



Software for Supply Chain Management

Jeroen van den Berg Consulting

Jeroen van den Berg Consulting, in cooperation with Koninklijk Nederlands Vervoer (KNV), investigated fifteen software systems for supply chain captains. The survey addresses the entire logistics process from closing a purchase/sales transaction to delivering the goods at the recipient. The results of the survey can be studied with the online selection tool at www.JvdBconsulting.com. The tool automatically computes the overall scores of the systems on the desired functions.

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The traditional roles in the supply chain of the manufacturer, the wholesaler, the retailer and the logistics service provider are under dispute. Collaboration in the supply chain increases service levels and reduces costs. However, the role-changes also affect the power balance in the supply chain. Can a logistics service provider take control over the supply chain? Or how does the logistics service provider cope best with a dominant supply chain captain? Which tasks in the supply chain can the logistics service provider appropriate?

The logistics service provider should make up his mind on how to realise his ambitions. Clearly, information technology is an essential enabler. ERP, WMS and TMS are well established in the logistical world, while the connection of these applications now brings extra savings. Software vendors develop new applications named Supply Chain Event Management (SCEM), Order Management System (OMS), Enterprise Application Integration (EAI) and Advanced Planning & Scheduling (APS) that bring together the information in the supply chain for an integral control of the distribution processes.

The inventory availability and the fill rate of the trucks can be increased by centrally planning the orders of multiple sites in a distribution network. With virtual warehousing, an enterprise looks into the stocks of its suppliers so that it can satisfy customer demand without even having the product in stock. Furthermore, the logistics service provider can offer improved services such as the online tracking of shipments throughout the supply chain or integral invoicing of the logistical services.

Research and consulting firm Jeroen van den Berg Consulting, in cooperation with Koninklijk Nederlands vervoer (the Dutch organisation of large logistics service providers), has investigated the capabilities of modern software to control the supply chain. The vendors have filled out an extensive questionnaire. The answers have subsequently been verified in an interview with the vendor and a system demonstration.

The survey addresses the entire process from the closing of a purchase/sales transaction until the delivery to the recipient. The individual aspects that have been investigated, are:

- Connectivity, i.e. the connection of information systems in the supply chain;
- Computation of the desired inventory levels per site;
- Central entry and processing of sales orders,

Table 1. Background of the participants.

Enterprise Software	Supply Chain Execution	Specialists
AXI	CAL Consult	Axway
Baan	DCS	G-Log
JD Edwards	Interchain	Quintiq
Oracle	LIS	
Qurius NC (Navision)	Manhattan Associates	
IMI	Marc Global	

- including the computation of availability and delivery time (available to promise);
- Integral distribution planning over multiple sites;
- Full visibility on stocks, orders and shipments in the supply chain and anticipation on certain events in the execution (supply chain event management);
- Control of the warehouse processes (warehouse management systems, WMS)
- Central administrative processing of customs, invoicing of services and the generation of management information (data warehousing).

The scope of the various software systems differs considerably (Table 1). Some vendors are highly specialised, while others attempt to cover a broad range. You can use the online selection tool to find out which software is most suited for your supply chain logistics. The tool selects the systems with the most advanced support on the functions that you require. Furthermore, you may find comprehensive information on the systems and vendors.

The following software vendors have been evaluated: AXI, Axway, Baan, Cal Consult, DCS, G-Log, IMI, Interchain, J.D. Edwards, LIS, Manhattan Associates, Marc Global, Oracle, Quintiq and Qurius (Navision).

Conclusions

From various backgrounds, the vendors develop software for better control over the supply chain. The strength of the ERP vendors clearly lies in inventory and order management. These applications are especially interesting for logistics service providers who take over the planning tasks from shippers, such as vendor managed inventory

or order acceptance. The ERP vendors also have sound modules for WMS and TMS, although the SCE-vendors still have a functional lead and more experience in the field of distribution. For ERP-vendors this typically is a new target group. Finally, the specialists excel in their own field.

Connectivity is for all participants a hot item. Most participants limit themselves to the connectivity of their own applications to those of third parties. Some provide a tool for the integration with any arbitrary information system in the supply chain. The specialists in enterprise application integration (EAI) have a prominent role.

