool for technology buyers interested in pursuing an inventory optimization application. Further the quadrants reflecting "low" and "high" are relative, not absolute, measures.

Given the importance of these vendors, we will now look at them in a bit more detail.

**FIGURE 3**

Inventory Optimization Assessment "Maturity" Matrix



Source: Manufacturing Insights, 2009

### **Axxom Software AG**

Based in Munich Germany, Axxom is a privately owned software company with deep analytical roots. This vendor's presence is primarily concentrated in Europe and it has a satellite office established in Romania, but it has customers in more than 30 countries — from Australia to South Africa. The IO application part of the solutions family **Orion-PI** includes functionality for supply chain network design as well as optimization and some simulation.

Axxom targets a broad range of industry value chains, both distribution and manufacturing driven. Customers include, for example, apparel, chemical, food and beverage, and pharmaceutical companies. This company tends to compete on the perceived strength of its algorithms, visualization, and integration capabilities. Its resident *Cost Scaling Algorithm (CSA)* as well as its combinatorial-based algorithms offer an alternative to linear programming to factor nonlinear constraints such as transportation rates and fixed and variable costs. Professional services and installation assistance are offered by an unusually large network of smaller, specialized systems integrators primarily located in Europe. With a high concentration in Europe, Axxom claims strong integration capabilities with SAP ERP and is also listed in the Oracle Partner Network.

### **IBM/ILOG/LogicTools**

One of the early market players in the IO market space was **LogicTools**. It was founded in 1995 by Dr. David Simchi-Levi, a noted, well respected, and published author in supply chain and operations management from MIT, and earlier from Northwestern University. As with many vendors in this space, LogicTools was conceived as the evolution of the specialized consulting activity from its academic founder. Simchi-Levi also had a belief that there was a need for specialized supply chain optimization software that could be provided to customers at a more affordable price offering than the typical seven-figure deals in the early 2000s. During its growth cycle, the company was always privately financed and profitable, and in 2003 was one of four vendors (along with Optiant, SmartOps, and ToolsGroup) designated by SAP as potential partners for IO needs among its manufacturing-related customer installed base. From its initial *LogicNet Plus* supply chain network design product offering, the company later added *Inventory Analyst*, a Web-based multi-echelon IO application based on nonlinear optimization technology using ILOG's *CPLEX* optimization technology.

After some success in the market, LogicTools was acquired by French-based optimization and business rule engine components vendor **ILOG** in April 2007. The LogicTools network design and IO application were subsequently made a part of a newly created *ILOG Supply Chain Applications*, joining ILOG's two other rather

specialized offerings: *Plant PowerOps* and *Transportation Analyst*. *Inventory Analyst* has since been augmented with a product flow optimizer, along with strategic and tactical extensions to allow for deeper support for item-level IO needs in more complex manufacturing-driven value chains. The newest 7.0 release of *Inventory Analyst* enhances data integration workflow as well as a number of customer-requested inventory modeling enhancements. A utility that calculates various scenarios of landed cost based on production, transportation, and other costs was a timely enhancement for manufacturers with outsourced production operations. Three basic types of optimization are supported: push-pull and optimization of buffer locations, service-level optimization, and trade-off between mode and inventory.

The underlying architecture is built on Microsoft technology, and integration is facilitated by external connectors. ILOG does provide its own in-house professional services organization and markets the notion that users can be trained in 7–10 days and full implementation can be accomplished in 60 days. LogicTools held *Powered by SAP NetWeaver* certification for integration to SAP applications and was also a Microsoft-certified partner for integration to Microsoft Dynamics applications.

In late July 2008, the *WebSphere* group within IBM made a business decision to acquire ILOG, primarily for its business rules technology. This acquisition was completed in January 2009, and ILOG is now a part of IBM's *WebSphere* software platform group. It would appear at this stage that the marketing and selling of ILOG's supply chain applications will remain the responsibility of ILOG, but the long-term picture of product strategy still remains unclear. IBM at one time offered its own internally developed IO application, and IBM Global Services also had a partnership arrangement with competitor SmartOps for IO application needs within SAP installed base accounts. Evaluation teams should ensure that they have a satisfactory picture regarding the long-term product direction when performing an evaluation of this product. Prior to the IBM acquisition, there were some external system integration and consulting partnerships with specialty firms; they remain for now, but their status remains unclear long term with the recent acquisition by IBM.

