

# Hype Cycle for Supply Chain Execution, 2013

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**Analyst(s):** C. Dwight Klappich

Supply chain and IT leaders can transform logistics by building business processes that span traditional application domains using this Hype Cycle to understand the maturity and viability of various supply chain execution technologies.

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## Analysis

### What You Need to Know

Hype Cycle for Supply Chain Execution, 2013 is a new Hype Cycle that integrates components from the Hype Cycle for Supply Chain Management and the former Hype Cycle for Transportation. The Hype Cycle for Transportation is being retired and replaced by this Hype Cycle because the lines between pure transportation and broader global logistics are blurring. Hype Cycle for Supply Chain Execution, 2013 covers technologies used to support the global logistics function, including subsets of technologies aimed at transportation, warehousing and global trade management.

### The Hype Cycle

Many supply chain execution (SCE) processes and supporting technologies are mature, and most organizations have used some level of SCE applications to target and remove obvious waste and inefficiencies from their logistics operations. Most logistics organizations, however, have fragmented portfolios of independent and not seamlessly integrated logistics applications. These solutions are often from multiple vendors and are at differing levels of maturity. Furthermore, many companies also have an assortment of the same type of application, originally from different sources, such as multiple warehouse management system (WMS) products from different vendors. Additionally, many organizations are on their second- and third-generation foundational SCE applications, such as WMSs, due to functional and technical obsolescence, but they trail in adopting new technologies that would enhance business value. We find these organizations struggling to derive additional benefits from their SCE processes and systems as implemented today. This is now driving increased demand for new SCE technologies.

In general, we find the highest level of SCE maturity in warehouse management. While the foundational WMS capabilities are quite mature (see "Apply an Architectural Framework to Stratifying Warehouse Management Systems"), what Gartner refers to as core WMS, new, value-adding capabilities are available today, and new solutions continue to emerge and evolve. Examples of value-adding components would be yard management, dock scheduling, workforce management and slotting optimization. Core WMS is beyond the plateau, so it is not covered in the Hype Cycle. However, capabilities like workforce management, slotting optimization, warehouse resource planning, transportation and distribution-specific analytics, performance management, warehouse control systems, and robotics are at differing levels of hype and maturity, and are covered within. These capabilities are now allowing some users to advance their warehouse operations by targeting new sources of business value via enhanced efficiencies and greater throughput.

Transportation, while slightly less mature than WMS, is evolving rapidly as transportation technologies gain market penetration. As stated last year, Gartner clients have identified four significant challenges and obstacles to achieving their logistics goals and objectives:

- Logistics cost volatility
- More complex transportation and logistics constraints and costs
- Increasing logistics network complexity

- The need for better visibility across extended supply chains

During 2013, Gartner continues to see a shift in motivation, from focusing transportation initiatives exclusively on lowering costs, to laying the foundation for improved customer service, a return to growth and more innovation. Transportation-related client inquiries remain high, with clients indicating that the importance of effectively managing transportation continues to grow. Cost volatility, increasingly complex operating environments, continuous service and financial pressure, capacity volatility, and, increasingly, demanding mandates continue to place pressure on transportation organizations — and that's just to maintain reasonable performance, not innovate or pursue new modes of operation.

Transportation remains an area of innovation, and users continue to seek new tools that will help them manage operations more effectively. Most transportation organizations view technology as one way to adapt to changing and more-difficult business and economic climates. Gartner continues to see an expansion in the market for transportation-oriented technologies as users seek solutions that can help them reduce costs, improve efficiency and generally run their freight operations more effectively.

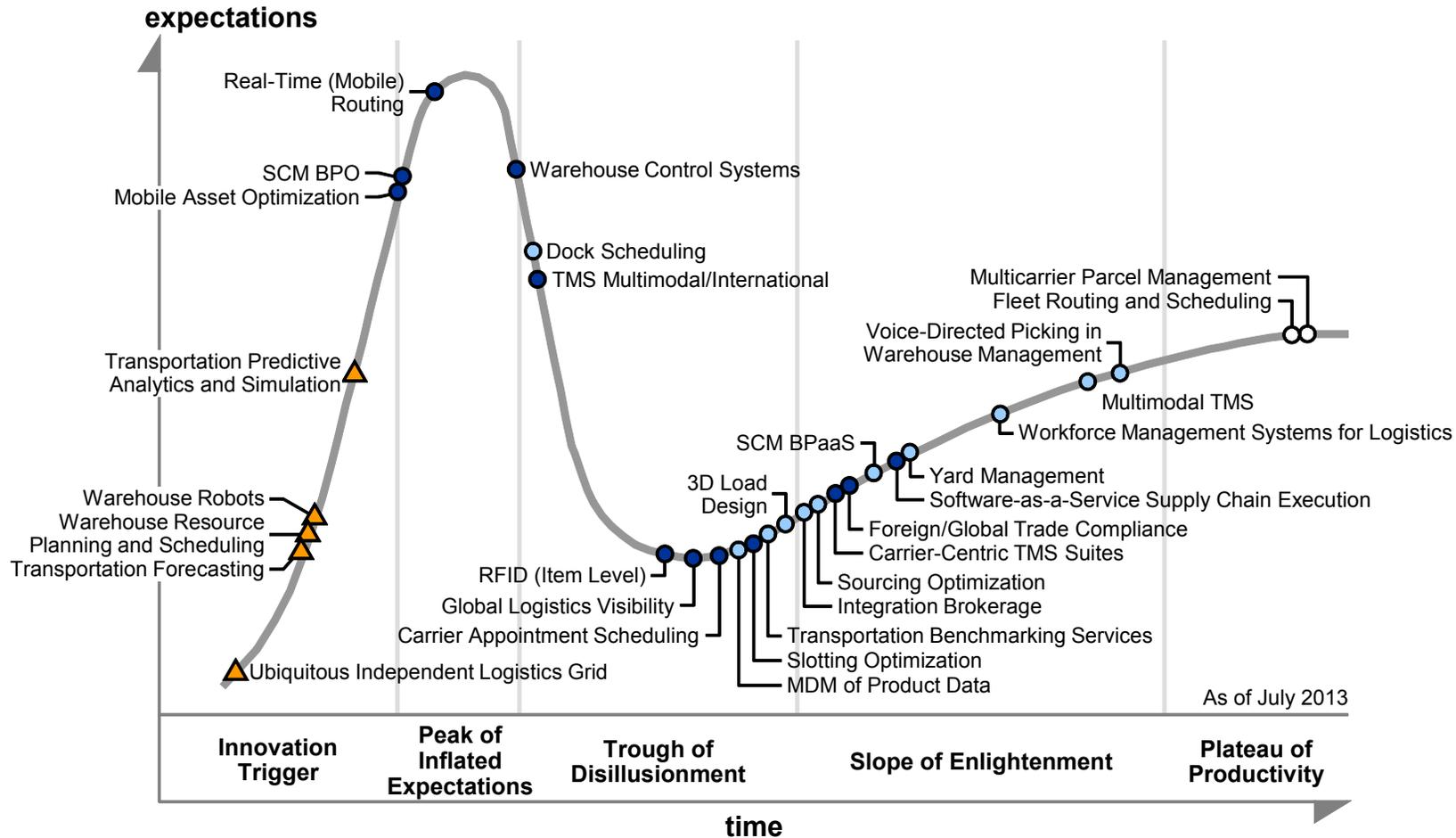
Some areas of transportation, such as fleet routing and scheduling, parcel management, and domestic multimodal transportation management systems (TMSs) are quite mature, but continue to evolve as vendors add new features and capabilities. Other areas, such as multimodal international TMS and global logistics visibility, are a bit less mature, but are gaining traction more rapidly as solutions improve. At the same time, innovations continue that offer promise and new value, but these solutions are nascent at this time. Examples of these emergent offerings are freight forecasting, predictive analytics, real-time mobile routing and ubiquitous logistics grids.

### Changes to the 2013 Supply Chain Execution Hype Cycle

The following services have been added since the "Hype Cycle for Transportation, 2012" (see Figure 3):

- **Warehouse robots** — Warehouse robots are mobile and able to self-navigate in complex warehouse environments, with their power coming not just from the robotic hardware, but also the control systems and software that orchestrate the robots' work.
- **Warehouse resource planning** — Tools to better plan and optimize work processes within a warehouse.
- **Slotting optimization** — Tools that provide a set of scientific methods used to determine the most efficient locations for storing each item in a warehouse.
- **Warehouse control systems** — Middleware-like capabilities that sit between a WMS and material handling equipment that translate business-oriented instructions into forms meaningful to material handling automation.
- **Ubiquitous logistics grids** — In the 2012 transportation Hype Cycle, this was called "ubiquitous logistics network." While the concept is the same, the title was changed to better align with other Gartner definitions for networks and grids.

Figure 1. Hype Cycle for Supply Chain Execution, 2013



Plateau will be reached in:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau

Source: Gartner (July 2013)

## The Priority Matrix

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Risk-averse technology providers and logistics operations should focus on the left half of the Priority Matrix for Supply Chain Execution, 2013, to determine which technologies are mature and proven (see Figure 2). Focusing on the upper half highlights technologies that will have maximum impact on the industry, based on the level of benefit (transformational or high benefit). Some technologies offering transformational value propositions, such as transportation forecasting, as well as warehouse resource planning and scheduling, are emerging technologies with 10 or more years to maturity. They are evolving rapidly, have moderate risk and are worth considering by sophisticated logistics operations and third-party logistics (3PLs). Although some technologies (for example, fleet routing and scheduling) are approaching the Plateau of Productivity, innovation in and around these solutions is worthy of consideration as upgrades to, or replacements for, solutions. Several technologies (such as TMS multimodal/international) show a time to plateau of five to 10 years. However, this shouldn't be viewed as an indication that they're immature. These technologies *are* mature and have many viable providers, but the high budget outlay and entrenched legacy systems mean it will take several years for these new technologies to replace legacy systems, despite the strong business case for them. In addition, these solutions continue to evolve and expand, which is extending their time to plateau.

Figure 2. Priority Matrix for Supply Chain Execution, 2013

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational			RFID (Item Level)	Transportation Forecasting Transportation Predictive Analytics and Simulation Warehouse Robots
high	Fleet Routing and Scheduling	3D Load Design MDM of Product Data Multimodal TMS Sourcing Optimization Workforce Management Systems for Logistics	Carrier-Centric TMS Suites Slotting Optimization TMS Multimodal/International	Warehouse Resource Planning and Scheduling
moderate	Multicarrier Parcel Management	Dock Scheduling Integration Brokerage SCM BPaaS Transportation Benchmarking Services Voice-Directed Picking in Warehouse Management Yard Management	Carrier Appointment Scheduling Foreign/Global Trade Compliance Global Logistics Visibility Mobile Asset Optimization Real-Time (Mobile) Routing SCM BPO Software-as-a-Service Supply Chain Execution Warehouse Control Systems	Ubiquitous Independent Logistics Grid
low				

As of July 2013

Source: Gartner (July 2013)

## Off The Hype Cycle

This is a new Hype Cycle that integrates components from both the Hype Cycle for Transportation and Hype Cycle for Supply Chain Management.

## On the Rise

### Ubiquitous Independent Logistics Grid

**Analysis By:** C. Dwight Klappich

**Definition:** This is the formation of a ubiquitous multistakeholder grid that supports a collaborative, electronically enabled and comprehensive network of trading partners (for example, carriers, forwarders, suppliers, brokers and shippers across modes and geographies). The grid platform would provide trading partner pre-onboarding, community management and trading partner connectivity that is independent of — but integratable with — other business applications.

**Position and Adoption Speed Justification:** In last year's transportation Hype Cycle, this was referred to as a "ubiquitous independent logistics network." The name was changed to "logistics grid" to expand the definition from just connecting trading partners electronically to also providing other value-added capabilities around the network. In this context, the logistics grid is composed of the trading partner network + multienterprise applications + community management services + application platform as a service + data services + workflow management. The logistics grid is a multienterprise solution that combines most — if not all — of the component pieces above and is a broad, multichannel offering that has many-to-many and one-to-many elements (public and private, such as Facebook). It has a fixed data model at the core but is customizable.

Various specialized logistics, carrier and trading partner networks already exist, but they are limited in many ways. First, what networks exist today tend to be shipping-mode-specific (for example, over the road, ocean, rail and air). Second, networks are typically also geographically specific (for example, North American versus European over-the-road or rail carriers). Third, networks are incomplete, with only a fraction of the trading partners in an area participating in any one given network. Fourth, some of the most capable — although still limited — networks are tightly integrated into some SaaS transportation management system (TMS) applications, but all the previous limitations still exist. Although there are some advantages to having the network embedded within the applications today, this can force users to choose between the best network and the best application if they are not the same, which they often are not today. Furthermore, because networks are incomplete, large users that span modes and geographies will need to develop and maintain their own networks and participate in multiple networks, which causes integration challenges.

Although SaaS TMS vendors have embedded networks, these are not independent or ubiquitous today. To exploit the network, you have to use the vendor's application, and there are limitations with these. Furthermore, given that no vendor supports a comprehensive set of trading partners across modes and geographies, not only would users have to integrate multiple networks, but they would also have to figure out how to manage the processes among multiple applications.

Over time, we believe that specialized networks will merge, creating broader and more-comprehensive independent networks. Given the complexity and cost of creating these networks, there will be a very limited number of these. Electronic data interchange remains the predominant business-to-business communications mechanism in transportation and logistics, and this will not go away anytime soon. However, it is not the most effective or time-sensitive mechanism for shipper and carrier collaboration and freight visibility.

**User Advice:** For the near term, plan to support multiple networks, choosing partners based on the fit and focus of the network. If a SaaS application with an embedded network fits your functional requirements, then this is a viable option. However, the network should not overshadow functionality, because networks can be built, and multiple networks can be integrated into an

application. As independent networks emerge, monitor this evolution, and consider these networks if they fit your functional needs and the provider can demonstrate effective integration strategies and capabilities.

**Business Impact:** The emergence of a ubiquitous, independent network will enable enhanced trading partner collaboration, reduce the onboarding time for new trading partners, and provide users more flexibility in adapting their trading partner networks.

**Benefit Rating:** Moderate

**Market Penetration:** 1% to 5% of target audience

**Maturity:** Embryonic

**Sample Vendors:** C.H. Robinson; E2open; GE Transportation (RMI); GT Nexus; Intrra; OAG Cargo; Railinc; SAP (Ariba); SAP (Crossgate); SPS Commerce; Transporeon

## Transportation Forecasting

**Analysis By:** C. Dwight Klappich

**Definition:** Transportation forecasting solutions apply demand-sensing/forecasting techniques specifically aligned to transportation networks and hierarchies. Product forecasting systems do not align well with transportation networks, because transportation is shipping-lane-specific, while product forecasts are location-specific. Transportation forecasting solutions offer robust, transportation-specific allocation methodologies that can translate customer, location and product demand into lane-specific shipping demands.

**Position and Adoption Speed Justification:** Gartner research finds that shippers and carriers are shifting from a singular emphasis on cost reduction to looking to better address efficiency and productivity, with a focus on the impact of transportation and logistics on company growth and profitability. Transportation is a significant cost to most shippers, yet transportation largely remains unplanned. Shippers continue to invest in operational transportation planning and optimization (multimodal transportation management systems [TMSs]). These solutions deliver cost reductions based on their ability to consolidate shipments and enforce least-cost carrier strategies. However, most companies plan only a couple of days into the future, because most TMSs require orders/shipments, and companies only have real orders several days in advance of shipping.

Business conditions are changing. This will make the traditional methods of managing transportation obsolete and risky. Freight capacity is expected to become increasingly constrained, and power is shifting back to carriers. This will demand that users be more effective in looking beyond the operational planning horizon, which is normally two to five days, to forecast their future transportation requirements on a lane-by-lane basis.

If done at all, most companies rely too much on spreadsheets to forward plan, and there are many flaws in this approach. Most companies have instituted product forecasting systems, but product demand hierarchies (for example, SKU, product, product line and brand) do not align with

transportation hierarchies, which might look like products, shipments, loads, modes, lanes and carriers.

With growing capacity shortages and carriers becoming more selective in what freight they want to handle, a two- or three-day planning horizon is no longer good enough. Companies must be able to forecast future transportation requirements, so they can collaborate with carriers to plan and lock in capacity. Transportation forecasting will supplement — not replace — multimodal TMSs. Although transportation forecasting solutions must be designed to address the specific and unique needs of transportation, the processes will be similar to the process used in demand planning. Consequently, demand planning processes need to be extended to supply transportation, manufacturing and distribution requirements, and transportation deserves a place at the table for sales and operations planning (S&OP) meetings.