Supply chain event management (SCEM) is for all participants a new application area. Via SCEM, the progress of the various processes can be tracked in real-time and quicker than before the operators can anticipate special (unexpected) events in the supply chain. Also here we see that most vendors provide visibility on the progress of the processes in their own applications. A limited number of SCEM systems tracks the processes in the entire supply chain.

Traditional TMS packages support the transportation planning for a single site. Systems that provide an integral transportation planning in a network of sites, are still rare. The applications compute an optimal planning with the aid of APS-techniques that increase the fill rate of the trucks by consolidating shipments via cross-docking. The first implementations show savings on the transportation costs of 5% to 15%. A new development is factory gate pricing. The purchased goods are picked up from the factory, so that the inbound flow of goods can be incorporated in the transportation planning.

Centralisation makes administrative tasks more efficient. The customs declaration is established on

one location for all sites or integral invoices are generated for all services provided. Here we see that vendors choose between developing their own application and cooperating with a specialised partner.

There are also strong technological developments. Almost all vendors have made their software accessible via the web. Since the systems are not only used within the company, but also by others in the supply chain, this is a logical development. Furthermore, the vendors attempt to increase the configuration capabilities of their standard software. Utilising workflow & configuration tools, a company may specify process flows and corresponding user screens without programming customisations. Meanwhile the vendors of customer specific software work on the standardisation of their products to facilitate the maintenance and upgrades. Finally we see that the systems become available on more platforms. Especially, systems that traditionally operate on the AS/400 platform, become more and more available on Unix and Windows NT.

In conclusion, the survey shows that the logistics service provider has more choice than just the traditional WMS and TMS systems. The SCE specialists encounter more competition from the ERP generalists. In functionality, and even more in experience, the ERP vendors are still behind. However, the extensive development budgets and the considerable customer base of the ERP-vendors contribute to the modern architecture and a solid continuity. The number of implementations of software for supply chain captains is still limited. We advice you to evaluate the functionality of the new software and the experience of the vendor in detail during the selection process. Consider to do a pilot project, before signing the contract.

PARTICIPANTS

Vendor	WWW	Vendor	WWW
AXI	www.axi.nl	J.D. Edwards	www.jdedwards.com
Axway	www.axway.com	LIS	www.lis-online.com
Baan	www.baan.com	Manhattan Associates	www.manh.com
CAL Consult	www.cal-consult.com	Marc Global	www.marcglob.com
DCS	www.dcstrans.com	Oracle	www.oracle.nl
G-Log	www.glog.com	Quintiq	www.quintiq.com
IMI	www.im.se	Qurius (Navision)	www.qurius.nl
Interchain	www.interchain.nl		

Survey “Software for Supply Chain Captains”

The survey addresses the entire logistics process from closing the commercial purchase/sales transaction to delivering the goods at the recipient. Here we discuss the various system functions that have been studied in the survey. We distinguish the following areas:

- Software
- Inventory Management
- Order Management
- Transportation Planning
- Supply Chain Event Management
- Warehousing
- Administrative Logistics

In this section, we discuss these functions in more detail. Moreover, we present the scores of the systems in the survey on the individual functions. You find the scores per function in the various tables. For every function the maximum score has been indicated. This is either 3 or 5.

For easy selection of systems that suit your supply chain logistics, we have developed an online selection tool . You find this tool at www.JvdBconsulting.com. The tool automatically computes the overall scores of the systems on the functions desired by you. Furthermore, you find exhaustive information on the systems and vendors.

Software

Connectivity

Connectivity refers to the abilities of the software to exchange messages among applications. All systems in the survey offer excellent support for connecting to and communicating with systems of third parties. Simple packages only offer connectivity between the vendor’s applications and the outside world. Advanced systems provide the integration and message transfer between a large number of different applications (enterprise application integration). They offer a user friendly interface to define messages between systems. Also logical rules can be specified for manipulating and routing messages.

Web-enabled

All vendors have discovered the web as a user interface for their applications. The web provides many advantages, for instance that the system can be made accessible to any user with a web browser. In the evaluation, we considered whether the application is entirely or partly web-enabled. Furthermore, we investigated whether the web

screens have been built as a layer on top of an existing application or that the system has been developed especially for the web. Finally, we assessed which relevant functions are available through the web.