### ***i2 Technologies***

Headquartered in Dallas, Texas, i2 is one of the original best-of-breed vendors that developed advanced planning and scheduling (APS) applications as well as other supply chain analytical applications. The i2 Inventory Optimization application has been in the market for about 10 years and was originally developed to help its core high-tech industry customers address their rather difficult needs in multi-echelon value chains. The design principle of i2 was to provide functionality support for both strategic and tactical inventory deployment needs for

item-level inventory investments in a highly outsourced, manufacturing-centric value chain, although this approach can also facilitate complex distribution-centric problems by optimizing trade-offs across inventory, transportation, and purchase costs. This application has matured to be a rather sophisticated application featuring multidimensional segmentation of product demand patterns, customer criticality, product life-cycle trending, or other custom attributes. The application has the ability to plan the best inventory policy for individual SKUs for each stocked location and can support what-if type scenario analysis. Integration is performed through a services-based architecture common to all i2 applications. i2 claims to have in excess of 50 customers currently utilizing its inventory optimization application. Semiconductor value-chain deployments are included.

This vendor was not able to gain the market traction of the other best-of-breed vendors in this space because of a number of strategic marketing errors, as well as market factors. Initially, when the product was first brought to market, it was priced exceptionally high and was targeted more toward upgrading i2's existing installed base of high-tech industry customers, although to be fair, this was also about offering enterprise-level support. Even so, customers evaluating the application could often not justify the high cost with other competitive offerings available in the market. The original application was further positioned to be integrated and marketed as a subset or add-on to i2's other advanced planning applications (even though it does provide complete inventory functionality), which precluded some prospective customers from short listing the application in favor of other vendor offerings that were marketed and certified for major ERP vendor integration capabilities. Finally, in the past few years, i2 has had a history of financial challenges, including management turnover, which cast further concerns for prospective customers.

i2 Inventory Optimization is now being positioned as one of six "industry-oriented solutions" with the company, with dedicated presales consulting and product development support. The application is further positioned as either a custom-developed or an industry-specific offering for customers. More sophisticated functionality has been added, including:

- Closed-loop electronic workflows and integration to inventory execution supporting a low-touch, exception-based deployment
- Plan review root-cause analysis as to why targets changed, or why stock-outs occurred in execution
- Early warning analysis as to impending stock-outs and excess inventory
- Replenishment interval optimization

- Total landed cost optimization
- Flexible budget-constrained optimization
- Excel-based look and feel with graphical visualization of the value-chain network
- Risk scenario management capabilities

### **Optiant**

Based in Burlington, Massachusetts, Optiant Inc. was one of the early vendors offering solely an IO application. The roots of the company stem from its two cofounders, Dr. Sean Willems and Dr. John Ruark, who conceived the need for this type of technology from their joint thesis work at MIT and later consulting work with manufacturers such as Kodak, HP, and The Gillette Company. Both remain actively involved with the company. Optiant's primary IO offering is termed PowerChain Inventory, which is bundled in what is termed as the PowerChain Suite of applications. The company additionally offers a tactical planning application, PowerChain Planner, and in February 2007, it acquired a small supply chain network design vendor, SLIM Technologies, which was renamed PowerChain Network Design. PowerChain Planner was designed to integrate with PowerChain Inventory for more granular or tactical planning needs related to individual inventory end items. PowerChain Network Design has more limited integration capability than PowerChain Inventory. Integration to other ERP or APS systems is primarily leveraged by Optiant's PowerChain Connector technology. In addition, Optiant achieved Powered by SAP NetWeaver certification to assist SAP installed base customers in their integration needs. The PowerChain suite has been primarily architected on Microsoft architecture, and thus the company holds a Microsoft Certified Partner status because of its technical components.