**User Advice:** Recognize that business conditions are changing from shipper-favorable to carrier-favorable, and that this will force shippers to be more proactive and collaborative with carriers to ensure freight capacity availability. Make transportation planning part of the S&OP process. Understand that operational transportation planning is not enough. Users must start planning freight further into the future. Although spreadsheets are ubiquitous — and the most common tools for attempting transportation forecasting — they are not multiuser, enterprise-class tools. They are not scalable, they have limited logic granularity and they lack effective controls.

**Business Impact:** While controlling transportation costs remains a prime focus for shippers, looming capacity constraints and increasingly selective carriers will demand that shippers become proactive in forecasting future freight demands. Doing so will help ensure adequate freight capacity with a shipper's core carriers by helping the carriers align their driver and asset movement patterns with customers' freight demographics and demands. This will help ensure that companies can maximize the use of the best freight rates and minimize the need to go deeper into the routing guide, where rates are typically higher. Furthermore, the future-state scenario has the potential to jeopardize costs and capacity. If it is not planned effectively, then shippers will pay more for strained capacity resources. Shipper partnerships with carriers for known quantities at specific times will secure capacity at predictable and lower rates, while latecomers will be forced to pay higher spot-market prices.

**Benefit Rating:** Transformational

**Market Penetration:** Less than 1% of target audience

**Maturity:** Embryonic

**Sample Vendors:** 4flow; JDA Software; Oracle; Terra Technology

## Warehouse Resource Planning and Scheduling

**Analysis By:** C. Dwight Klappich

**Definition:** Warehouse resource planning and scheduling applies the concepts of forward-looking, constraint-based planning and optimization to work activities within a warehouse or warehouse campus.

**Position and Adoption Speed Justification:** Although constraint-based planning and optimization techniques have been used in manufacturing plants for more than 25 years, warehouses still rely on relatively rudimentary work allocation methodologies (for example, task interleaving and wave planning) to assign warehouse work activities. These rudimentary tools employ relatively lightweight heuristics to group work to improve productivity, but they are insufficient for planning work out over time, while taking into consideration available resources and constraints across departments, users and equipment. Although these concepts are mature in manufacturing, they are only emerging in warehousing. Part of this has been rooted in the needs and wants of warehouse leadership that, until recently, had minimal exposure to — or interest and expertise in — these concepts. However, there were previous attempts at introducing constraint-based tools in warehousing, but the vendors that explored these concepts tried to apply production scheduling tools, which did not fit the work structures of warehouses, so these solutions failed to materialize.

Some WMS vendors are now building some forward labor planning capabilities into their WMSs, but these are new, unproven and incomplete. However, given user demands for continuous productivity improvements, we anticipate that these solutions will evolve quickly to include more resources, constraints and planning sophistication. Today, this market is limited to early adopter customers willing to invest in early stage technologies. As the solutions become more mature and robust, we anticipate more users looking to invest in these types of capabilities.

We find some of the warehouse control system vendors (for example, Forte, Reddwerks and QueenCity Software) leading the thinking about real-time work planning and optimization particularly around complex order/item picking and automated warehouses.

**User Advice:** If you are risk tolerant and desire improved planning and optimization, then discuss what capabilities your WMS vendor offers today and/or what capabilities it is working on. If your vendor offers nothing, and has nothing on its road map, then consider some stand-alone applications like Logivations that do address forward planning.

**Business Impact:** Without the emergence of new capabilities, given the maturity of WMS and parity in core WMS capabilities across vendors, warehouse productivity gains will dwindle. As warehouse operations become more complex, the need for new sources of productivity gains will drive demand for constraint-based planning concepts within warehouse management.

**Benefit Rating:** High

**Market Penetration:** Less than 1% of target audience

**Maturity:** Emerging

**Sample Vendors:** Forte; JDA Software (RedPrairie); Logivations; Manhattan Associates; Optricity; Reddwerks; Transportation Warehouse Optimization

## Warehouse Robots

**Analysis By:** C. Dwight Klappich

**Definition:** Where industrial robots are typically large, heavy and designed to do specific tasks (such as welding or assembly), warehouse robots are typically mobile and able to self-navigate in complex warehouse environments. The power of robotic warehouse systems comes not just from the hardware, but also from the control systems and software that orchestrate the robot's work.

**Position and Adoption Speed Justification:** Industrial robots are mainstream in factories and plants, and have been evolving for more than 20 years. Although there are potentially some applications for industrial robots in warehousing (such as palletizing), these are limited by the typical architecture of industrial robots that are normally large, heavy and fit for very specific tasks. Given the mobile and varying types of work required in warehouses, this architecture is not applicable for most tasks.

Warehouse robots are not new, but new types of robotics are emerging to address the limitations of complex automated warehouses from the past and are advanced evolutions of previous generations of automated guided vehicles (AGVs). While AGVs have been around for years, there are notable limitations, such as having to follow a rigid travel path and lack of intelligence within the AGV. Basically, they were pretty dumb peopleless lift trucks. Large-scale automation, although still important, historically suffered from high costs and lack of flexibility to adapt to changes in the warehouse. Large-scale automation solutions could be productive, but the time, effort and cost to build these warehouses made paybacks longer and required long life cycles.

Warehouse robots will evolve rapidly during the next decade to address some of the limitations of previous generations of automation. Some of these are:

- **Cost:** The allure of warehouse robots will be to reduce some of the upfront costs inherent in building complex highly automated facilities. Although the long-term total cost of ownership might not be that different, the upfront cost and the ability to prototype and phase implementations will favor robots for certain applications, such as goods-to-man order picking. Furthermore, we find some evidence that costs in lighting, electricity, and heating and cooling can be reduced because you don't have to light/heat an entire warehouse. Additionally, there can be some benefits in employee satisfaction (those that don't lose their jobs), because they don't have to walk around miles a day. They can stay in one place and have the goods come to them.
- **Flexibility:** One of the downsides to large-scale automation, simple automation (such as AGVs) or automated picking systems (such as pick-to-light and carousels) is that these are fairly inflexible systems. The automation design needed to be very specific upfront. Otherwise, large change costs would occur. Because of the flexible and mobile nature of robots, the process can be designed and the robots instructed to work to the process. The vision is that the robots will be almost as flexible as humans in structuring the work to fit the process.
- **Adaptability:** Like flexibility, adaptability has historically been a challenge in large-scale automation, because the cost to change the automation can be high. Although some materials-handling automation vendors are now making more adaptable systems, this issue will continue to favor robots that cannot only adapt to process changes, but also to changes in work within a day.

- **Scalability:** Although large-scale automation was justifiable for high-volume environments, it was typically too costly and complex for smaller environments. Robots offer the potential to scale down and up. Along with flexibility and adaptability, they are able to grow more easily with the needs of a business.
- **Utility:** Historically, automation was designed to fit very specific purposes. If the purpose changed, then the automation had to change. Today, warehouse robots are fairly limited in utility (they do specific things well, others not well and some things not at all). However, this will be an area of innovation over the next decade. The goal will be to have software determine the utility, instead of hardware being limited to one or two tasks. Innovation will continue in areas such as vision control, touch sensitivity and more flexible movements that can fit a variety of tasks.
- **Intelligence:** This is where notable innovations have already occurred and where much of the future innovation will take place. Where AGVs were dumb and had to follow rigid travel paths — often following wires or lines on a floor, robots will need the ability to move around unencumbered by rigid travel paths. Furthermore, many advancements are focusing on how groups of robots can interact with each other, and how they distribute work among themselves. Things such as embedded analytics and use of agent-based technologies will enable the robots to optimize work across the group and respond to unforeseen events, such as a breakdown or a bottleneck.

Although warehouse robots will gain traction in complex distribution centers, the same technologies will have applications outside warehouses as the technology matures. For example, in retail stores, there is the potential in the not-too-distant future that robots will be able to unload trucks and deliver pallets of goods to specific departments in a store without human intervention.

**User Advice:** Warehouse operations with high-volume order picking should consider some of the current generations of robots and automation as an alternative or supplement to existing automation. Companies looking to build new automated facilities should explore the potential value of warehouse robotics.

**Business Impact:** Warehouse robots will transform warehouse operations over the coming decades, as the costs and complexities come down, which will open the market up to more companies. Labor reductions seem the most likely drivers, but improvements in overall throughput and productivity will be the primary value, whether labor is reduced or not.

**Benefit Rating:** Transformational

**Market Penetration:** Less than 1% of target audience

**Maturity:** Emerging

**Sample Vendors:** Kiva Systems; Swisslog; Symbotic

## Transportation Predictive Analytics and Simulation

**Analysis By:** C. Dwight Klappich

**Definition:** Transportation predictive analytics and simulation are capabilities used to model current and future transportation networks and varying predictive operating conditions to test future-state scenarios. Where operational transportation planning is deterministic, these solutions are typically used for iterative simulations, where variables and outputs are tested and compared.

**Position and Adoption Speed Justification:** Operational transportation planning and management applications are maturing, but they focus on planning and optimizing a known set of planning data (such as current orders and shipments) that need to be executed in a particular time frame (such as a day or shift). Operational planning systems are good at optimizing what is known today, which is commonly referred to as "deterministic optimization." They are not intended to look to the future to help predict conditions based on limited information. For example, a transportation planner might want to model the future impact of rate changes or the impact of changes to a delivery network. By "forward looking," we mean beyond the operational planning horizon, which is typically shifts, days or a single week, focusing instead on weeks, months, quarters or even a year in the future.

The use of forward-looking, predictive modeling tools in a transportation context is nascent but evolving rapidly. Most users historically built their own capabilities, using various generic analytical or simulation toolkits, most typically spreadsheets. Some strategic network design applications are used to do some transportation forward planning, but their scope for transportation is often limited. A few transportation management system (TMS) or specialty vendors are adding forward-looking planning capabilities, such as freight forecasting, tactical planning and transportation network design. TMS vendors will continue to add advance-planning capabilities, with these exploiting their core TMS planning engines and data models. The advantage of this is that the tools to move data between the operational and tactical planning engine are native and seamless, the data is highly granular, and implementing changes is facilitated within the core application.

Other vendors that provide raw simulation tools or generic optimization engines will likely create semipackaged, vertical templates based on the work they do with early adopters to construct transportation-oriented simulation and planning toolkits. These vendors will be more adept at considering conditions external to the TMS, such as traffic patterns and economic models. The latter solutions will be stand-alone external tools used by a few planners. Additionally, GIS tools might be used for doing spatial analysis independent of transportation, using the output of these exercises to feed information into a transportation planning tool. For example, a company might use a GIS to analyze population densities to plan where to locate facilities or stores. That information could help evaluate traffic patterns for use in transportation planning.

**User Advice:** If your predictive modeling needs to align directly with the TMS and focus on forecasting and planning future transportation requirements, direct your attention to the incumbent TMS provider. If the need is freight-related, but not aligned with the data housed in the TMS (such as traffic or economic data), consider generic simulation and modeling tools, but expect to build your own solution for the next few years. For the near term, assemble your own toolkits of solutions to conduct various types of transportation-related predictive analytics.

**Business Impact:** Although operational planning reduces costs and improves service for the given parameters, data and constraints, predictive tools can have an equal or greater impact on planning because they look forward and can identify and plan for future events that would adversely affect the day-to-day operational plan. For example, if the organization is in a capacity crunch, then the

operational planning engine can determine how best to operate under those conditions — whereas, using predictive tools might have enabled the organization to avoid the problem altogether. Furthermore, because transportation is a significant element of supply chain performance, predictive analytics will become increasingly important in supply chain risk management.

**Benefit Rating:** Transformational

**Market Penetration:** Less than 1% of target audience

**Maturity:** Embryonic

**Sample Vendors:** 4flow; Esri; JDA Software; LLamasoft; Oracle

## At the Peak

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### Mobile Asset Optimization

**Analysis By:** C. Dwight Klappich; Kristian Steenstrup

**Definition:** Mobile asset optimization maximizes the use of an enterprise's mobile assets by combining business process software, sensory technologies, operational research techniques for forecasting and optimization, and business intelligence. It exploits the principles of supply chain management to use sensory technologies to track, monitor and note the state of mobile assets, going beyond a real-time location system (RTLS), where only the asset location is known, to now having information about its variable condition and where it should be located.

**Position and Adoption Speed Justification:** This technology is emerging for the following reasons:

- Sensory technologies, such as RFID and GPS, enable mobile asset tracking and more accurate tracking of positions, but they need to be extended to include the ability to track inside buildings in three dimensions, as in the case of medical equipment inside a hospital.
- Enterprises increasingly want to manage the use of mobile assets, such as shipping containers in warehouses and wheelchairs in hospitals, to optimize their contribution to the value chain.

This technology is at an early stage. Few users have adopted it, the solutions are still in development, and many projects are system integration efforts — with users assembling their own solutions from multiple pieces of technology. At this point, there's no technology leadership regarding the sensory technologies that will be dominant. Users must proactively identify and manage solution components. However, these projects will be easier to pursue than sensor-based inventory projects. In some ways, mobile asset optimization technology complements bar code technology, which is used to identify an asset being tracked.

Today, holistic solutions require system integration work bringing together various technology components to create a complete solution. This limits adoption to organizations that either have the resources, expertise and financial means to assemble a solution in-house or the financial means to

engage third-party integrators to deliver a solution. Over time, more packaged solutions that are fit for specific purposes will emerge.

Certain industry-specific examples are working well, such as the tracking of reusable containers. Although some industry-specific approaches will continue, the horizontal approaches to this discipline will accelerate adoption across a broad range of industries.

**User Advice:** Start any project by establishing the discipline of a life cycle of mobile assets and building business processes to optimize them. Many enterprises start off by just wanting to track assets, but later find that they need a holistic view of mobile asset optimization to realize further business value. Applications are emerging to cater to this from IBM Tivoli (Maximo) and Cetaris, for example.

From a sensory technology perspective, establish use cases and general infrastructure components for mobile asset optimization projects to understand the information that's available and the additional information needed to further optimize the process. Understand the infrastructure patterns for indoor and/or campus asset tracking, outdoor asset tracking, shop floor asset management, and wide-area asset management, as well as how additional information beyond that provided by an RTLS can be beneficial. Pilot projects should be undertaken because of the early stage of this application area.

**Business Impact:** Traditional asset management systems have focused on cataloging and documenting asset location and maintenance. Sensory technologies can enable enterprises to determine where the assets are and how they're being used in a process in real time, especially as more sensory technologies become mobile across the supply chain. This information can be used to infer the status of a business process, or to assign responsibility for assets to the individuals or entities that control them. It can also associate different assets and inventory within or across specific business processes. Ultimately, this improves the efficiency or accuracy of the business process and reduces the number of misplaced and stolen assets.

**Benefit Rating:** Moderate

**Market Penetration:** 1% to 5% of target audience

**Maturity:** Emerging

**Sample Vendors:** AeroScout; Cetaris; Check Point Software Technologies; Cubic Global Tracking Solutions; Ekahau; IBM Tivoli (Maximo); InSync Software; Microlise; Savi Technology; Texada Software; Zebra Technologies

**Recommended Reading:** "Tracking IT Assets With RFID and Bar Codes"

## SCM BPO

**Analysis By:** Michael Dominy

**Definition:** Supply chain management (SCM) business process outsourcing (BPO) is the outsourcing of one or more supply chain processes to an external service provider. SCM BPO

providers use people and technology to perform tasks that would otherwise be performed by internal supply chain professionals. The scope of SCM BPO includes supply chain planning (SCP) and analytics, direct material sourcing and procurement, manufacturing management, and logistics management.

**Position and Adoption Speed Justification:** Today, the adoption of SCM BPO is patchy and limited. Although there are examples across every aspect of SCM, only a handful of enterprises have embraced SCM BPO in multiple supply chain process areas. The adoption varies by SCM function, with postsales support (a logistics management function that is often bundled with contact center outsourcing), and direct material sourcing and procurement being more mature, compared to other supply chain functions. Broadly speaking, adoption is more advanced for SCM BPO reporting and transactional processes than for planning processes and applications.