Personalisation & Authorisation

To what extent is it possible to modify the system according to the requirements of the users? We may think of manipulating the screen layout to enhance the user friendliness or giving users restricted access to information. For instance, an account manager only sees the information of his own customers.

Modelling & Optimisation

By this we mean the ability to model complex distribution problems and finding an optimal solution using advanced computational methods. Examples of such methods are linear programming, integer programming, heuristics, stochastic models, etc.

Table 2. Scores of the systems on “Software”. The maximum score per function is indicated between brackets in the left column.

Software	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Connectivity (max. score 5)	2	5	5	3	4	3	4	3	5	4	3	3	5	3	4
Web-Enabled (max. score 5)	2	3	3	3	3	5	2	3	5	4	4	3	5	2	4
Personalisation & Authorisation (max. score 5)	4	3	4	4	5	5	3	4	5	4	4	4	5	5	5
Modelling & Optimisation (max. score 3)	0	1	3	0	0	2	1	0	2	0	0	0	3	3	2

Inventory Management

Demand Forecasting

The system computes how much should be ordered at what moment to achieve the required service level against minimum costs. In simple systems the parameters must be configured in advance. Advanced systems compute the optimal parameter setting while considering trends, seasonal fluctuations, special promotions, etc.

Procurement

Available support for placing purchase orders at vendors. This is possible in all systems in the survey, although the user friendliness differs significantly. Advanced systems provide an e-procurement portal with a complete product catalogue. By looking into the stocks of the vendors, the system can suggest from whom the goods can preferably be purchased.

Inventory Registration

Register the available stock and the specific stock attributes such as lot and serial numbers, best before date, owner, responsible client, etc. For multi-

site environments it is important that this information is registered centrally for all sites.

Replenishment

The system automatically generates orders for inventory replenishments between warehouses within an enterprise. A well-known example is the replenishment of a satellite warehouse from a central DC. Simple systems only look at the inventory level and establish a replenishment when the lower bound has been reached. Advanced systems take into account the demand forecast in the area of supply of the various sites.

Vendor Managed Inventory (VMI)

The system automatically generates orders on behalf of customers. The system is accessible to the customer and the supplier. Simple systems only consider the inventory level and generate an order when the lower bound has been reached. Advanced systems take into account the demand forecast for the various customers. VMI can lead to complex situations inside a (third party) warehouse when the client responsible for the goods is not the owner.

Inventory Management	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Demand Forecasting (max. score 3)	2	0	2	0	0	0	3	0	2	0	0	0	3	0	1
Procurement (max. score 5)	3	0	4	1	2	0	4	2	4	1	1	1	5	0	3
Inventory Registration (max. score 3)	2	1	2	3	3	1	2	3	2	3	3	3	3	1	3
Replenishment (max. score 3)	2	0	1	1	1	0	3	1	3	2	1	1	3	1	2
Vendor Managed Inventory (max. score 3)	2	0	2	1	1	0	3	0	2	1	0	0	3	0	1

Table 3. Scores of the systems on “Inventory Management”.

Order Entry

Here we consider the system's support for entering orders manually. This is possible in all systems in the survey, although the user friendliness differs significantly. Advanced systems provide readily support for call centres and web shops. For multi-site environments it is important that the orders from various sites can be entered in a central application. By centrally taking decisions on order acceptance and order allocation, instead of decentrally in the various sites, the available stock can be optimally deployed.

Order Acceptance

After entering the order, the system indicates if the goods can be supplied and how long this will take. For this, the system first verifies if there is sufficient stock in the warehouses of the company (available to promise). Subsequently, the system checks if the order can be supplied from the goods in existing purchase orders or scheduled production runs. If this is not the case, then the system considers if it is possible to purchase or produce the goods (capable to promise). Also the system can verify if there is sufficient transportation capacity to deliver the goods in time (capable to deliver). Finally, the system can indicate the profit margin on the order (profitable-to-promise).

Order Allocation

The system allocates stock to the incoming orders. To select specific stock, the system distinguishes various stock attributes such as the lot number, availability status (blocked/free), quality status, expiry date, etc.. If there is insufficient stock for all orders, then the system divides the stock among the customers according to certain rules, e.g. evenly, first come first served or according to customer priority. In multi-site environments the system also decides from which sites the goods should come. It is even possible to allocate orders to goods that are still in route to a warehouse.