Optiant primarily targets both distribution- and manufacturing-driven value chains, with a stronger focus on consumer products and high-tech companies. However, the company has demonstrated success in the life sciences, semiconductor, and other process industries, thus exhibiting the ability to optimize inventory planning within rather complex supply chains. Optiant's prized lighthouse customer is Procter & Gamble, which is deploying PowerChain Planner and PowerChain Inventory in multiple product divisions on a worldwide basis. Other lighthouse customers include Boston Scientific, HP, Intel, Kraft Foods, and Microsoft.

This company competes on the perceived strengths of its PowerChain Suite of applications and further provides a small in-house professional services group to assist customers in application training, integration, or software implementation. Optiant has often struggled with profitability and has consumed a rather large amount of private

venture funding. After three previous CEOs, a new CEO was recruited in 2008 to bring a renewed and leaner focus to this company. While the company exhibits a direct sales model, many of its presales engagements are led by a proof-of-concept methodology supported by professional service consultants. Optiant additionally partners with a smaller group of system integrators to ensure coverage for larger customers and ensure support for more globally based customers or prospects.

### **Oracle**

Within this IO grouping, Oracle is the only major ERP vendor to offer its own IO product offering. Both SAP and Microsoft have chosen to partner with other vendors in this IO grouping.

*Oracle Inventory Optimization* has been in the market for the past seven years. This application was originally designed and developed for key Oracle customer and prospect needs within the high-tech industry. To no surprise, many of Oracle's current IO customers currently reside in this industry. Oracle policy does not allow disclosure of its customer installed base, by product, so *Oracle Inventory Optimization* is no exception. Manufacturing Insights does however believe that this IO offering can also be highly competitive for Oracle customers residing in certain brand-oriented value chains (refer back to Figure 2).

The prime emphasis of *Oracle Inventory Optimization* is pre-integration with other Oracle business suite applications, but Oracle does position and market its IO offering as an independent market offering capable of integrating with other ERP and supply chain planning environments. Integration with non-Oracle environments is supported via middleware or ETL extracts.

Since its original development, *Oracle Inventory Optimization* has been augmented with additional functionality to support other key value-chain sectors, both distribution and complex manufacturing focused. Oracle is also leveraging its other acquisitions in the supply chain technology area, for example allowing product and promotional demand lift data to be fed into *Oracle Inventory Optimization* via its *Demantra Demand Planning* technology. Supply chain network optimization is in turn accomplished by *Oracle Strategic Network Optimization (SNO)*, originally offered in the former JD Edwards EnterpriseOne supply chain suite, and now integrated within Oracle's IO technology. Oracle marketing therefore emphasizes *Oracle Inventory Optimization* to be a part of Oracle's *Value Chain Planning* technology suite. *We have found the ability to look at optimization across both inventory and the supply network to be quite powerful.* Manufacturing Insights believes the integration of inventory optimization with strategic network design applications is particularly important in the current business climate of broader, more

geographically diverse supply networks, where the ability to plan for inventory deployment is inexorably linked to the design and operation of the nodes in the network. Oracle clearly is a leader here.

Because of its high-tech roots, *Oracle Inventory Optimization* provides support in product postponement, combination push-pull inventory management, and enhanced process modeling capabilities within value-chain environments exhibiting high uncertainty and variability. Modeling capabilities include the ability to enforce service level, financial, or capacity constraint needs. The application has also been augmented to connect to Oracle's *Advanced Planning Command Center*, a dashboard and decision-support utility that links all of Oracle's various supply and demand planning applications.

Oracle Advanced Planning Command Center offers key supply chain decision makers a comprehensive solution that provides executives and planners with multi-dimensional analysis of operational, tactical, and strategic supply chain plans; robust scenario modeling and management; and automated business process execution capabilities.