SCM BPO will often evolve out of existing BPO relationships, especially those involving finance and accounting BPO or contact center BPO, and it is influenced by major application areas, such as ERP and SCM. For example, enterprises will outsource direct material procurement processing to a provider that's already responsible for other transactional processes performed by an ERP or SCM system. Similarly, enterprises may outsource activities, such as warranty management and returns processing, to a BPO provider that runs transactional contact center processes residing within CRM systems.

Supply chain functions, such as SCP and direct material sourcing, will be adopted less broadly and less often as SCM BPO moves through the Hype Cycle. SCP and sourcing are considered strategic, and require a high degree of staff experience and business integration with mission-critical functions, such as manufacturing operations. So, companies will retain decision-making and coordination responsibilities and primarily use SCM BPO providers to support SCM functions. For example, a direct material sourcing organization will use a BPO provider to source direct items that are used in established products, but not new products. In the area of SCP, enterprises will use a BPO provider to perform analysis, gather data, and run applications that generate plans and schedules. However, trade-off decisions and final plans that are determined in some supply chain processes, like the sales and operations planning (S&OP) and new product introduction and launch processes, are retained and orchestrated by an enterprise's supply chain organization.

**User Advice:** SCM BPO is still in its formative stages, but represents a potential opportunity to improve supply chain capabilities without adding employees or buying technology. Offloading activities, such as transactional management or reporting and analytics, to a SCM BPO provider frees supply chain professionals to spend more time and effort on complex, cross-functional and interenterprise initiatives, such as S&OP, collaborative demand and supply planning, and contract manufacturer management. This can help the enterprise accelerate its entry into growth markets or other high-impact, high-value strategic initiatives, since critical internal resources will have more time to work on them.

Supply chain executives should meet with the enterprise's existing BPO providers and inquire about their SCM BPO qualifications. The executives responsible for relationships with BPO providers should be involved in the review and assessment process, since they will be able to share their own

insights regarding the BPO providers' performances, and the providers will be able to help the supply chain executives understand the key aspects of the existing contract.

Supply chain leaders should target outsourcing supply chain transactional processing activities, such as creating and managing purchase or replenishment orders, which can be performed by the BPO provider. Enterprises should consider using SCM BPO when they need specialized talent, but the volume of work does not justify adding a full-time employee, such as supply chain network design or inventory optimization. In these cases, it can be more effective to use a service provider, especially for supply chain organizations that are part of enterprises with less than \$5 billion in annual revenue.

**Business Impact:** There are multiple areas where BPO can be applied to SCM processes and functions, from new product introductions and launches to after-sales services. For example, head count and costs related to clerical and administrative roles can be reduced within the functions of direct material sourcing and procurement, logistics management or customer order management. Other areas that are well-suited for SCM include supply chain and sustainability compliance activities (such as supplier tracking and reporting, as well as environmental, health and safety tracking and reporting). Direct costs can also be reduced as a result of improved analysis and control over the sourcing and management of goods and services. Supply chain executives can use the cost savings to invest in highly skilled supply chain professional roles to lead higher-value initiatives, such as international growth, improved channel collaboration or enhanced product life cycle management.

**Benefit Rating:** Moderate

**Market Penetration:** 1% to 5% of target audience

**Maturity:** Emerging

**Sample Vendors:** Accenture; Avnet; Capgemini; Celestica; Chainalytics; Genpact; Havi Global Solutions; IBM Global Services; Infosys; UPS; WNS

**Recommended Reading:** "What Supply Chain Leaders Need to Know About Business Process Outsourcing for Supply Chain Management"

"Cool Vendors in Supply Chain Services, 2013"

"Cool Vendors in Procurement and CLM, 2013"

"User Survey Analysis: Data Supports the Business Case for Cloud based BPaaS Adoption Through 2014"

"Agenda Overview for Supply Chain Strategy and Enablers, 2013"

SCM definition in the Gartner IT Glossary [www.gartner.com/it-glossary/supply-chain-management-scm](http://www.gartner.com/it-glossary/supply-chain-management-scm).

## Real-Time (Mobile) Routing

**Analysis By:** C. Dwight Klappich

**Definition:** Real-time/mobile routing solutions enable real-time communication between the routing application and the drivers/vehicles to track their activities and locations, and, when necessary, to reroute them "on the fly."

**Position and Adoption Speed Justification:** Real-time routing is an evolution of traditional batch-oriented fleet routing and scheduling, wherein real-time events can compel the routing system to reroute assets that are in transit. Initial real-time routing solutions will be dispatcher-centric, with limited communication with the driver, but more robust solutions are emerging that can automatically and proactively adapt to unforeseen events. For example, as traffic monitoring solutions emerge and become pervasive, the routing system could receive notification of a traffic congestion problem that will delay a driver, and for which rerouting might be warranted. Then the system could dynamically recalculate the route and communicate the new route to the driver in real time. On the surface, it seems simple to just calculate a new arrival time by indexing the schedule based on the time of the delay (for example, if one hour late leaving the previous stop, then just add one hour to the anticipated arrival time). However, this is overly simplistic, and leading vendors are working on algorithms that will recalculate the new arrival time based on other factors, such as time of day.

Traditional routing and scheduling applications typically used batch planning algorithms, wherein orders/deliveries/pickups (that is, stops) for a day's worth of work were planned together, creating an optimal set of routes for a given day or shift. These routes were assigned to a driver and an asset, and the routes were often distributed on a piece of paper. As technology has evolved and mobility technologies have become more cost-effective, there has been a shift from paper-based distribution of routes to electronic downloads to handheld or other devices, but the routes are still static and set at the beginning of the day or shift.

Grouping stops and running them through a batch solver allow for consideration of the most alternatives and will provide a better, more optimized solution. However, as businesses become more dynamic, companies will need to balance the trade-offs between optimal and feasible routes that consider changes throughout the day. The best alternative will be the one that combines the approaches, wherein the largest group of stops is considered in the initial solve, but then more dynamic algorithms are used to adapt the schedules during the day as changes occur.

Real-time routing solutions are nascent, and only a few vendors are testing their reach so far. Initial solutions will be adaptations of traditional routing and scheduling, wherein a route could be replanned and a dispatcher would control the process. In the future, more automated solutions will emerge, with real-time data (such as traffic data) from within and outside the organization being used to more automatically direct daily activities. Similarly, support for pieces of this technology is becoming more mature and commonplace, such as automated vehicle locating, but the numerous technologies required to accomplish real-time routing have not yet been integrated to the extent that real-time rerouting in transit can become automatic and systemic.

**User Advice:** Users should first get daily routing and scheduling under control. The first priority is to implement more traditional routing and scheduling solutions. Mature users of commercial routing and scheduling that are seeking incremental benefits should determine what, if anything, their current vendors are doing or plan to do with regard to real-time routing. However, most users should conduct new investigations, considering their incumbent vendors as well as others. Not all users will need real-time routing, and traditional fleet routing and scheduling will suffice. Users that have high levels of change over the course of a route planning horizon are the best candidates for real-time solutions.

Users should define their specific use case before investigating solutions to ensure that the solutions they consider fit the needs of their operations. For example, with a fuel delivery scenario (or any other bulk liquid), the system does not know the exact amount of product that will be consumed at each delivery stop, and it may be that outer stops need to be replanned, because an earlier stop consumed too much product. This scenario would likely be quite different from a direct store delivery, or a pickup and delivery use case.

**Business Impact:** Real-time routing will add incremental benefits to mature users of routing and scheduling, further reducing costs and improving service in dynamic environments. Less-mature users should start with traditional routing and scheduling tools that are mature and proved.

**Benefit Rating:** Moderate

**Market Penetration:** 1% to 5% of target audience

**Maturity:** Emerging

**Sample Vendors:** Descartes; Manhattan Associates; Oracle; Ortec; Quintiq; Roadnet Technologies; TMW Systems

## Warehouse Control Systems

**Analysis By:** C. Dwight Klappich

**Definition:** Warehouse control systems (WCSs) are software applications that can be viewed as middleware that sits between a WMS business application and materials-handling equipment (MHE). The WCS communicates instructions to the MHE to help orchestrate product movements within an automated warehouse.

**Position and Adoption Speed Justification:** WCSs translate business-oriented instructions into forms that are meaningful to materials-handling automation, and then communicate directly with automated equipment to execute instructions. The WCS coordinates materials-handling subsystems, such as conveyor belts, carousels, scales and sorters. At each decision point, the WCS determines the most efficient product flow and transmits directives to the equipment controllers to achieve the desired result. WCS is undergoing an evolution — moving from its initial focus of purely communicating with materials-handling equipment to a point where some solutions now offer more comprehensive business applications. This can enhance the operations of the warehouse by providing things such as analytics, visibility, monitoring and oversight. All vendors listed in the Sample Vendors section cover some aspect of WCS, but some go further.

WCSs are not new. There have been narrowly focused solutions for years. Initially, these were often proprietary solutions offered by an MHE vendor, and were designed to specifically work with MHE vendors offerings only. Over time, WCSs became more generic, and specialty vendors began offering WCSs that could communicate to a variety of MHE products. These expanded in scope to handle more hardware types and vendor products within a single WCS solution. However, for most of the life of the WCS market, the solutions were focused only on translating business instructions into materials-handling control instructions and functioned primarily as a middleware between the WMS and the MHE. These were also called materials-handling control systems because of this narrow focus initially.

Over the past several years, the role of WCSs has expanded to include more capabilities other than just automation control. Leading WCS vendors are expanding the capabilities to include analytics, event management, diagnostics and, increasingly, some business-like logic within the WCS. For example, in high-volume, order-picking environments, certain WCSs can now begin to control the order-picking process by helping sequence work to help improve picker and automation productivity. Emerging concepts (such as "goods to man") are accelerating this evolution, because the automation is increasingly responsible for ensuring that the goods get to the picker in the right sequence and at the optimal time.

Adoption of traditional MHE-centric WCSs is high, but adoption of the newer more ubiquitous and broader WCSs now offered by leading vendors is minimal at this time but growing.

**User Advice:** Companies building new automated facilities should familiarize themselves with best-of-breed WCS solutions, as well as those that might be offered by their choice MHE provider. Companies with existing automated warehouses that are struggling to maintain automation integrations — or those that have added or changed their MHE over the years — should consider a stand-alone WCS to ease the integration burden.

**Business Impact:** At a minimum, a WCS eases the maintenance burden of integrating a WMS to automation. As WCSs continue to evolve, additional business benefits will emerge from the analytics and event management capabilities embedded in the WCS.

**Benefit Rating:** Moderate

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Adolescent

**Sample Vendors:** Forte; Fortna; Oracle; Queen City Software; Reddwerks; SAP; Tompkins Associates

**Recommended Reading:** "Supply Chain Management Market and Vendor Guide, 2012"

## Sliding Into the Trough

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### Dock Scheduling

**Analysis By:** C. Dwight Klappich

**Definition:** Dock scheduling is the use of tools to automate dock door and yard schedules. In this system, a dock calendar is maintained, showing all operating constraints, such as open/close time, commodities accepted through the dock door (for example, refrigerated or ambient) and trailer types accepted. Advanced dock scheduling systems consider transportation constraints and upstream warehouse constraints, such as labor and other warehouse resource constraints.

**Position and Adoption Speed Justification:** Dock scheduling is a long-standing concern among many of the world's largest shippers. However, recent challenges in carrier capacity, increasing customer requirements for on-time shipment performance and the effects of government mandates (such as hour-of-service rules that demand faster and more consistent shipment turnaround) have driven more enterprises to evaluate this technology. With the economic slump, some of the business drivers have eased, but pressures to reduce costs and increase productivity have kept up interest in dock scheduling. In addition, as solutions evolve, scheduling and appointment management systems can be used in conjunction with constraint-based warehouse dock optimization to begin creating a supply chain execution model that moves more toward flow-through and cross-docking models.

Integration with warehouse management systems (WMSs) and yard management systems, as well as talking with transportation management systems (TMSs), is becoming a more important consideration. Some WMS vendors of these types of solutions are adding rudimentary, often Web-based appointment requesting and dock-door allocation, as are many of the TMS providers. More advanced solutions are emerging from the leading WMS or best-of-breed vendors.

In the most sophisticated systems, users can define sets of rules for how to handle external queries. For example, if there is congestion during a particular period, then the system would not operate on a first-come, first-served appointment basis. Instead, the materials being delivered or shipped would be evaluated based on criticality or capacity to determine which appointments must be scheduled during the congested period and which can be scheduled during alternative periods.

Although dock appointment management is not new, most current generation systems are rudimentary calendars with minimal scheduling or other advanced logic. As these systems mature, advancements will come in several areas. First, more flexible rule structures will enable users to define conditions around which the system can help create dock schedules. Next, these will take on more constraint-based optimization concepts, where the solution will help create better, yet feasible, schedules. Lastly, these systems will integrate with mobile solutions that can geofence a location such that, when inbound deliveries cross a certain geographical line, an appointment is confirmed. A geofence is a virtual boundary around a geographical point, such as a warehouse address, that uses GPS coordinates to identify when the boundary is crossed.

**User Advice:** Users with capacity constraints in their yard or dock areas should evaluate this system. In addition, users that are capacity-constrained within their warehouses should evaluate

dock scheduling and optimization as part of an overall flow-through system. Users with large numbers of unnecessary penalties for excessive dwell time caused by drivers having to wait for a dock should also look at these technologies.

**Business Impact:** Dock scheduling reduces the amount of administrative time required to set carrier appointments and manage the dock schedule. If managed properly, this approach can improve relations with an enterprise's carriers, customers and suppliers, because the system can be more responsive than manual processes. Dock scheduling can improve the overall throughput and capacity of a warehouse by optimizing appointments and activities, reduce operating labor costs by reducing idle time, and lower transportation costs by increasing the number of cross-docking opportunities. Finally, improving dock efficiency and activity prioritization helps support better order fulfillment times and improved customer service.

**Benefit Rating:** Moderate

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Adolescent

**Sample Vendors:** Blue Sky Technologies; C3 Solutions; IBM (Sterling Commerce); JDA Software; LeanLogistics; Manhattan Associates; One Network; Oracle

**Recommended Reading:** "Magic Quadrant for Transportation Management Systems"

### TMS Multimodal/International

**Analysis By:** C. Dwight Klappich

**Definition:** Transportation management system (TMS) multimodal/international applications focus on automating the planning and execution of multileg global shipments by ensuring that processes are synchronized with all the parties involved in international transportation. International shipments are typically complex, multileg movements, where goods and information flow among many constituencies. These must support multiple modes of transportation with unique planning and execution requirements not traditionally addressed by a domestically oriented TMS.

**Position and Adoption Speed Justification:** Solutions are changing rapidly because of pent-up buyer demands and consideration of global shipping requirements by many enterprises, coupled with the increasing economic pressures to reduce supply chain costs. Although solutions are incomplete, they are maturing rapidly, and support for international shipping requirements is improving. Getting accurate source data — such as vessel sailing schedules — as well as difficulties in modeling the complexities of orchestrating itineraries across multiple shipping modes, have limited adoption of these solutions. While planning and executing port-to-port movements is minimally complex, planning and executing multileg intermodal shipments is quite complex, and few shippers have chosen to pursue doing so in-house at this time.

International logistics remains a largely semimanual process, where freight forwarders or third-party logistics (3PL) companies use phone calls and faxes to communicate with all parties to schedule

and execute a multileg shipment. The technology needed to automate the multienterprise, multileg, workflow inherent in international logistics was less well-defined and more difficult to automate, which is a main reason for the difference in maturity level between domestic and international multimodal TMS. Furthermore, in emerging markets, the inland over-the-road carrier communities are large and highly fragmented, and often lack technology, so integrating these carriers as part of a TMS is problematic.

Market demand for these technologies by freight owners (that is, shippers) is less than expected, given the continued growth in international sourcing. This phenomenon is largely because of a high percentage of shippers outsourcing international logistics to 3PL and freight forwarders because of the challenges of building global competencies and systems that span geographies, modes, carrier communities, trading partner networks, languages and cultures. Consequently, logistics service providers remain a key target market for these types of solutions, as well as those large international shippers that are increasingly looking to manage their international shipping in-house.

**User Advice:** Enterprises with significant international logistics operations should consider these solutions, paying particular attention to the breadth and depth of the TMS solutions, with equal or greater attention focused on vendors' global logistics-domain expertise. Although integration with carriers is important in any transportation environment, it is particularly challenging and important in complex multileg international shipments, where many parties can interact with a shipment, including multiple carriers (for example, land, ocean and land), freight forwarders, customer brokers, 3PL companies, governments, banks and other trading partners.