Delivery Composition

The system decides how an order must be delivered. Is the order delivered as a whole or in multiple subdeliveries? Also multiple orders from the same customer can be consolidated into one delivery. In case of inventory shortages, the system facilitates the back-ordering.

Returns

Here we consider how the system supports the administrative handling of goods that are returned by customers. This begins with a request from the customer to return the goods, after which he receives an authorisation. With the authorisation number the return delivery is traced throughout the (reverse) supply chain until the reimbursement to the customer. The physical handling of the returns is not part of the evaluation. This is considered under "Warehouse Management".

Order Management	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Order Entry (max. score 5)	3	1	5	2	5	2	5	4	4	2	4	2	5	1	4
Order Acceptance (max. score 5)	3	0	5	2	3	3	3	3	4	2	2	2	4	4	3
Order Allocation (max. score 5)	2	0	4	3	4	1	4	2	2	3	4	3	4	2	3
Delivery Composition (max. score 3)	1	0	3	2	3	0	3	2	2	1	1	2	3	0	2
Returns (max. score 3)	2	0	3	1	1	0	3	2	3	2	2	2	3	0	2

Table 4. Scores of the systems on "Order Management".

Inbound Transportation Planning

Enterprises have focused in recent years on optimising the outbound supply chain. However, also in the inbound supply chain considerable benefits can be realised. For instance, instead of having the goods delivered by the supplier, the company purchases the goods off-factory and collects them by itself. Accordingly, large savings are possible by combining the inbound and outbound trips.

Single-Site Transportation Planning

The system supports the transportation planning of a single site. It is possible to manually assign the deliveries to the available trucks or to do this automatically according to specific rules. The system incorporates the loading capacity of the various trucks and it provides efficient routes. These are typically the functions of a classic transport management system (TMS).

Multi-Site Transportation Planning

The system optimises the goods flows in a network of sites. By combining deliveries, the truck occupancy can be increased. This can imply that goods are not delivered directly, but through cross-docking at an in-between site. As long as the lead-time allows it, the system can advance or delay an order by one or more days, to establish a better truck occupancy. This opportunity can be further exploited by negotiating a multiple day time-window for delivery with the customer, instead of a specific delivery date. This is an interesting opportunity when the situation permits it.

Cross-Docking

Cross-docking implies that the incoming goods are not putaway unto storage, but onto a loading dock instead, possibly via an intermediate buffer. It reduces the necessary handling and the goods are available more quickly. We distinguish three types of cross-docking. The first type is opportunistic cross-docking. This occurs when there are (back) orders on incoming goods that need to be delivered immediately. The second type is planned cross-docking with the objective of limiting the transportation kilometres. Instead of shipping two semi-full trucks directly, one full truck drives to a site halfway where the goods are cross-docked to trucks for both destinations. The third type is merge-in-transit where goods from various sites are consolidated into an order and subsequently are shipped together. We have investigated to what extent the systems are able to plan these three types of cross-docking, e.g. taking into account the available capacities and the required transfer time. The physical handling of the cross-docking is not incorporated in the evaluation. This is part of “Warehouse Management”.

Carrier Selection

The system decides which carrier (forwarder) is most suited to deliver the goods at their destination within the requested lead-time. Advanced systems have an extensive table with the (graduated) rates of the carriers.

Supply Chain Simulation

The system simulates modifications in the supply chain. It can answer the question what are the consequences of adding or removing a particular site. For third-party logistics service providers the system can evaluate the consequences of including a new customer into the existing network.

Transportation Planning	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Inbound Transportation Planning (max. score 3)	1	0	2	1	2	3	1	1	1	1	1	1	2	2	1
Single-Site Transportation Planning (max. score 3)	2	0	3	2	3	3	1	2	2	1	2	1	2	3	2
Multi-Site Transportation Planning (max. score 5)	1	0	5	1	3	5	1	3	1	2	2	1	4	5	2
Cross-Docking (max. score 3)	1	0	3	2	2	2	1	1	2	1	1	1	2	2	1
Carrier Selection (max. score 3)	1	0	2	1	2	3	1	1	1	1	2	1	3	2	2
Supply Chain Simulation (max. score 3)	0	0	3	0	0	0	0	2	3	0	0	0	1	2	2

Table 5. Scores of the systems on “Transportation Planning”.