### **SmartOps**

Based in Pittsburgh, Pennsylvania, SmartOps is a privately held software applications provider with a sole concentration on IO technology. Like many others in this group, the company stemmed from the academic expertise of its founder, Dr. Sridhar Tayur, a professor in operations research and management at the Tepper School of Business at Carnegie Mellon University. Tayur founded SmartOps in 2000, after his consulting activities with manufacturers on inventory policy and complex inventory management needs. The basis of Tayur's research led to the development of Multistage Inventory Planning and Optimization (MIPO), which remains this vendor's prime IO market offering. Manufacturing Insights believes that this company has been profitable since 2003.

MIPO was developed on a J2EE Web-based platform, powered with an Oracle database, and includes proprietary, mostly stochastic-based algorithms. This application can support both distribution- and complex manufacturing-driven value-chain environments with high complexity. Functionality is generally competitive with all other designated vendors in this grouping. SmartOps claims support for supporting higher levels of data model scalability in the area of tens of millions of items and provides its prospective customers many flexible options for deployment, including hosting the application, a SaaS-type model, or a traditional licensed model. In addition, this vendor offers customers an option of either automated connections or standalone with Microsoft Excel spreadsheet interfaces to MIPO.

In 2003, SmartOps was one of four vendors chosen by SAP to provide IO application support across its many industry business units. This was an acknowledgment by SAP of the increasing interest of its

installed base customers for needs in this area, and, rather than developing its own solution, SAP instead chose a partnership strategy. Since that time, SmartOps has aggressively pursued a closer relationship with SAP and has moved through all the designated levels of SAP NetWeaver integration status. The company has subsequently received Endorsed By SAP designation for certain specific industry verticals, to include chemicals, consumer products, high tech, and life sciences. Users evaluating MIPO as their potential IO application should strive to understand the goals and purpose of this "endorsed" rating by SAP. In essence, SmartOps has committed to work closely with SAP on future product development and integration strategies having MIPO listed on the SAP price list, but in turn, share a portion of the MIPO license revenue with SAP. Manufacturing Insights mentions these facts solely to advise prospective IO customers that other vendors in this grouping can also integrate well with SAP applications but made individual business decisions to not pursue revenue sharing or higher levels of partnership with SAP. This vendor can support integration with other major ERP platforms such as Oracle, as well other major APS systems through its built-in connector technology.

SmartOps has subsequently added other applications to supplement MIPO, including a supply chain network design tool: Network Design Optimization & Simulation (NDOS).

### **ToolsGroup**

Two academic partners founded ToolsGroup in 1993: Eugenio Cornacchia, an MIT graduate and former engineer at Draper Labs, and Joseph Shamir, a physicist with Tel Aviv University. The pair collaborated on a variety of major supply chain projects within ITP Group and together founded ToolsGroup. They used their extensive hands-on experience of distribution-intensive supply chains to create the original Distribution Planning Model (DPM) product suite. Shamir remains the CEO and president of this privately held company, and Cornacchia continues to serve in the role of chief scientist and cofounder. The company established its United States-based operations in 2002 and currently has its U.S. office in Boston, Massachusetts, and its European office in Amsterdam, the Netherlands. Customers currently span 31 countries and include Barilla, Diageo, Dixons, Cadbury Schweppes, Ingram Micro, and Luxottica.

ToolsGroup does not portend to provide full support for the two major IO value chain problems but rather focuses itself in a laser-type focus on distribution and demand-oriented value chain environments where high service-level performance is critical. Where some of its competitors may take a strategic view of inventory optimization, ToolsGroup provides a more tactical and granular approach to the inventory optimization problem. Early in its development history,

DPM included rather sophisticated product demand modeling capability, as well as rather sophisticated and proprietary stochastic-based optimization algorithms related to mix, stage, and lot size. The application also includes rather sophisticated "stock to service" logic based on more than 10 statistical parameters for modeling inventory by product SKU or location.

Today, ToolsGroup articulates its IO capability as "demand-driven inventory optimization" with the ability to overcome the "long tail" of marginal returns when trying to use traditional safety stock logic in planning inventories for a high customer service level. The former DPM has been renamed and is now marketed as SO99+. The vendor has also added an exceptions-driven Replenishment Control module for alerting to either under- or overinventory stocking levels within identified customer inventory replenishment processes. It is also one of the very few IO vendors in this group that can support both distribution and service-related inventory optimization needs.