Consequently, users should focus attention on vendors' ability to support trading partner onboarding and integration, what methods they use to integrate, how long onboarding takes, data quality processes, and how much onboarding and integration cost. Vendors often have strengths in some modes, while functionality in others is lacking. Create a matrix of functionality tracking procurement, contract management, execution, audit and performance management across all modes. Understand that a combination of vendors may be the best approach.

**Business Impact:** Complexity and the rising cost of global logistics — particularly rising fuel costs — combined with the need to manage international operations cost-effectively and with sufficient management controls for the safe and secure transit of goods, drive the need for software to help manage global logistics operations.

**Benefit Rating:** High

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Amber Road; CargoWise; Freightgate; GT Nexus; inet; JDA Software; Log-Net; Oracle; SAP

## RFID (Item Level)

**Analysis By:** C. Dwight Klappich; Tim Zimmerman

**Definition:** This refers to high frequency (HF) and ultrahigh frequency (UHF) passive RFID solutions that specifically target theft prevention and tracking inventory at the item level.

**Position and Adoption Speed Justification:** Value from RFID will be largely hidden from most customers that are implementing the technology until there is a change in the business process where more information is needed to make a better business decision, such as product weight (catch weight), expiration date or country of origin, and that information cannot be conveyed with a traditional bar code. While RFID can provide productivity enhancements, tag costs remain a barrier to the widespread use of RFID at the item level. Theft prevention, which typically uses HF RFID (13.56 MHz) to tag each item, has been the accepted application. Costs have steadily reduced in recent years. Item-level tagging and UHF (900 MHz) have also been used for theft prevention, which can be integrated into the packaging by the manufacturer for items such as DVDs or electronics. UHF has still only been adopted for inventory applications in specific departments where there is a large amount of size, shape or color options. Tagging can provide value not only for inventory management, but also for customers looking to find a specific product, such as apparel solutions for jeans or hosiery. Recent large-scale rollout programs still elude general acceptance of the technology, but increased commitments by Macy's and Walmart to ramp up item-level, departmental RFID deployments continue to prove that item-level RFID can bring business benefits. However, wide-scale deployment in other retail sectors, particularly food retailing, remains some time out.

**User Advice:** Projects at the item level must focus on business issues, such as loss prevention or potential customer benefits, instead of on the inventory and supply chain benefits. Thus, they remain largely "leap of faith" initiatives, and the best hope of achieving an earlier ROI is when operating in a relatively closed-loop supply chain.

**Business Impact:** This technology has the yet-unfulfilled potential to improve product visibility across the supply chain. It also has the potential to improve availability to the consumer and help reduce shrinkage. However, to realize the full potential of item-level RFID, companies must use the technology where it properly fits and outperforms other auto identification technologies, such as bar codes. RFID is not a panacea, and it must add additional needed information as part of an improved work process to add value over and above other identification options.

**Benefit Rating:** Transformational

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Mature mainstream

**Sample Vendors:** Checkpoint Systems; Motorola Solutions; Tagsys; Tyco Retail Solutions

**Recommended Reading:** "Seven Best Practices for Implementing RFID to Maximize Investment Value"

"Supply Chain Advisory: RFID Tags Cover New Ground"

## Global Logistics Visibility

**Analysis By:** C. Dwight Klappich; Christian Titze; William McNeill

**Definition:** Global logistics visibility improves the connectivity and visibility of events across facilities, multiple transportation modes, transportation providers, trading partners, suppliers, customers and logistics service providers. This technology enables companies to monitor international logistics events across an entire multileg shipment itinerary to detect event-driven problems early enough to notify recipients of problems.

**Position and Adoption Speed Justification:** Event management applications are maturing, despite remaining data quality issues. Also, connecting to carriers and other constituencies — such as suppliers, forwarders, brokers and third-party logistics (3PL) companies — is still difficult, but getting easier. Capturing movement information beyond large constituencies that are typically enabled via electronic data interchange (EDI) remains problematic because of the lack of a single unified logistics grid. EDI continues to be the dominant way for companies to connect with trading partners, but has limited worldwide adoption beyond large, sophisticated trading partners, such as ocean carriers and 3PL companies, as well as some large freight forwarders. Vendors now offer trading partner portals (for example, carriers and suppliers), where trading partners can use the Web to receive and update movement information, such as ready-to-ship notifications or in-route status reports. Simplified trading-partner portals make it easier to capture data from less-sophisticated or automated trading partners. Often, we see such trading-partner portals being implemented as multitenant, meaning that the software is offered as a single codepage and shared among business partners.

Transportation visibility solutions, a subset of global logistics visibility often referred to as track and trace, emerged as stand-alone applications built to pull information from multiple systems to provide shipment status information. However, adoption of these systems was hampered by challenges in sourcing, maintaining data, and connecting to carriers and other trading partners. Newer visibility tools are delivered as fully integrated components of commercial transportation management system (TMS) software. Because the TMS houses a high percentage of the needed data, adoption is accelerating. Stand-alone visibility solutions, however, are becoming less competitive, although they are still desired by companies that outsource transportation to a third party or do not have or plan to have a TMS.

True end-to-end visibility that spans transportation, inventory, orders, multiple modes of transport (such as land and ocean) or multiple functions (such as transportation and trade compliance) is less mature and often requires that multiple applications be stitched together or, at the very least, that disparate data sources are pulled into one visibility application. For example, several vendors of visibility offerings partner with other solution providers to build a holistic, interfaced, solution.

Because many international shippers depend on third parties, 3PL companies or freight forwarders to handle their international shipping, independent global logistics visibility tools remain viable. For domestic shipping, most shippers expect visibility to be part of their TMS offerings.

Supply chain event management (SCEM) emerged around 1999/2000. At that time, these solutions were generic toolkits that could be used to model and monitor anything for shipments, orders, inventory, people, assets and so forth. Users were not ready for this emerging technology, and most

were unclear what they would use these systems for, let alone how they would justify a purchase. Initial vendors were also overly aggressive in stating how easy these would be to implement. Consequently, the first generation of vendors largely exited the marketplace. Tracking shipments was one of the first successful use cases where SCEM concepts and value was proved, and adoption has increased during the past several years. We believe that stand-alone transportation visibility will be subsumed inside broader SCEM offerings, where users can track all the supply chain events they want to monitor — taking the appropriate action based on the enhanced insight.

**User Advice:** Midsize to large international shippers (those with 1,000 or more containers per year) in dynamic international logistics environments will benefit from improved visibility. Early adopters of stand-alone solutions should consider on-demand global logistics visibility solutions, where upfront costs are minimized. TMS users should first consider the visibility solutions offered by their providers, only considering stand-alone solutions when their TMS vendors lack a visibility offering or when their offerings are inadequate. Users looking for true end-to-end visibility across locations, processes and data types should look for generic tools that can support this breadth of use. However, they should plan multiphase rollouts to ensure they address the numerous potential hurdles that will crop up for engagements of this size and scope.

**Business Impact:** Given the increased risk of managing a global supply chain, the visibility of potential problems is critical to managing global logistics operations effectively. Visibility alone provides only incremental value. Although it can identify and diagnose problems, it cannot resolve them. The value of visibility increases when it is integrated with other applications, such as a TMS, a warehouse management system and ERP, where problems can be identified, diagnosed and resolved in a single environment.

**Benefit Rating:** Moderate

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Amber Road; Descartes; E2open; GT Nexus; JDA Software; Log-Net; One Network Enterprises; Oracle; SAP

**Recommended Reading:** "Supply Chain Management Market and Vendor Guide, 2012"

"Magic Quadrant for Transportation Management Systems"

### Carrier Appointment Scheduling

**Analysis By:** C. Dwight Klappich

**Definition:** Carrier appointment scheduling refers to the use of Web-based carrier portals to help automate appointment management and improve the overall use of shipping and receiving docks in distribution centers. In this system, carriers can log on through the portal to view a dock calendar to identify delivery or pickup slots, which they can then book online. Carriers, customers, suppliers

and company users can query the system to determine open dock times available for pending shipments or receipt requests.

**Position and Adoption Speed Justification:** In previous Hype Cycles for transportation, carrier appointment scheduling was included as part of dock scheduling. However, although having these two capabilities function together would be optimal, we find a bifurcation in the market, in which these two capabilities are normally independent but can be co-dependent on each other. Carrier appointment scheduling is now a common part of transportation management systems (TMSs), in which carriers can use the provided carrier portals to book appointments online — eliminating the traditional manual, phone-call-based processes used today.

The bifurcation has occurred because the needs of carriers and appointment scheduling are less complicated and require less-sophisticated planning engines than advanced dock scheduling, which considers many more rules and constraints specific to the warehouse and the yard. Without question, having the two capabilities tightly integrated would be beneficial, but many users are satisfied with the basic calendaring within carrier appointment scheduling tools that are much easier to implement and maintain. Larger, more complex and more sophisticated warehouse operations will drive the future convergence of these capabilities. Furthermore, the most sophisticated users are now considering how best to address the intersections of yard management, dock scheduling and carrier appointment scheduling to drive even greater throughput.

Carrier appointment scheduling is becoming more commonplace as the carrier portal in multimodal TMSs matures. Although the applications typically offer basic calendar time slot query and allocation, this is often acceptable to users. More rules and constraints are being introduced into carrier appointment scheduling; however, unlike advanced dock scheduling, these are very transportation-centric, such as equipment dock compatibility, receiving versus shipping calendars and unload rules. There are some stand-alone appointment scheduling tools, but many users choose to source this capability as part of their TMSs. SaaS-based offerings are gaining momentum, as carriers take advantage of the benefits of having multiple potential shipper customers on a single TMS platform, which reduces training efforts.

Current models use portals to request appointments, but the increasing acceptance and availability of mobile applications offer the potential to move this closer to the driver and mobile assets, as well as to add capabilities, such as geofencing, wherein a GPS device notes when a truck is within a certain distance of the distribution center, and the appointment can then be electronically confirmed.

**User Advice:** If you use a commercial TMS and are looking for basic carrier appointment management capabilities, first, look at your existing TMS to determine what capabilities it offers and whether the solution fits your needs. If the system does, then there are advantages in having this integrated with the rest of the TMS. If you are evaluating a TMS — even if appointment scheduling is not part of the initial project — then review what various vendors offer for your future consideration. If you do not have a TMS, or if your current TMS lacks reasonable capabilities, then consider one of the best-of-breed offerings.

**Business Impact:** Carrier appointment scheduling (such as dock scheduling) reduces the amount of administrative time required to set carrier appointments and manage the dock schedule. If

managed properly, this approach can improve relations with an enterprise's carriers, customers and suppliers, because the system can be more responsive than manual processes. Scheduling and appointment management can improve the overall throughput and capacity of a warehouse by optimizing appointments and activities, it can help reduce operating labor costs by reducing idle time, and it can help lower transportation costs by increasing the number of cross-docking opportunities.

**Benefit Rating:** Moderate

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Blue Sky Technologies; C3 Solutions; IBM (Sterling Commerce); JDA Software; LeanLogistics; Manhattan Associates; MercuryGate International; One Network Enterprises; Oracle; TransCore

## MDM of Product Data

**Analysis By:** Andrew White

**Definition:** Master data management (MDM) of product data enables the business and the IT organization to ensure the uniformity, accuracy, stewardship, semantic consistency and accountability of the enterprise's official, shared product master data assets. Such implementations enable the authoring of product master data in workflow-, batch- or transaction-oriented processes that conform with one or more MDM implementation styles.

**Position and Adoption Speed Justification:** The interest and hype associated with this technology-enabled discipline continues to grow, though the market shows clear signs of being mired in the Trough of Disillusionment. Increasing numbers of organizations are attempting MDM of product data, but an increasing number are struggling to achieve the desired results. This is because these more recent implementations are not true to the initial concept of MDM and are evolving in a way that undermines the very promise of MDM. For example, some users are successful early on when focused on just product master data but then make the mistake of adding other, non-master product data to the hub — breaking the connection between the working governance body and what data is being managed in the system. Instead, some users are now using their business applications as the "hub," only to find there is insufficient flexibility in these systems to meet the needs of an MDM program. This is in contrast to the purity of the idea of MDM when this technology-enabled discipline was at the Peak of Inflated Expectations.

In terms of additional new hype, in 2013 we have seen a continued emphasis related to the linking of product data to social data that provides, for example, consumer sentiment concerning a new product release to a brand manufacturer. Other big data phenomena also play out beyond social data, because product information is once again central to many other very hyped technologies such as mobile — where consumers may do comparative shopping (retail) for products and services — as well as in hospitals (healthcare) to identify and even track medical devices and

compounds. Public sector organizations are adopting MDM of product data solutions (and other MDM solutions) in support of their open data and open governance mandates.

The large megavendors — IBM, SAP and Oracle — claim the largest share of this maturing market, but there remains a large number of smaller vendors that continue to grow. These vendors include Riversand, Stibo Systems and Tibco Software, as well as newer entrants that have, thus far, specialized in other domains or use cases: Informatica (customer data), Kalido (analytical and operational MDM) and Orchestra Networks (analytical and operational). There are others that have yet to make their presence known: Microsoft, SAS, and Talend. New vendors continue to surface in this market (for example, Agility Multichannel) and other older vendors continue on the fringe of the main market (for example, Software AG).

An MDM product data strategy should be part of a wider multivector MDM strategy. A multivector strategy adds to multidomain the idea of meeting requirements spanning other vendors; for example, use cases, implementation styles and industries, as well as governance/organization models. This may include multiple domain MDM (that is, two separate best-of-breed, single-domain solutions/vendors) or a trade-off between a best-of-breed, purpose-built, single-domain offering compared to a generalist multidomain MDM offering. An MDM program is also a key part of a commitment to enterprise information management and helps organizations and business partners break down operational barriers, enabling greater enterprise agility and simplifying integration activities.

**User Advice:** Large and midsize organizations with heterogeneous IT portfolios containing product data fragmented across many systems should think in terms of buying or building an MDM of product data solution that integrates with established source systems and becomes the system of record for product master data:

- Make MDM of product data part of your overall MDM strategy.
- Focus on business outcomes when seeking to govern product master data.
- Review the organization's capabilities and readiness and compare to current and potential challenges.
- Create a vision for what can be achieved.
- Focus on key business problems and build a business case based on benefits.
- Monitor vendor capabilities for multidomain as well as multivector MDM, as well as information stewardship, and evaluate based on references — not just vendor hype.
- MDM of product data systems must have rich, tight-knit facilities, including a comprehensive data model, information quality tools, workflow engine and integration infrastructure.
- Think big and act small, by delivering early and often.

**Business Impact:** Inconsistent product master data can be very costly, but for many organizations it rarely leads to bankruptcy or failure on its own. Such data will slowly (over time) eat away at an organization's ability to perform and achieve its goals. Eventually so much of IT's budget will be spent on coping with bad data that there will be insufficient funding left to support innovation. By

establishing the necessary governance and stewardship of product data, enterprisewide, a customer- or consumer-oriented strategy has a much greater chance of being successful. An effective implementation of an MDM of product data solution will help improve a range of benefits, including:

- Increased revenue through better upselling and cross-selling, by knowing what products have been acquired.
- Improved customer service through better management of product rules, and integration across multiple channels.
- Reduced time to market (for new product introduction).
- More efficient business process optimization (within ERP).
- More effective product performance, analysis (that is, business intelligence) and resulting marketing and product strategy since analytics and insight will be using consistent data globally.
- Reduced costs.

For those industries to which it is applicable, regulatory compliance can also be achieved, as well as improved risk management. MDM, specifically MDM of product data, impacts all business applications and intelligence data stores because it becomes the centralized governance framework across all data stores.

**Benefit Rating:** High

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Agility Multichannel; Heiler Software; IBM; Informatica; Kalido; Oracle; Orchestra Networks; Riversand; SAP; Software AG; Stibo Systems; Talend; Teradata; Tibco Software

**Recommended Reading:** "Magic Quadrant for Master Data Management of Product Data Solutions"

"MDM Products Remain Immature in Managing Multiple Master Data Domains"

"Consider Three Specific Scenarios for MDM of Product Data"

"Software Vendors That Augment Your MDM of Product Data Program"

"Research Library for the Seven Building Blocks of MDM"

"Forecast: Master Data Management, Worldwide, 2010-2015"

## Slotting Optimization

**Analysis By:** C. Dwight Klappich

**Definition:** Slotting optimization refers to tools that provide a set of scientific methods used to determine the most efficient locations for storing each item in a warehouse, considering a facility's unique product, demand, movement and storage characteristics. The optimal profile minimizes travel time and allows workers to put away and pick items more efficiently.