Tracking & Tracing

The system registers events with all relevant details and archives these for tracking & tracing purposes. Shipment tracking & tracing shows a detailed time-stamped path of the specified carrier and deliveries.

Visibility

The system shows the status of stocks, orders and shipments in the supply chain until the delivery at the customer. The system achieves this by extracting data from various information systems such as ERP, WMS, TMS, CRM or even proof-of-delivery scanners. The information is accessible via the web so that the relevant information may be shared with third parties.

Alerts & Messages

The system tracks the progress of the processes in the supply chain. If certain planned or unplanned events occur or contrarily do not occur, then the system sends an alert to the responsible operator. The alert can be transmitted by email, pager or fax. When the problem has not been solved in time, eventually a new alert e.g. to the supervisor of the operator is sent. Instead of an alert to an operator, the system can also send a message directly to an information system.

Workflow Decision Support

During the execution of the processes in the supply chain, differences with the planning may occur. E.g. when a truck from a supplier is delayed, the system investigates which consequences this will have for the other processes in the supply chain. Subsequently, the system will automatically modify the planning or give a suggestion to the responsible operator.

Warehouse management

The system (WMS) controls and registers all processes within the warehouse walls.

Supply Chain Event Management & Warehouse Management

	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Tracking & Tracing (max. score 3)	2	3	3	3	3	3	3	3	3	3	3	3	3	2	3
Visibility (max. score 5)	2	2	4	3	4	5	3	3	4	5	4	4	5	3	3
Alerts & Messages (max. score 3)	1	3	3	2	3	3	3	3	3	3	3	3	3	2	2
Workflow Decision Support (max. score 5)	1	3	5	1	4	5	2	3	4	3	2	2	4	5	3
Warehouse Management (max. score 5)	3	0	3	4	4	0	4	4	3	5	5	5	3	0	3

Table 6. Scores of the systems on “SCEM” and “WMS”.

Invoicing of Logistical Services

The system registers the services that have been provided by a logistics service provider on behalf of a client. Based on a table with (graduated) rates, the costs for the various services are calculated. Simple systems do this for a single warehouse or transportation centre. Advanced systems generate an integrated invoice for transportation, warehousing and e.g. customs handling. For outsourced transportation the system automatically matches the invoices of the carrier with the services that actually have been provided. Advanced systems can also compute the invoice amount for outsourced services, so that the carrier does not have to send an invoice (self-billing).

Customs Handling

The system supports the registration and declaration of customs goods. Several vendors have chosen not to develop their own customs system, but instead to connect their system to an existing customs system. These vendors have organised their system such that it registers all information required for the customs declaration. Simple customs systems support one site and a limited number of customs' warehouse types. Advanced

systems support multiple sites simultaneously to enable central customs handling and all customs' warehouse types (C-sum, C-spec, C-bac, D and E). The latter can be interesting for logistics service providers when clients have different customs' warehouse types.

Reports & Management Information

Interesting information can be distilled from historical data, e.g. overviews and performance indicators. Also processes can be analysed, to establish a continuous improvement process. Vendors offer their own management information system (MIS) or they have tailored an existing business intelligence system (e.g. Business Objects, Crystal Reports or CorVu) to the specific needs of their application.

Packaging Pool

The system registers how many pallets (or other reusable packaging materials) have been shipped to any party in the supply chain and how many have been returned. Furthermore, the system records how long the pallets have been used to be able to calculate the rental fee.

Table 7. Scores of the systems on "Administrative Logistics".

Administrative Logistics	AXI	Axway	Baan	Cal Consult	DCS	G-Log	IMI	Interchain	J.D. Edwards	LIS	Manhattan Ass.	MARC Global	Oracle	Quintiq	Qurius NC
Invoicing of Logistical Services (max. score 5)	5	3	3	4	5	5	3	4	3	4	3	4	4	0	3
Customs Handling (max. score 3)	1	1	2	1	3	1	1	3	1	1	1	3	1	0	2
Reports & Management Information (max. score 3)	0	2	3	2	3	1	2	3	3	1	1	3	2	1	3
Packaging Pool (max. score 3)	3	3	2	2	2	2	2	2	3	2	2	2	3	2	2

Jeroen van den Berg Consulting is a research & consulting firm specialised in warehouse and supply chain management. For more information you can contact us at the underneath address or via our web site.

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