Like others in this group, DPM has been architected on a Microsoft .NET platform and has been certified at the Powered by SAP NetWeaver level for SAP installed base customers. In fact, this vendor boasts of 32 implementations within SAP environments.

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### **A Few Words on SAP Integration**

In 2003, four vendors were evaluated by SAP to provide IO application support across its many industry business units: SmartOps, Optiant, ToolsGroup, and LogicTools (now part of IBM). This was an acknowledgment by SAP of the increasing interest of its installed base customers for needs in this area, and rather than developing its own solution, SAP instead chose a partnership strategy by selecting SmartOps. Since that time, SmartOps has aggressively pursued a closer relationship with SAP and has moved through all the designated levels of SAP NetWeaver integration status. The company has subsequently received "Endorsed By SAP" designation for certain specific industry verticals, to include chemicals, consumer products, high tech, and life sciences. Users evaluating MIPO as their potential IO application should strive to understand the goals and purpose of this "endorsed" rating by SAP. In essence, SmartOps has committed to work closely with SAP on future product development and integration strategies and has MIPO listed on the SAP's price list, but, in turn, shares a portion of MIPO license revenue with SAP. Manufacturing Insights mentions these facts solely to advise prospective IO customers that other vendors in this grouping can also integrate well with SAP applications but made individual business decisions to not pursue revenue sharing or higher levels of partnership with SAP.

## FUTURE OUTLOOK

IO technology has matured and can be more of value to today's manufacturers challenged with the need for higher working capital utilization and more informed decision making in overall inventory deployment. Although the IO market is relatively small compared with overall supply chain management (SCM) spending, it is a significant and growing segment. Based on IDC's IT spending taxonomy and vendor tracking, we estimate that the current global market is currently in the \$60 million range. In Table 3, we show expected spending growth for IO over the next five years.

**TABLE 3**

Global Inventory Optimization Application Spending, 2009–2013 (\$M)

| Year | Spending |
|------|----------|
| 2009 | 59.7     |
| 2010 | 65.7     |
| 2011 | 75.5     |
| 2012 | 81.2     |
| 2013 | 88.0     |

Source: Manufacturing Insights, 2009

The current global economic climate makes spending projections particularly challenging, and five-year trends are currently building off a "depressed" 2009 number; however, we believe that over the course of the next five years, IO will experience healthy growth in the 10% per annum range.

Manufacturing Insights further believes that IO technology will morph into a broader category consisting of supply chain-related business analytics and decision-support applications. In addition to IO, these applications would include:

- Strategic supply chain network design and simulation
- Sourcing and procurement spend management analytics
- Analytics that integrate supply demand sensing, real-time execution information, and global transportation and logistics landed cost information

Whether this future category is dominated by a major ERP vendor, a best-of-breed supply chain, or a business intelligence provider is still an open question. Regardless, as has been true to date, alignment and/or pre-integration with the two dominant ERP platforms will remain critical.

## **ESSENTIAL GUIDANCE**

IO technology does provide value for manufacturers and service providers, and, in this currently challenged economic environment, can help companies save money on their overall inventory investment while ensuring high customer service levels. This technology also serves as an effective building block to support better, faster, and more-informed decisions related to overall inventory investment and deployment.

As pointed out in this report, the majority of IO offerings in the current market have been built around unique algorithms and structure, therefore yielding somewhat different approaches and results. Further, we have also indicated that the overall effectiveness of today's sophisticated IO applications is predicated on the ability to seamlessly import key external data from existing ERP or other applications, as well as the ability to export the optimized inventory planning or item data back to the resident planning systems. Broad acceptance of an IO application also stems from the overall ease of use and understanding of the functionality and results generated by the application.