**Position and Adoption Speed Justification:** Inventory slotting optimization tools are specialized capabilities used to determine the most efficient placement for products and SKUs stored in a warehouse or distribution center. Developing effective stocking strategies has become more difficult as companies' distribution needs have become more complex. A company's warehouse layout can be different, the company can have varying segmentation strategies unique to a location, the product mix can differ across facilities, the customers the warehouses serve can have different needs, and the types of inbound and outbound processes can be different. When combined, these can affect stocking and handling strategies differently across facilities. The greater the differences and complexities the more robust tools are needed to help optimize the storage and picking processes by location.

Today, most small operations use rudimentary spreadsheet-based tools; however, as the complexity grows, so does the need for more powerful optimization tools. What network design does for the supply chain, slotting does for the placement of inventory inside a warehouse. At the task level, a WMS can only optimize the flow of work as well as the inventory is placed in the warehouse. As a result, slotting becomes a critical mechanism for maximizing workflows by ensuring that inventory is placed in the best positions to drive efficiency.

Sophisticated slotting tools provide powerful algorithms that take the raw data provided about products and locations, combine this with demand information, and then use predefined constraints to determine the best (optimal) slotting profiles given certain goals and constraints. Specialized slotting tools are needed by organizations with large numbers of SKUs, complex picking and packing processes, complex order picking and automation systems, and environments where inventory assortments change dramatically over time, such as in highly seasonal businesses or high volume e-commerce facilities.

Slotting optimization is not new. However, as warehouses become more complex, experience higher volumes and have a more difficult time making productivity improvements (for example, in areas such as e-commerce), the sophistication of the optimization engines will continue to grow and evolve. In the past, organizations would run slotting optimization but found it difficult to allocate the necessary and seemingly wasted time to move items around a warehouse. Now, given the highly volatile business environments companies operate in, being able to reconfigure a warehouse on demand is no longer a "nice to have." It is a requirement.

Adoption has been limited to big sophisticated warehouse operations — largely because of the need for expertise, and the time and effort required to set up and maintain effective slotting processes. Many companies have dabbled with slotting but have failed to achieve the promised benefits — largely because they are not ready to embrace the discipline required to exploit the tools and underestimate the change management required. We see two trends driving increased interest

in slotting. First, evolving supply chain management strategies (such as e-commerce, segmentation and omnichannel fulfillment) are forcing companies to rethink their warehouse processes and stocking strategies. Second, increased interest in automated picking technologies require better inventory locating strategies.

**User Advice:** If you have a contemporary packaged WMS, first determine your WMS vendor's slotting offerings, because data integration is a consideration. However, if the vendor does not have adequate slotting, you operate a legacy environment that doesn't support slotting or your needs go beyond the capabilities offered, then consider specialized slotting optimization offerings.

**Business Impact:** Proper slotting takes time and expertise to establish, and diligent maintenance is necessary to ensure items remain positioned optimally. However, slotting software can accelerate the analysis process and often offer iterative solutions that can be compared to ensure users put inventory in the best place. By placing inventory in the right place, users can increase picking productivity and make order selection easier, safer and more accurate.

**Benefit Rating:** High

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Descartes; HighJump Software; JDA Software (RedPrairie); Manhattan Associates; Optricity; Softeon

## Transportation Benchmarking Services

**Analysis By:** C. Dwight Klappich; Greg Aimi

**Definition:** Transportation benchmarking services are typically firms that collect freight rate data on a lane-by-lane basis, aggregating and normalizing this data, so companies can compare their current rates to the benchmark rates by lane.

**Position and Adoption Speed Justification:** There are two basic types of benchmark service providers by which companies can compare their freight rates to other companies: consortium-based and network-based. There are additional benchmark services firms that only offer comparisons against logistics and business metrics and not transportation rates. A consortium-based benchmark service provider invites companies to participate in its group (consortium) of shippers, in which the companies provide their detailed rate data by lane. The service provider then combines the data from all the members and analyzes it by various factors, and then allows members to compare their data to the consortium data, looking for lanes in which their rates differ meaningfully — either positively or negatively — from the benchmark rates.

A network-based benchmark service provider is typically a SaaS- or cloud-based transportation management system (TMS) vendor that has built up a network of shippers and carriers that share a common instance of a TMS. Because large volumes of shipments flow across a SaaS TMS, these systems can capture market rates on a shipment-by-shipment basis. By "market rates," we mean

that each shipment flowing across the network has a specific rate associated with it, so that the network has very granular shipment-by-shipment, lane-by-lane freight rate data (including base rates, fuel surcharges, stop-off charges and assessorial charges). The service provider then can aggregate and normalize this data, and shippers and carriers on the network can compare their current rates to the benchmark rates.

Consortium-based benchmark services have been around for several years. The size of the consortiums continue to grow, and the service providers continue to enhance their analytical capabilities, expand the numbers of modes covered and develop tools to support the use of the benchmarking data. Network-based benchmarking services are newer, and the offerings are less mature, although growing in popularity. The advantage of the network-based approach is that the data is collected as part of the daily operations of the system, so it is granular and timely. The potential disadvantage is that the quality of the data depends on the customer, shippers and carriers — both on the network, and on the modes and lanes the network supports. There is potential in either approach that a particular company might find gaps in the benchmark data for some of its specific lanes or modes.

Because transportation costs are volatile and represent a high percentage of logistics costs, being able to understand a company's transportation rates versus the market rates will increasingly drive companies to seek these types of services. However, some barriers remain to extensively exploiting this data. Today, many early adopters believe the data is not as timely as they would like. By the time a vendor scrubs and aggregates the data, it could be months before companies get to see it. A second problem today is that, in many cases, it is difficult for a company to know whether it is getting an "apples to apples" comparison, because providers don't always delineate the commodity type. For example, an apparel manufacturer could be looking at data for a bulk chemical importer and not even know it.

Nowadays, benchmarking services are primarily mode-specific, with the most common focused on North American truckload freight. Over time, service will continue to expand by mode and geography.

**User Advice:** Transportation organizations that predominantly ship over the road with a heavy percentage of truckload shipments are immediate candidates for transportation benchmarking services. Shippers with more volume in other modes — such as air, parcel, ocean and intermodal — can still find value in benchmarking services, but users need to challenge service providers to demonstrate their support for the types of modes the company uses.

**Business Impact:** Because freight rates are inherently cyclical and volatile, it is difficult for shippers to know whether they are receiving good rates when they source freight, because all they see is their information. Knowing where shippers have favorable rates is as important as knowing where they have poor rates. However, the business value will mainly come from identifying places where they have higher rates than the market, so that they can target these to seek lower rates from carriers. This will help companies lower their rates.

**Benefit Rating:** Moderate

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Adolescent

**Sample Vendors:** Chainalytics; C.H. Robinson; Establish; LeanLogistics

### 3D Load Design

**Analysis By:** C. Dwight Klappich

**Definition:** 3D load design refers to software solutions that enable companies to build plans for mixed pallets, optimized pallet patterns, and trailer and container loads that maximize vehicle/container capacity. These solutions allow users to optimize load patterns by considering business rules and constraints, such as product dimensions/weight, axle position/weight, center of gravity, stacking rules and other equipment characteristics.

**Position and Adoption Speed Justification:** 3D load design solutions are not new. Historically, they were non-enterprise-class point solutions that, although functionally sophisticated, were not effectively integrated into logistics business processes. They were quite often stand-alone analytical tools used by a select few users and were outside normal process flows requiring manual execution. For example, while data on shipments could be dropped into one of these solutions and run through the optimizer, the output would be a physical drawing that users would then use to try and load a vehicle or container. As these tools have evolved, they have become increasingly built on enterprise-class technical platforms and more tightly integrated with transportation and logistics processes, which will increase demand for and use of these capabilities.

**User Advice:** Companies that have adopted a multimodal transportation management system or a routing and scheduling system and are looking for the next level of benefit — notably, reducing the total number of shipments — should consider these solutions. Additionally, companies and warehouse operations that ship products with standard or nonstandard characteristics can benefit from better load design.

**Business Impact:** More optimal loading of vehicles and containers can reduce shipment numbers, which often dramatically lowers transportation costs.

**Benefit Rating:** High

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** JDA Software; MagicLogic; Oracle; Ortec; Tops Software; Transportation/Warehouse Optimization

### Climbing the Slope

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### Integration Brokerage

**Analysis By:** Benoit J. Lheureux; Paolo Malinverno

**Definition:** Gartner defines integration brokerage (IB) as a category of discrete IT outsourcing for integration projects, particularly for B2B multienterprise integration projects involving cloud services integration and supply chain integration. IB is one of three primary cloud services brokerage (CSB) roles and combines cloud-based B2B integration infrastructures with people and methodologies to help companies with initial implementation and ongoing project management for a wide range of integration projects.

**Position and Adoption Speed Justification:** IB usage and adoption scenarios vary widely and include:

- Traditional e-commerce — Typically, a form of supply chain or sales channel integration (for example, automating orders and other B2B transactions related to direct material procurement for customer and supplier integration). Such projects are found worldwide, across nearly all industries.
- CSB — In this scenario, providers embed IB within other technologies and services as part of a CSB offering (see "A CIO Primer on Cloud Services Brokerage"). CSB providers deliver IB (as one of three primary roles, the other two being CSB aggregation and customization) to help customers integrate cloud services with each other, or with on-premises applications and data, and with supply chain partners.
- Service-oriented architecture (SOA) and partner Web APIs — Connecting internal service consumers associated with internal ERP, SOA or API management projects with external trading partners, or vice versa (for example, to receive purchase orders electronically from customers directly into your order entry system).
- Data synchronization — IB is used to help enable the propagation of product information from internal catalogs to customer and regional data pools (for example, 1Sync) or with e-commerce providers (for example, SAP-Ariba).
- Managed file transfer (MFT) — MFT is increasingly a requirement (either as a stand-alone capability, or as a complement to the more widely needed message-based approach to integration) from companies that outsource integration projects.
- Infrastructure modernization projects — Modernizing or consolidating multiple internal B2B (and occasionally, internal application-to-application [A2A]) integration products or projects onto one infrastructure. This is particularly relevant for larger companies that have legacy investments (e.g., in widely adopted legacy B2B products, such as Gentran Server or Trusted Link Enterprise) that have accumulated numerous, sometimes up to several dozen, internal B2B integration hubs, and that want to consolidate those hubs and outsource them to an external provider.
- Multinational e-invoicing projects — IB is often utilized in conjunction with invoice automation. The approach is fairly mature, but the breadth and maturity of specific e-invoicing solutions vary widely among different service providers and geographies. Adoption is rapidly expanding worldwide, particularly in Europe, Latin America and some pockets of Southeast Asia.
- Internal (A2A) integration — An emerging use case scenario, where IB is applied to internal application integration projects. Some providers (notably E2open, Hubspan and Liaison

Technologies) have early adopters of IB that involve internal integration projects, typically in conjunction with B2B projects. Technology providers (e.g., Axway and Seeburger) and system integrators (e.g., HP and Infosys) also manage on-premises integration projects, the latter often in conjunction with more-comprehensive business process outsourcing.

- Small to midsize projects — Companies with a small to midsize B2B integration project requirements that are looking for an outsourcing alternative to a B2B infrastructure investment typically adopt IB. Often, such a company lacks the IT skills or resources — or desire — to do B2B itself. The project itself often involves only one to 50 B2B connections.

The most predominant adoption scenario for IB (and largest source of spend on IB) is still for some form of e-commerce-related supply chain integration, simply because connecting dozens, hundreds or even thousands of companies requires a lot of effort relative to more-limited-scope cloud services integration projects that involve a few cloud and on-premises application endpoints. However, we are seeing a rapid acceleration of IB adoption for IT project scenarios involving A2A integration, cloud services (typically SaaS) integration, B2B Web APIs and CSB.

Several years ago, the hype associated with IB peaked, driven by the macro IT trend to outsource noncritical internal core competencies overall, by the effect of the worldwide recession on IT users' sourcing decisions for B2B integration projects, and by aggressive supply-side marketing for IB solutions. Because of limited capital budget and personnel resources, many companies have avoided investing more capital and people in new B2B projects or B2B modernization projects; instead, they have chosen to outsource their B2B applications (via IB).

This year IB has moved from a point just before the Trough of Disillusionment to a point just after the trough (without hitting trough) to reflect the combined adoption of IB for traditional supply chain and cloud services integration projects, which has driven IB onto the Slope of Enlightenment as traditional supply chain projects merge with cloud services integration projects, and vice versa. On the one hand, this is because ever more companies that are involved in complex supply chains are implementing their supply chain software in the cloud as SaaS rather than using on-premises application software. On the other hand, this is because ever more companies implementing SaaS projects increasingly must integrate that functionality — whatever it is — with external business partners.

Today, most IB providers focus primarily on cloud services integration or traditional e-commerce integration, but not both. This is reflected in how providers have implemented their IB solution stack, and in what types of IB projects the vendor historically is asked to implement. Many prominent providers (for example, Axway, GXS, IBM, Liaison Technologies, Seeburger and SPS Commerce) have made specific investments in cloud-native capabilities (including SaaS adapters and API management) and are changing their go-to-market strategies to address projects that combine traditional e-commerce with cloud services integration. Some providers of IB (for example, Appirio, Celigo and Cloud Sherpas) have always been cloud-centric, since their typical projects revolve around SaaS implementation; thus, their technology stacks are generally cloud-native (e.g., deployed on Force.com). Therefore, approaches to IB implementation can range from traditional, scalable multitenant architectures (that have been evolving over the last 10 years) to more-

contemporary, cloud-elastic architectures based on integration platform as a service (iPaaS) solutions (see "Gartner Reference Model for Integration PaaS").

Despite the increasing maturity of IB offerings, IT users are still ill-informed about their options, and vendor offerings that address a combination of B2B scenarios in one solution are still in their first generation. Most IB offerings still tend to be strong for some scenarios, while relatively weak for others. But as more companies adopt cloud computing, expose data and functionality through APIs, and combine that with e-commerce projects — and as vendors respond with more-mature IB solutions to address all these requirements — IB will continue to move up the Slope of Enlightenment.

Relative to CSB itself, IB is much further along in the Hype Cycle. This is because some aspects of IB — e.g., traditional supply chain integration and stand-alone cloud services integration projects — are more widely adopted as largely stand-alone offerings versus IB delivered in the context of an overall CSB offering that includes all three primary CSB roles (aggregation, integration and customization).

**User Advice:** Consider IB when you need to implement an IT project to integrate your internal applications and data with your external business partners or with cloud services, but would prefer to have a service provider implement and manage that project rather than licensing integration software or subscribing to iPaaS and implementing and managing the project on an ongoing basis, particularly if you have limited internal resources to apply to such tasks. A key criterion for deciding whether to leverage IB or implement such B2B projects yourself is whether or not you are considering having B2B integration and/or cloud services integration as a required internal core competency (see "How to Identify the Right Basic Approach for Your Application Integration Project"). B2B, API and cloud services integration projects are usually strategic and mission-critical, but they are not always a required internal core competency.

Vendor viability will be particularly important for larger projects (involving hundreds or thousands of external business partners) with a five-year or longer life span. Although complex projects may require custom implementations and quotes, prospective customers should consider vendors that can accelerate project deployments and manage costs by considering an IB offering with these attributes:

- Uses a multitenant B2B infrastructure implementation — This can be enabled by more-traditional scalable IT infrastructure, but ideally, it should be some variation of embedded iPaaS.
- Operates a substantive consolidated B2B network and trading partner/cloud provider community (which can leverage substantial economies of scale and reduce the time and cost of implementing connections to new cloud services or trading partners).
- Includes prebuilt adapters and maps for integration (e.g., for whatever combination of applications and B2B protocols and cloud APIs is required for your project). Ideally, IB is delivered as a complete, prebuilt solution, known either as a cloudstream or packaged integrating process.
- Offers unit-based pricing for one-time and recurring fees (rather than custom quotes).

- Is provided by a vendor with experience in traditional e-commerce, e-invoicing, cloud services integration, and so forth.