Many of these IO applications featured in this report offer robust functionality as well as stronger or certified data integration capabilities. It very important for prospective buyers or evaluation teams to do their homework in understanding their value chain structure and inventory planning problem needing to be addressed, whether distribution or manufacturing driven, or a mixing of both. Utilize the tables we provide in this report to navigate the landscape and capabilities of the various vendors offerings. Vendors offer specific strengths, and pricing will vary significantly.

Our other guidance includes:

- Ensure that IT is well represented on the selection team, since effective integration of data with other existing systems is one of the keys to a successful deployment of an IO application. IT teams will ensure that standardized data integration tools are utilized and that certified ERP integration is indeed provided. It will also be helpful to have finance and S&OP process representation on the selection team to ensure that the selection can meet needs for inventory and what-if decision-making or scenario needs support.

- Narrow your short list of vendors to those that can meet your specific value chain and inventory challenge and can optimize both demand- and supply-side variables. The tables included in this report were designed to assist teams in this effort since Manufacturing Insights has only included vendors we believe can support today's complex value chain needs. Check customer references specifically related to your industry and value chain environment. Interview these references to ascertain the overall culture of the particular vendor, the ability to be responsive to specific needs, and the ability to perform ongoing technical support or assistance for the application, if required.
- Since supply chain network design is so integral to effective IO, ensure that your short list either includes an integrated supply chain network design or a solid integration to a network design package.
- Ensure that the IO vendor either has its own team of application professional services experts who can assist in your deployment strategy options or has strong partnership with IO consultants that can provide this assistance. With this specific IO technology, it is important that specialists help ensure you understand the various deployment options or can leverage best practices in implementation, as well as help ensure a smooth deployment and timely value in achieving the benefits of this technology. Specialists can also help in determining the best timetable for standalone versus a completely automated IO deployment strategy.
- Since many of these IO vendors are small, ensure that the selection team and your management sponsors are comfortable with either the long-term viability of the vendor or the ability of the in-house or the external consulting group to provide specific IO application future support. This may be difficult to assess in the overall negative aspects of the current recessionary economy, but evaluation teams need to ensure that if a particular vendor is later acquired, the application can be supported by in-house or other teams.
- Have the short-listed vendors perform a "proof of concept" implementation utilizing your existing data, and compare the results. While vendors may charge for a proof of concept, Manufacturing Insights believes it is well worth the investment to ensure that the application can adequately and effectively perform in your value chain environment. Utilize the proof-of-concept phase to gain comfort level with the overall usability factors of the application, as well as a general understanding of the features and functionality.
- Design your deployment in manageable phases, with each phase providing meaningful monetary benefits that can support subsequent phases. Don't set your objective for a complete

automated behind-the-scenes IO deployment until your teams are comfortable with both the operations and optimized recommendations of the IO application.

## **LEARN MORE**

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### **Related Research**

- *Worldwide Supply Chain 2009 Top 10 Predictions* (Manufacturing Insights #MI215807, December 2009)
  - *Worldwide Manufacturing 2009 Top 10 Predictions* (Manufacturing Insights #MI215758, December 2008)
  - *Profitable Proximity: Product Sourcing Decisions in the Modern Supply Chain* (Manufacturing Insights #MI212760, July 2008)
  - *Modernizing Your Supply Chain: The Execution Imperative* (Manufacturing Insights #MI212394, June 2008)
  - *Data Proliferation and the Rise of the Demand Signal Repository* (Manufacturing Insights #MI212383, June 2008)
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### **Synopsis**

This Manufacturing Insights report presents our view of the current landscape of inventory optimization technology, its state of maturity, and key vendors that continue to provide competitive offerings in this technology space.

"In the current challenging economic climate, cost control and capital preservation are at the very top of manufacturers' priority lists. Optimizing assets and working capital — particularly inventory — is an area of particular focus, and with quite reasonable acquisition cost and attractive ROI, inventory optimization (IO) applications are quite compelling. The key vendors in this space offer maturing applications with strong functional capability. If IO is not on your short list of priority projects, at least look at these applications as the level of benefit may surprise you!" — Simon Ellis, practice director, Supply Chain

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