Finally, users should take a proactive approach relative to intellectual property (IP) protection and vendor "stickiness." As is the case with most cloud-based services, IB incorporates IP such as B2B and API document standards, maps for translation, choreography and process models, and trading partner profiles, which are collectively the master data for your integration project. In service agreements with providers, include terms that ensure your rights to such IP and that define the procedure for taking possession of it when desired. While doing so does not guarantee portability (in most cases, such IP is proprietary to a service provider's IT infrastructure), having direct access to that IP is simply prudent and likely to reduce the effort to port your integration project to another solution if required.

**Business Impact:** Although many companies still implement and then manage their own B2B integration projects, the alternative of IB offers potential benefits for almost all firms, small or large, across all industries and geographies. This is because cloud and B2B integration projects are relatively easy to segregate and outsource, and because IB providers offer a viable and cost-effective alternative to implementing such projects in-house. The impact of IB will continue to be substantial, and most midsize and large companies likely will still outsource at least some of their multienterprise integration and cloud services integration projects and implement some in-house.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Accenture; Appirio; Bluewolf; Capgemini; Celigo; Comarch; DiCentral; eZCom Software; E2open; Edicom; Elemica; Evenex; Exostar; GXS; HP; Hubspan; IBM; Infosys Technologies; Liaison Technologies; OmPrompt; RedTail Solutions; SAP (Ariba + Crossgate); Seeburger; SPS Commerce; Tie Commerce; Tieto; Wesupply; Wipro Technologies

**Recommended Reading:** "Integration Brokerage Offers Intermediation for Cloud Services Brokerage and B2B E-Commerce"

"Competitive Landscape: Integration Brokerage"

"Devise a Systematic API Management and Governance Strategy for Long-Term CSB Success"

"Integration Brokerage Solution Patterns Address Many Integration Problems"

"Toolkit: RFP Template for Integration Brokerage"

## Sourcing Optimization

**Analysis By:** C. Dwight Klappich; Deborah R Wilson

**Definition:** Sourcing optimization enables procurement and transportation organizations to evaluate high volumes of complex, conditional bids, in which the expected outcome is agreements with multiple suppliers.

**Position and Adoption Speed Justification:** Sourcing optimization is sometimes delivered as a service, with the vendor leveraging a sourcing optimization application to construct and run sourcing events on behalf of the company, coupled with consulting services based on the vendor's deep understanding of one or more spending categories, such as transportation (lane, mode and capacity), packaging, marketing services and telecommunications.

Sourcing optimization application functionality typically includes the following:

- For transportation — lane-specific bid responses, plus the ability to combine lanes.
- Seasonal demand profiles and capacity/demand commitments.
- Support for constraint-based optimization with rules, such as "award no more than 25% of the business to any single supplier."
- Support for conditional supplier proposals, such as "if business requirements for Norway are included in our award, then take 10% off our proposal."
- Suppliers can combine elements to offer lower costs, if they are guaranteed demands for both, such as a carrier bidding for two lanes of transportation as a group bid. Suppliers can submit "unbundled" bids — that is, they are not forced to bid on many requirements, but they are permitted to bid on only those requirements that they find suitable.
- The construction of "what if" scenarios, such as "calculate the difference in the total award amount for: (1) giving 30% of my business to the incumbent supplier at its current bid and the rest to the lowest bidder; versus (2) awarding all my business to the lowest bidder." What-if scenarios can be saved for later evaluation, audit trail creation and reporting.
- Support for optimization against multiple constraints, plus automated scoring of the weighed elements of supplier proposals, such as awarding a higher score for longer proposed warranty periods.

Specialized sourcing optimization offerings for transportation truckload bid optimization have been around for several years, and competition in this specific space is established. In large part, sourcing optimization has become a piece of a holistic multimodal transportation management system (TMS), and there are advantages to having sourcing optimization integrated with TMSs; however, some stand-alone solutions remain. Sourcing optimization for other transportation modes, such as less than truckload, air, ocean and rail, is less mature, although solutions are evolving to support them. General purpose sourcing optimization offerings are available as solutions or services from specialty vendors such as CombineNet, Trade Extensions and Emptoris.

Continuing interest in this technology has attracted new competition. The broadened field of players has helped to more clearly define the value proposition of sourcing optimization, which has, in turn, aligned market offerings more closely with buyer expectations. Moreover, managed service providers that supplement sourcing optimization tools with services and expertise are helping companies learn and exploit the value of these types of solutions. The technologies are proven, and

users are plentiful and growing, but largely the market has been the domain of more sophisticated organizations with high spending. Thus, overall market penetration remains modest. The net result is that sourcing optimization has moved past the Trough of Disillusionment; however, conservative buyers are only now considering these technologies, although many will favor managed service providers to gain expertise in the use of advanced sourcing optimization technologies.

The most sophisticated tools have been, and continue to be, used primarily by large, sophisticated buyers. These organizations have knowledgeable procurement professionals that understand the power and flexibility of powerful sourcing optimization tools. Adoption beyond the high end of the market is, and will continue to be, hampered by the complexity of these solutions. In some commodity areas, such as transportation, simpler tools (such as LeanLogistics' LeanSource) are starting to gain traction and will expand the marketplace.

Even with the availability of proven and sophisticated sourcing optimization tools, spreadsheets remain the tool of choice for much of the market. Many smaller and less-sophisticated organizations lack the internal expertise to conduct complex bids in-house and either revert to simple tools like spreadsheets or, increasingly, we see them seeking partners that conduct bids on their behalf.

**User Advice:** Transportation organizations:

- Consider truckload sourcing optimization where you expect to make strategic awards to many carriers. If you are looking to source other modes, then make this requirement explicit during vendor evaluation to ensure that you develop the appropriate shortlist of vendors.
- Favor vendors that offer deep market knowledge of the spending categories you need to source, because this kind of expertise can dramatically improve event results.
- Consider specialized service providers that will provide sourcing optimization as a managed service, combining robust tools with specialized domain expertise.

Other commodities:

- Procure sourcing optimization as a service unless you have the know-how inside your organization to set up and operate this powerful but complex solution.

**Business Impact:** The ability to simultaneously evaluate hundreds of unbundled, conditional bids against dozens or hundreds of business rules or preferences enables large organizations to effectively leverage multiple sourcing options and quickly identify the best combination of sources, even when there are thousands (or more) of individual bids to consider.

Basic freight costs are often locked in during periodic freight-sourcing exercises, so the business value of freight sourcing optimization is high. This technology empowers organizations to source in ways that were not previously possible, which facilitates hard-dollar savings.

**Benefit Rating:** High

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** BravoSolution; Chainalytics; CombineNet; Elemica; GT Nexus; iSOCO; IBM (Emptoris); JDA Software; LeanLogistics; Manhattan Associates; Oracle; SynerTrade; Trade Extensions

### Carrier-Centric TMS Suites

**Analysis By:** C. Dwight Klappich

**Definition:** Carrier-centric transportation management system (TMS) suites focus on the broad needs of over-the-road truckload, less-than-truckload, flatbed and bulk commodity carriers. Carriers control their own assets, which include drivers, tractors and trailers. Therefore, these solutions share some characteristics with private fleet routing and scheduling, and multimodal TMS products, but also provide capabilities needed by carriers, such as order entry, dispatching, rating, invoicing, settlement, accounting, driver pay, driver logs and maintenance.

**Position and Adoption Speed Justification:** Carrier-centric TMS suites are not new. They have been growing and evolving for several years, almost exclusively in North American trucking and fleet operations. In North America, these would be considered mature technologies, but the same cannot be said internationally, where most vendors have, so far, elected not to expand their operations. Consequently, the time to plateau in North America is soon, while these solutions remain nascent internationally. Large carriers have built homegrown applications, but these are becoming technologically obsolete — opening high-end and midtier markets for these solutions.

Although shippers and carriers collaborate on the transportation of goods, they are not mirror images of each other, and the needs and motivations of one are not the same as the other. Carriers look to maximize the use of their assets (for example, drivers and equipment), while serving the needs of their customers profitably. Increasingly, they are looking for capabilities that help them achieve these goals strategically and tactically.

**User Advice:** North American carriers with more than 25 trucks should consider these types of solutions. International carriers should seek local niche solution providers (if they exist) or consider one of the large suite providers in this space.

**Business Impact:** Carrier-centric TMS suites will become the application backbone of carriers and help users more effectively control most business processes.

**Benefit Rating:** High

**Market Penetration:** 5% to 20% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Accellos; Cheetah Software Systems; McLeod Software; Oracle; TMW Systems

**Recommended Reading:** "Supply Chain Management Market and Vendor Guide, 2012"

## Foreign/Global Trade Compliance

**Analysis By:** William McNeill; C. Dwight Klappich

**Definition:** Foreign/global trade compliance (GTC) addresses the rules, regulations and costs (such as duties and taxes) when conducting cross-border trade. GTC is a main component of a broader category of software called global trade management (GTM), which also looks at the logistics and financial aspects of conducting global trade.

**Position and Adoption Speed Justification:** GTC solutions have three primary components: the business application, the trade content and, where necessary, connectivity with customs authorities for document filing. Trade content is the repository of the data, rules and costs for each harmonized tariff schedule code by source or destination country, as well as the special rules governing regional trade agreements. Some GTC vendors provide the application and the content, while others only provide the application, with the customer sourcing the content independently. Holistic GTC solutions cover restricted, denied or sanctioned U.S. Office of Foreign Assets Control (OFAC) screening; import compliance; export compliance; and support for regional trade agreements, free trade zones and other duty drawback programs.

Although elements of GTC have been in place in the U.S. since World War I, such as restricted party/OFAC screening regulations, knowledge of these rules is widespread in some industries, but less extensive in others. While the OFAC affects consumers individually as well, few have heard of it, except as a Cold War artifact restricting their access to Cuban cigars and rum. The usefulness of sanctions as a tool of statecraft has been questioned, but trade sanctions and interdiction lists are an increasingly popular "action other than war" to enforce national policies with a limited risk of casualties.

GTC is a mature application category, but solutions continue to evolve to cover more geographies within a single solution and to enable broader trade compliance coverage. However, GTC remains underautomated, largely because many companies lack the internal expertise to perform it in-house, regardless of the availability of good systems, so they outsource GTC to third parties, such as customs brokers, third-party logistics (3PL) providers or freight forwarders. Gartner finds the GTC vendor landscape changing, with new entrants moving in front of more established vendors for several reasons, including newer and more flexible technology, richness of trade content or the availability of GTC as part of an integrated GTM suite. Today, no single GTC application covers every type of trade control across all industries or geographies, so specialized solutions remain (for example, free trade zone management). Furthermore, as the scope of global trade controls expands, specialized solutions will emerge, and these capabilities will continue to be merged into broader suites from GTM, ERP and supply chain management (SCM) vendors. We believe global trade content has the potential to affect more strategic sourcing, product life cycle management (PLM) decisions and applications. Restricted party screening has been used in other areas, including screening in human resources.

**User Advice:** Users must understand that the business application and the trade content are two independent, but tightly connected, aspects of GTC solutions. They must first understand their content needs, and then use this information as they evaluate GTC offerings to ensure that the solutions address their compliance needs. Although there are advantages to a single-vendor

offering of the application and the content, this should not overshadow all other considerations, such as integration with back-end systems, vendor domain expertise and the cost of ownership. Additionally, users should evaluate software based on whether they will be doing their own document filing directly with various customs bureaus, or whether they will be outsourcing document submission. In the case of the latter, direct electronic connections are not as important as the document generation itself or the visibility layer to track the status of submissions.

Users must be cognizant of the evolving nature of compliance mandates, such as the Registration, Evaluation, Authorisation and Restriction of Chemical (REACH) substances, International Traffic in Arms Regulations (ITAR), and other new and changing mandates. The U.S. Customs and Border Protection website is a good place to start, but will not cover everything. As these regulations continue to change, and users need to consider the flexibility and adaptability of the application to support change. Some of these regulations (ITAR, for example) have not only document filing requirements, but also rules for data storage and use, which extend beyond the expertise of many GTC providers, and have created the rise of special vendors that address this security issue.

Implementation time for these applications varies widely. If a company is simply instituting denied party screening (DPS), for instance, then the project time can range from nothing (for example, the company simply signs up for a third-party content service, and enters names and addresses manually on an ad hoc basis) to a few weeks or months (for example, the DPS system is incorporated into the workflow of other business processes, such as order management or customer creation). More complex compliance systems for global companies with many locations around the world can take 12 months or more.

Enterprises and individuals should prepare for unannounced shifts in enforcement emphasis and ever-tightening regulations. Essentially, the heat can be turned up or down at will (for example, through the granting of humanitarian exemptions), without legislative or judicial input, as a way of fine-tuning government pressure on a foreign entity. Additionally, any act of terrorism or instability has the potential to elevate the criticality or magnitude of certain compliance requirements.

**Business Impact:** While any company that conducts cross-border trade has to comply with global trade compliance rules and regulations, it has the option either to outsource these capabilities to customs brokers or to bring these capabilities in-house, supported with GTC technologies. GTC is an important application category, but not many companies are using it as a value-adding area. It is important because not adhering to the rules that govern trade can result in delays, and, in some cases, fines and seizures of goods.

However, being "world class" at trade compliance is not a source of business differentiation, unless it's used as part of a more strategic sourcing effort, and not a source of financial return, short of avoiding fines. Users must be able to comply with the rules that govern global trade, and any viable application must be able to support this need. GTC is primarily a risk-avoidance investment. The business benefits can include reduced administrative costs, avoidance of penalties and less disruption in the flow of goods. For example, by automating these processes, many companies find that the cost of processing documents and the money spent on couriers fall dramatically. Additionally, by using regional trade agreements and duty drawback programs strategically, there is tremendous savings to be had. So, while this does not add competitive differentiation, cost avoidance can be significant. Even in outsourced environments, this software can give a company

real-time visibility into the status of submissions placed on their behalf, and reduce the time needed for any error mitigation.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Amber Road; Customs Info; Integration Point; Kewill; LexisNexis; MIC Customs Solutions; NextLabs; Oracle; QuestaWeb; SAP; Thomson Reuters

## SCM BPaaS

**Analysis By:** Michael Dominy

**Definition:** Supply chain management (SCM) business process as a service (BPaaS) is an externally provisioned service. Processes falling within SCM BPaaS tend to be very standardized and are often delivered on a unified, one-to-many cloud-sourced technology platform. SCM BPaaS differs from SCM BPO, since the service provider uses its own technology, processes and people. SCM BPaaS examples include manufacturing support processes, such as compliance and regulatory reporting, freight forwarding, customs processing, supply chain analytics and sourcing.

**Position and Adoption Speed Justification:** In traditional SCM BPO, the client dictates how the process is executed and what technologies the BPO provider uses. By contrast, in SCM BPaaS, the provider decides what technologies and applications to use and how to execute the process. The provider uses commercially available software, its proprietary applications and technologies, or a combination of commercial and proprietary solutions.

SCM BPaaS varies greatly by SCM process area:

- SCM BPaaS is pervasive in the logistics process (for example, in shipment tracking and customs clearance processing). Although basic tracking is not charged separately in many instances, service providers will charge an incremental fee for more advanced tracking and tracing, such as proof of delivery. In the case of customs clearance, when an individual or company ships goods internationally, customs documents must be processed to enable the goods to enter the country to which they are being shipped. Many logistics service providers offer customs clearance and processing services.
- In the demand management process within SCM, analytic services that aggregate and synthesize point of sale (POS) scan data and other sources of demand data are delivered via a BPaaS model.
- The adoption of BPaaS in another core supply chain process area, sourcing and procurement, is also common in the market. Credit-rating services used within sourcing and procurement processes would be an example.

The maturity levels and prevalence of SCM BPaaS varies by process area. For instance, SCM BPaaS for analytics would be near the Peak of Inflated Expectations, while SCM BPaaS for aspects of the logistics and sourcing process would be on the Plateau of Productivity. As a result, for SCM BPaaS overall, we have positioned it in the Slope of Enlightenment section of the Hype Cycle.

**User Advice:** Companies already using SCM BPaaS should still conduct regular audits and governance, especially to monitor areas of higher risk, such as global trade management (GTM). For example, ensure that there is a clause in the contract with the SCM BPaaS provider that gives you visibility into how the service provider updates its systems and processes to remain compliant with any relevant rules and regulations. An example in GTM would be denied-party lists, which are updated periodically by various organizations. Also, the service provider should furnish reports that detail the status of required updates and changes.

Supply chain executives also need to monitor the market for new SCM BPaaS services to identify opportunities for improving supply chain performance. As software functionality becomes more advanced, and as integration capabilities utilizing cloud services improve and expand, service providers will bring new and broader SCM BPaaS services to the market. Supply chain leaders must become familiar with these services: They represent potential opportunities to gain incremental capabilities without licensing software or hiring employees.

**Business Impact:** SCM BPaaS will continue to impact the logistics function, especially as logistics service providers look to leverage technology to deliver more differentiated services to shippers. SCM BPaaS will also impact manufacturing operations, particularly in supporting processes that involve regulatory and compliance activities, such as environmental, health and safety reporting, and material safety data sheet processing and reporting. The demand-sensing and demand-shaping functions within SCM will also be impacted as existing and new service providers capture and analyze consumer data from social networks, and combine it with other sources of demand data, such as POS scan data.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** Chainalytics; DHL; Expeditors; FedEx; Nielsen; UPS; Zyme Solutions

**Recommended Reading:** "What Supply Chain Leaders Need to Know About Business Process Outsourcing for Supply Chain Management"

"Cool Vendors in Supply Chain Services, 2013"

"Cool Vendors in Procurement and CLM, 2013"

"User Survey Analysis: Data Supports the Business Case for Cloud based BPaaS Adoption Through 2014"

"Agenda Overview for Supply Chain Strategy and Enablers, 2013"

SCM definition in the Gartner IT Glossary [www.gartner.com/it-glossary/supply-chain-management-scm](http://www.gartner.com/it-glossary/supply-chain-management-scm)

## Software-as-a-Service Supply Chain Execution

**Analysis By:** C. Dwight Klappich

**Definition:** Supply chain execution (SCE) as SaaS refers to SCE software that is owned, delivered and managed remotely by one or more providers. SCE refers to technologies that are used to support the supply chain management (SCM) execution tasks of transportation, warehousing and global trade management (GTM). SCE SaaS requires the vendor to provide remote, outsourced access to the SCE application and IT infrastructure, as well as to maintenance and upgrade services.

**Position and Adoption Speed Justification:** On-premises applications are still the dominant delivery vehicles for SCE applications. Overall, SaaS represents less than 20% of the SCM application market — growing to around 25% by 2017. Most of this growth is in transportation management systems (TMSs) and GTM, and less penetration but accelerating demand in areas such as warehousing. However, SaaS is growing in these areas, having moved from just one option to a preference for many users. Overall, market penetration of SCE SaaS remains modest, other than in the aforementioned categories, where it is growing rapidly. Gartner estimates that the number of companies choosing SCE SaaS will reach at least 40% within three years.

For GTM, most of the vendors favor SaaS deployment; however, vendors that offer on-premises GTM solutions are the exception. In other areas, such as warehouse management systems (WMSs), the percentage of implementations is small compared with the number of on-premises implementations; however, SaaS WMSs are growing, with new vendors offering more robust solutions. The initial focus of SaaS WMSs was largely on the very low end of the WMS market, but this is changing as new vendors enter the market. Although the number of SaaS WMS customers has grown, vendor revenue remains modest.

Generally, acceptance of SCE SaaS is balanced across most industries, but we still see higher demand for trade compliance and TMSs than other areas, such as WMSs. However, we are finding some continued, although reduced, resistance to SaaS in sensitive industries, such as aerospace, defense and life sciences, where data security remains a concern. In TMSs and WMSs, demand was mostly from smaller users, given the near-term cost advantages of SaaS and the less-stringent functional requirements; however, as SaaS applications become more functionally robust and better able to compete with on-premises SCM applications, we expect to see growth at the high end of the market.

Several traditionally on-premises vendors are moving their offerings to the cloud but typically not as multitenant SaaS.

**User Advice:** Understand and evaluate the trade-offs between rich functionality (which, for most categories other than GTM, favors leading on-premises SCE applications) and upfront costs (which, in most cases, favor SaaS). Companies with complex requirements that want and need more than

the basic SCE capabilities should focus on market-leading SCE solutions, which are primarily on-premises solutions today. Companies with less-stringent requirements or those seeking interim solutions — for example, less than three to five years of planned solution life — should consider SaaS SCE.

Model total costs comparing on-premises and SaaS deployment options over at least a five- to seven-year time horizon. This will enable users to compare the total cost of ownership of looking at long-term subscription costs with upfront license and annual maintenance costs, while taking into consideration possible annual increases. Users should carefully review implementation costs, because many SCE SaaS vendors tend to overstate their advantages. Many SaaS vendors claim significantly shorter implementation times, efforts and costs — sometimes more than 50% less. However, we find that, for a comparable project, the time and effort to set up, configure the application and address all related tasks are equivalent to a traditional on-premises project.

**Business Impact:** In general, SaaS SCE applications deliver the same business advantages of the relative SCE application category, whether on-premises or as SaaS. However, in TMSs and GTM, the availability of a pre-onboarded trading partner network or shared content improves the ability to collaborate with trading partners, allowing users added flexibility to change their networks when needed, without the burden of onboarding new trading partners each time.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** 3PL Central; Amber Road; C.H. Robinson; Deposco; Descartes; eBizNet Solutions; E2open; GT Nexus; inet; IBM; Integration Point; LeanLogistics; LogFire; Manhattan Associates; MercuryGate; Transplace

## Yard Management

**Analysis By:** C. Dwight Klappich

**Definition:** Yard management systems (YMSs) facilitate, organize and control the coming, going and staging of trucks and trailers in the parking "yard." They coordinate the location and movement of assets in the yard to support the needs of a warehouse, distribution center or manufacturing facility.

**Position and Adoption Speed Justification:** Yard management is a set of capabilities — normally closely associated with warehouse management — that takes into consideration equipment/facility/employee constraints and activity demands, focusing on the location and movement of trailers in the yard. The scope typically starts at the guard gate, with check-in/check-out, determining where to move incoming trailers, identifying where trailers are parked, coordinating movements in the yard via onboard capabilities provided to "yard jockeys" and, increasingly, coordinating with dock scheduling. The market is dividing between traditional data capture mechanisms for locating assets and the use of real-time location system (RTLS) technologies, such as RFID, for automatically identifying the location of assets.

In modern, large, high-volume logistics operations, the yard has become an extension of the warehouse in terms of synchronizing the yard with dock doors for shipping and receiving, and in using the yard as a supplementary storage location. Coordinating and managing the flow and movement of vehicles and trailers throughout the yard have become important activities for logistics operations. Yard management can be fairly rudimentary, with the application simply noting manual entries of asset movements in and out of parking spaces, to very advanced use of real-time, asset-tracking technologies, such as RFID and related technologies. Real-time visibility of asset movements is well-addressed by mature applications, while RTLS technologies are less mature. However, solutions exist and are evolving rapidly.

Companies with big yards (more than 200 parking spots) were traditionally the prime market for a YMS, particularly in industries such as grocery and food service. However, we see increased interest in smaller environments (100 or fewer parking spots) and other industries. For example, for hub-and-spoke transportation models, or even less than truckload (LTL) carriers, yard efficiency is critical. We have also seen renewed interest in industries that might store some goods in the yard until it is closer to the shipping window to allow for more efficient cross-docking.

YMSs are not new; manual YMSs have been around for many years. These systems have generally been effective, but they are dependent on people following procedures and not deviating from these. Demand for an RTLS-based YMS is increasing as organizations seek better controls, improved efficiency and higher throughput. The problem in the past with an RTLS-based YMS was cost — not just the YMS, but the cost of hardware (tags and readers) and implementation costs, which could be very high. Today, by using innovative approaches based on RFID, the costs have come down, which makes real-time YMS more realistic and affordable for midsize to large yards. The systems, which are sophisticated "under the covers," are not complicated to the user. Therefore, they implement pretty easily, and costs for implementation and support are not far from manual YMSs. Now that the cost is more reasonable, the barriers to looking at RTLS-based YMS are minimal.

**User Advice:** High-volume logistics operations with 100 or more trailer parking places should consider YMS, preferably as an extension of their warehouse management systems, for integration reasons. However, the largest and most complex yard operations should consider best-of-breed YMSs that offer traditional or real-time locating technologies.

**Business Impact:** Improving logistics throughput demands that yard activities are coordinated with warehouse activities, such as receiving and shipping, to ensure that goods flow smoothly and as quickly as possible. For very large yards, the ability to quickly identify the location of trailers and goods in the yard can eliminate wasted time looking for the right trailer or containers. Additionally, the YMS can do a quicker and more effective job determining where best to move trailers based on constraints and rules. An automated yard management system can also provide the improved security of goods coming into and moving around the yard.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** C3 Solutions; Fluensee; HighJump Software; Manhattan Associates; Navis; Pinc Solutions; Zebra Technologies

**Recommended Reading:** "Supply Chain Management Market and Vendor Guide, 2012"

## Workforce Management Systems for Logistics

**Analysis By:** C. Dwight Klappich

**Definition:** The workforce management (WFM) system for logistics, which in previous Hype Cycles was called "warehouse labor management system," is a technology used to target labor productivity improvements in warehouses and, more recently, transportation operations. WFM can be reactive (labor reporting) or predictive (planning labor requirements based on planned work considering engineered standards).

**Position and Adoption Speed Justification:** WFM use is mature in large grocery and food service facilities, but the technology and engineering standards have expanded during the past several years, making the technology and labor management processes applicable to most midsize and large warehouse facilities. However, most buyers of WFM remain users with large workforces who work in large warehouses. WFM systems were once specialized systems; however, with general use, there's more emphasis on integration with the warehouse management system (WMS), and on the technical fit and finish of the systems. In mature implementations, companies use WFM systems as a base measurement tool to offer incentive pay for above-standard performance. However, most vendors have not completed the technology projects to enable the systems to fully comply with restrictive labor laws outside the U.S.

Although basic labor reporting is mature, leading-edge systems are being extended to support labor and resource planning and scheduling. The goal is to provide tools that will consider all the activities of the warehouse, projected over a time frame, so that the labor and resource requirements can be more accurately forecast and scheduled. This trend is accelerating as warehouse managers strive to be more proactive in planning and managing the work within their warehouse operations, taking into consideration constraints and projected work requirements.

Most WFM implementations have been in the U.S., while European companies have generally resisted this technology because of local labor laws, labor unions or perceived cultural constraints. In parts of Europe, unions or work councils restrict detailed worker oversight from the use of tools such as WFM. In addition, there are still few reference customers on these systems outside the U.S., although some European companies use them at the aggregate level. Some vendors have begun focusing on deployments outside the U.S., amending systems to meet local conditions. Gartner expects these changes, as well as real-world experience in other countries, to accelerate adoption by users outside the U.S. WFM can be an add-on to established WMSs.

Although the value is high and the market is mature, adoption as a percentage of the total addressable market is low — largely because of the historical focus on warehouses with large workforces. There are several reasons for this. Many companies continue to operate aging WMSs

that do not have WFM as part of the package. These users are focused first on upgrading to a newer WMS. However, we find that WFM is now a common requirement for a new WMS. Another reason is that, historically, WFM fit certain environments, such as grocery facilities, because the solutions were not strongly packaged. In addition, the total cost of ownership (TCO) and the time, effort and cost to implement and support WFM were high, so only operations with large workforces could justify it. As WFM has matured and become more standard and prepackaged, the costs and complexity have come down, thereby opening the WFM market to more and smaller warehouse operations.

Lastly, although WFM is common in large warehouse operations, use in transportation is significantly less pervasive. Large fleet operators have focused primarily on vehicle and driver routing and less so on workforce management. As hours of service rules become increasingly restrictive and companies strive to be more driver-friendly to address driver shortages, WFM in transportation will become more important.

**User Advice:** Most logistics in the U.S. with more than 100 workers in their warehouses or trucking fleets should consider WFM. However, it isn't enough to install the system. Users must be willing to incorporate best work practices, as well as build a program of worker training and rewards based on the system. This requires a high degree of change management. Users who work with labor unions should employ a consultant with specialized expertise in working with labor unions regarding the deployment of WFM systems to ensure that a win-win business case and business process are developed.

Users outside the U.S. should begin evaluating WFM systems to determine whether there are real or perceived issues with cultural fit and legal regulations. In Europe, the scheduling components can be used to forecast labor requirements and reduce overtime expenditures. If shown the benefits (for workers and the business), workers' councils normally will allow a testing phase. The councils need to document their concerns and not have strict veto power.

**Business Impact:** Labor is typically one of the top cost items in a logistics operation. A typical warehouse might be performing at 50% to 70% of optimal performance through the use of performance management tools and a good WMS. The implementation of a WFM system can bring a warehouse to 90% or more of optimal performance. The deployment of pay-for-performance schemes based on engineered labor standard goal times can move a warehouse up to 110% to 120% of the "optimal" level for true best-in-class performance. Sometimes, these systems can be used to evaluate temporary labor to determine whether a full-time offer should be extended based on performance.

The scheduling components can be used to forecast labor requirements and reduce overtime expenditures. Some WFM vendors offer time-and-attendance system modules that can reduce the need for costly third-party systems.

**Benefit Rating:** High

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** HighJump Software; Infor; Kronos; Kurt Salmon; Manhattan Associates; SAP; SumTotal; TZA; West Monroe Partners

**Recommended Reading:** "Magic Quadrant for Warehouse Management Systems"

"Supply Chain Management Market and Vendor Guide, 2012"

"Apply an Architectural Framework to Stratifying Warehouse Management Systems"

## Multimodal TMS

**Analysis By:** C. Dwight Klappich

**Definition:** Domestic shipper-centric multimodal transportation management systems (TMSs) are used in a specific region or geography to manage domestic freight operations. These are used to plan movements, and perform rating and shipping across all modes (truckload, less than truckload, air, parcel, rail and intermodal), consolidate orders, select the appropriate route and carrier, communicate (tender) with carriers, and manage freight bills and payments.

**Position and Adoption Speed Justification:** Domestic multimodal TMS solutions are typically only used for domestic freight operations, not for complex multileg international, cross-border or global shipping. This is a mature market, emerging in the early 1990s. Until recently, penetration was limited to large shippers (more than \$100 million per year in freight spending) because of the high cost of TMS applications and the constrained benefits of more narrowly focused ones. With expansion of the TMS functional footprint to holistically cover most freight activities — from sourcing to planning/optimization, execution, audit and settlement — as well as more options for how users buy these types of solutions, the market is slowly expanding to include shippers from as little as \$15 million per year in freight spending.

The emergence of alternative TMS deployment models — notably, SaaS — has also helped to expand the market to smaller shippers. Breadth and depth continue to improve, but the basic core functions of planning, execution and audit/pay are mature, while other areas, such as procurement, performance management and support for all modes and styles of transportation (for example, bulk, packaged, dry van and flatbed), remain differentiated across vendors.

Although overall market adoption is estimated at slightly more than 20%, large-shipper adoption is far higher (50% of the large-shipper market), and smaller-shipper adoption remains quite low (5% to 10% of the midsize and small-shipper markets). It's growing rapidly, however, because of pent-up buyer demand and consideration of the high value and ROI of TMS applications. While the weak global economy negatively impacted many supply chain management application categories, demand for TMS remained steady, given the strong potential for cost reductions.

Until recently, the multimodal TMS market was largely focused in North America, with most of the demand and implementation in this market. Increased demand in other parts of the world, notably Europe and Asia, is changing the market landscape, as incumbent multimodal TMS vendors look to expand internationally and as vendors emerge to specifically target these new markets. For this reason, the position of multimodal TMS has not moved since last year, and the market penetration number has decreased, because the market has been geographically expanded. Penetration

continues to grow in North America, while markets emerge internationally, where penetration is minimal. Furthermore, the market is highly fragmented, and vendor consolidation is likely as global market penetration improves.

**User Advice:** Enterprises with more than \$10 million in annual freight spending that spans multiple modes of transportation should consider using TMS, but they should be diligent in creating a business case and selecting solutions that fit their budgets. Larger shippers with \$50 million or more in annual freight spending should consider these solutions as well, paying particular attention to the breadth and depth of the TMS solutions being considered, with particular focus on the planning engines.

**Business Impact:** Rising transportation costs (particularly volatile fuel costs), combined with the need to manage freight operations cost-effectively and provide high levels of customer service, make TMS almost a necessity for midsize to large shippers. Although many transportation metrics (such as lower fuel costs and freight capacity) improved during the economic downturn, most shippers and carriers believe this was a temporary respite, and costs and capacity constraints will likely spike in years to come. Cost reduction and payback are high, with most organizations finding a postimplementation return in less than 12 months and cost reductions of normally 10% or more of annual freight spending.

**Benefit Rating:** High

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Early mainstream

**Sample Vendors:** C.H. Robinson; Descartes; inet; IBM (Sterling Commerce); JDA Software; LeanLogistics; Logility; Manhattan Associates; MercuryGate International; One Network; Oracle; SAP; Transplace

**Recommended Reading:** "A Self-Diagnostic Model for Building a TMS Business Case and Evaluating TMS Sourcing Options"

"Issues to Consider When Building a TMS Business Case and Evaluating TMS Sourcing Options"

"TMS Sourcing Options Are Expanding With the Increase in the Number and Types of Products"

"Stratifying Transportation Management Systems: A Multilevel View"

"Magic Quadrant for Transportation Management Systems"

### Voice-Directed Picking in Warehouse Management

**Analysis By:** C. Dwight Klappich; Tim Zimmerman

**Definition:** Voice-directed picking in warehouse management involves the use of voice recognition and speech synthesis technology to drive activity that enables hands-free and eyes-free operations. It can be used in a multimodal capability (such as voice plus bar code or other technologies) with

many handheld platforms. In this implementation, voice recognition is used only for the operations or inputs that require eyes-free and hands-free operations, with other processes implemented via a bar code or keyboard as needed.

**Position and Adoption Speed Justification:** For many years, the industry struggled with competing designs and styles, wrestling with speaker-dependent versus speaker-independent, client-based versus server-based, and engine and middleware applications versus in-place speech. The technology has matured to the point where most facilities with meaningful picking volumes can afford to use voice technology. Adoption is increasing as the costs of the hardware, software and services to deploy voice have lowered.

Gartner still finds the most use of industrial, voice-directed picking in warehouses, where hands-free operation is valuable, although some companies are attempting to replace all radio frequency (RF) users with voice. We also find increased demand for hybrid voice/RF solutions, where part of the communication with the users is through voice commands and the other part through scanning. A common hybrid use case is providing picking instructions in voice, but allowing the users to scan items to more quickly and accurately pick up items with multidigit lot or serial numbers, which are often difficult to capture verbally.

**User Advice:** All users with intensive picking requirements, such as case-picking operations or pick and pass, should evaluate voice picking as an addition to a warehouse management environment. It's possible to go directly from paper-based picking to voice picking, so there is no need to step through RF picking before implementing voice picking. However, additional productivity can be achieved by optimizing the workflow using the middleware applications that are part of the voice-picking solution. Users will need to ensure that the warehouse has good wireless network coverage as part of the initial installation. They should also test to assure that any dialects or languages are being properly recognized. Additionally, users need to consider whether they should upgrade their warehouse management system (WMS) as part of the project to ensure that voice picking is implemented on top of modern business practices, although business benefits can be had without upgrading the underlying WMS.

**Business Impact:** Voice-directed picking can improve the productivity of order selectors, especially in situations where both hands are required to perform picking operations, such as case picking for pallet building. The use of voice direction can improve safety in the warehouse, since employees are not distracted by reading a screen for instructions. In hands-free operations, the productivity improvement can exceed 30%, and the ROI is less than one year, in comparison with the paper-based systems that they often replace.

Productivity improvements will be lower when integrating with a more modern WMS that has RF picking and integrated task management. This is because many of the productivity improvements cited when moving from paper picking to voice picking result from the use of task management technology, which would have been implemented in a modern WMS.

**Benefit Rating:** Moderate

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Mature mainstream

**Sample Vendors:** Datria; Lucas Systems; topVOX; Vocollect; Voxware; Zetes

**Recommended Reading:** "Magic Quadrant for Warehouse Management Systems"

## Entering the Plateau

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### Fleet Routing and Scheduling

**Analysis By:** C. Dwight Klappich

**Definition:** Fleet routing and scheduling (FR&S) software helps companies create vehicle routes and schedules that meet delivery objectives, considering multiple constraints, while minimizing cost and mileage. FR&S can create repeatable scheduled routes (that is, static routes), or dynamic routes based on inputs (orders, deliveries and pickups), rules and constraints for meeting an objective. Street-level FR&S can also provide turn-by-turn directions, factoring in detailed geographical information (for example, bridges, tunnels or one-way streets).

**Position and Adoption Speed Justification:** FR&S is a mature market, and solutions have been evolving for almost 20 years. Vendors offer proven and mature applications for major geographies, such as North America and Western Europe, while other markets are only partially covered by local vendors or some of the established vendors. The market has consolidated considerably during the past several years, and only a few dominant vendors of traditional FR&S remain. However, there are numerous smaller or local providers that can provide rudimentary or custom-made solutions, because the underlying planning algorithms have become partially commoditized. Nonetheless, the dominant vendors provide broader solutions, with higher-quality fit and finish than many of the smaller solutions.

Some changes are underway, as new entrants bring to the market contemporary tools, and transportation management system (TMS) vendors add more FR&S functionality to their multimodal TMS solutions. Outside of developing economies, most companies that have a fleet of more than 20 vehicles are using some form of a FR&S solution. So, most new sales are replacement sales, driven by technical obsolescence; sales to growing companies in emerging economies; or sales driven by the need for more-advanced capabilities, such as linking to onboard devices for driver communication.

FR&S emerged as stand-alone solutions, focused exclusively on batch daily planning. However, newer systems are extending the functional footprint to include more capabilities, such as dynamic rerouting based on changing conditions, dispatching, driver management and mobile functions (that is, electronic signature or proof of delivery). Traditional batch-oriented FR&S will remain important, because optimization engines benefit from larger problem sets, where more options can be considered in the mathematical solver. However, we see an evolution where batch planning is supplemented with real-time capabilities, which enables dispatchers to more intelligently respond to changing conditions.

**User Advice:** Shippers that control the day-to-day fleet operations, directly or indirectly, and need planning tools to improve route and schedule creation, are prospects for these types of solutions. New or replacement buyers should focus more attention on the technical architectures of the systems they are considering, and should look at their needs beyond just planning.

**Business Impact:** These solutions create routes and schedules that minimize miles and costs. They meet delivery objectives by considering the truck fleet's multiple constraints, which, when combined, help improve delivery performance and reduce delivery costs. With high fuel costs, improvements in routes can significantly affect fuel use and, thus, reduce energy expenses. Although few, if any, routing applications include sustainability metrics as explicit solve variables, such as optimally minimizing the given variable, several vendors are adding sustainability factors for reporting and analysis, such as being able to report the carbon footprint for a particular route plan.

**Benefit Rating:** High

**Market Penetration:** More than 50% of target audience

**Maturity:** Mature mainstream

**Sample Vendors:** Descartes; JDA Software; Oracle; Ortec; Paragon Software Group; Quintiq; Roadnet Technologies; Telogis; TMW Systems

## Multicarrier Parcel Management

**Analysis By:** C. Dwight Klappich

**Definition:** Multicarrier parcel management tools help companies select the appropriate (best) parcel carrier from among all contracted carriers, based on order characteristics (such as weight and dimensional properties) and delivery rules (such as delivery time and delivery zone), while considering the cost differentials of various carrier offerings. These tools also enable shippers to manage the creation of labels, create shipper manifests, provide status messages to customers or customer service representatives, and manage carrier rates.

**Position and Adoption Speed Justification:** Basic multicarrier parcel management is a mature solution category. Most companies that need a solution have one, so many new decisions are driven based on technology-obsolescence criteria. However, this market continues to evolve, with new vendors gaining traction in the market, new capabilities continually being added to stand-alone parcel solutions, and parcel management now being a stronger part of multimodal transportation management system (TMS) offerings.

Although multicarrier parcel management is mature in distribution environments, many companies have large parcel operations in other areas of their businesses, or they are not traditional shippers, but have a large parcel shipping need. These environments might be found in sales groups, banks, financial institutions, insurance companies or universities where the organization has many individuals shipping parcels, and the goal is to provide consistency and discipline to the process, as well as ensure that rules (such as selecting the lowest-cost carrier) are followed. Leveraging multiuser, Web-based technologies enables distributed users to access a common system to ensure control. This is a nascent market.

In addition, we find parcel capabilities becoming integrated with multimodal TMSs, in which parcel is one of the available mode choices. However, the system can also look to consolidate parcel shipments to find less-costly shipping alternatives, such as combining multiple parcel shipments into one less-than-truckload (LTL) shipment, which would have a lower total cost. Developments continue in this area, including technology renovation, footprint expansion to include more constraints (such as drivers and assets) and increased use of mobile technologies.

The position of multicarrier remains unchanged from last year, because the market is stable and is largely a replacement market in distribution and retail environments. As parcel becomes a more important mode in multimodal TMS, this market will undergo more evolution, with parcel management as a stand-alone category diminishing. Multicarrier parcel management remains in this Hype Cycle largely because of the continued evolution — most notably inclusion in multimodal TMS and the emergence of systems aimed at nondistribution-centric shipping environments.

**User Advice:** Companies that ship individual packages using multiple parcel carriers, and do not need multiple modes of transportation (for example, full truck, LTL, rail and ocean), should consider independent multicarrier parcel management solutions. Shippers using warehouse management systems (WMSs) should look for integrated solutions with their current WMS solutions, while shippers using a TMS should evaluate parcel management systems integrated with TMS products. Nondistribution users should focus on multiuser, Web-based solutions designed for desktop shipping or mailroom use.

**Business Impact:** Companies can lower parcel shipping costs and increase service levels with multicarrier parcel management.

**Benefit Rating:** Moderate

**Market Penetration:** More than 50% of target audience

**Maturity:** Mature mainstream

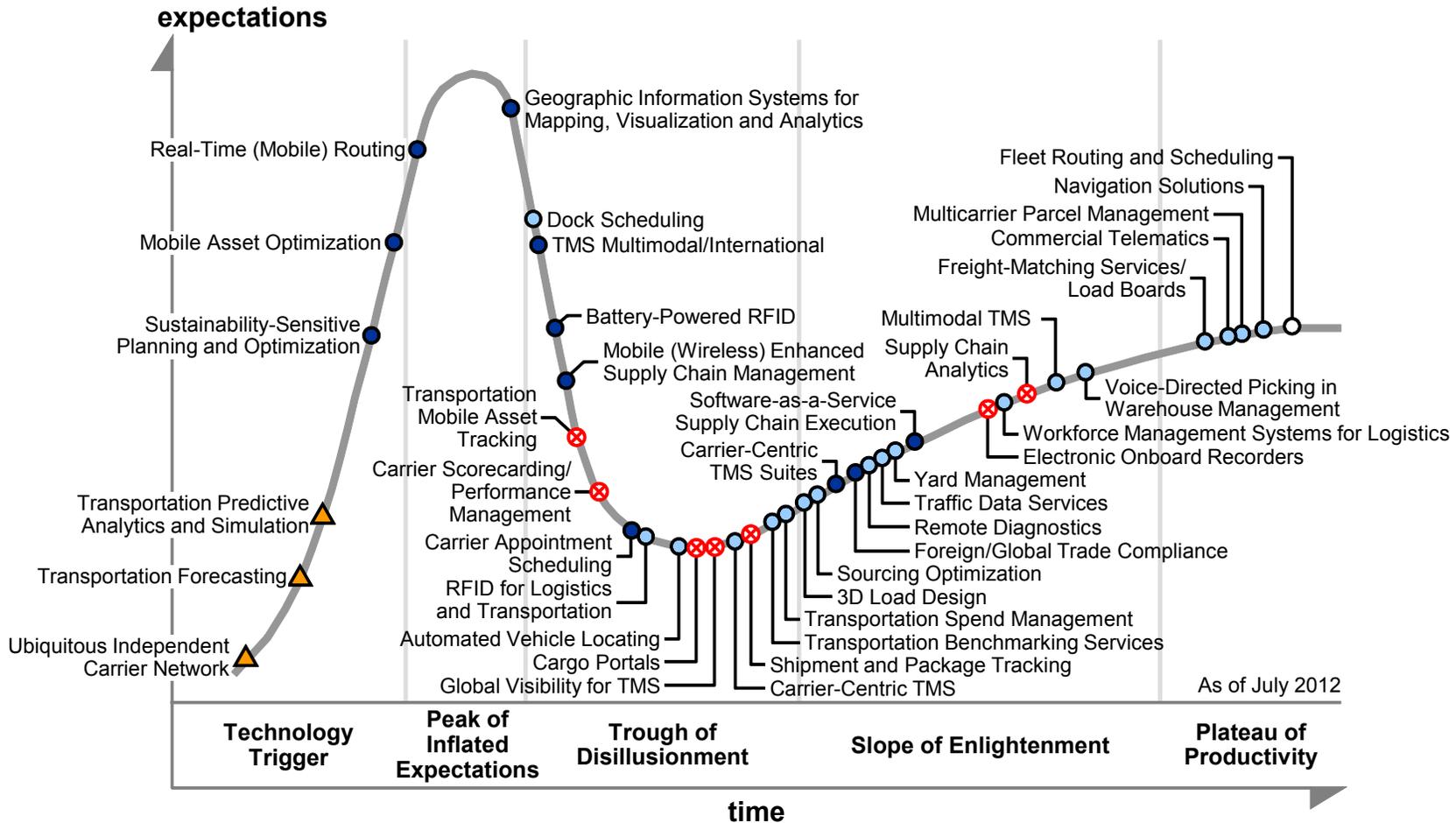
**Sample Vendors:** Agile-Network; Best Way Technologies; JDA Software; Kewill; Manhattan Associates; MercuryGate International; Precision Software; ProcessWeaver; UPS

**Recommended Reading:** "Supply Chain Management Market and Vendor Guide, 2012"

## Appendixes

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Figure 3. Hype Cycle for Transportation, 2012



Source: Gartner (July 2012)

## Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
<i>Innovation Trigger</i>	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
<i>Peak of Inflated Expectations</i>	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
<i>Trough of Disillusionment</i>	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
<i>Slope of Enlightenment</i>	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
<i>Plateau of Productivity</i>	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
<i>Years to Mainstream Adoption</i>	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2013)

Table 2. Benefit Ratings

Benefit Rating	Definition
<i>Transformational</i>	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
<i>High</i>	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
<i>Moderate</i>	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
<i>Low</i>	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2013)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
<i>Embryonic</i>	<ul style="list-style-type: none"> <li>In labs</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>
<i>Emerging</i>	<ul style="list-style-type: none"> <li>Commercialization by vendors</li> <li>Pilots and deployments by industry leaders</li> </ul>	<ul style="list-style-type: none"> <li>First generation</li> <li>High price</li> <li>Much customization</li> </ul>
<i>Adolescent</i>	<ul style="list-style-type: none"> <li>Maturing technology capabilities and process understanding</li> <li>Uptake beyond early adopters</li> </ul>	<ul style="list-style-type: none"> <li>Second generation</li> <li>Less customization</li> </ul>
<i>Early mainstream</i>	<ul style="list-style-type: none"> <li>Proven technology</li> <li>Vendors, technology and adoption rapidly evolving</li> </ul>	<ul style="list-style-type: none"> <li>Third generation</li> <li>More out of box</li> <li>Methodologies</li> </ul>
<i>Mature mainstream</i>	<ul style="list-style-type: none"> <li>Robust technology</li> <li>Not much evolution in vendors or technology</li> </ul>	<ul style="list-style-type: none"> <li>Several dominant vendors</li> </ul>
<i>Legacy</i>	<ul style="list-style-type: none"> <li>Not appropriate for new developments</li> <li>Cost of migration constrains replacement</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance revenue focus</li> </ul>
<i>Obsolete</i>	<ul style="list-style-type: none"> <li>Rarely used</li> </ul>	<ul style="list-style-type: none"> <li>Used/resale market only</li> </ul>

Source: Gartner (July 2013)

## Recommended Reading

*Some documents may not be available as part of your current Gartner subscription.*

"Understanding Gartner's Hype Cycles"

"Apply an Architectural Framework to Stratifying Warehouse Management Systems"

### More on This Topic

This is part of an in-depth collection of research. See the collection:

- Gartner's Hype Cycle Special Report for 2013

**GARTNER HEADQUARTERS****Corporate Headquarters**

56 Top Gallant Road  
Stamford, CT 06902-7700  
USA  
+1 203 964 0096

**Regional Headquarters**

AUSTRALIA  
BRAZIL  
JAPAN  
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