

Strategic Systems Solutions

Manufacturing Systems

The Challenge of Integration

A Business Development Group White Paper





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Introduction

Manufacturing organisations present a unique set of challenges to the software developer. In simple economic theory a firm is seen as having a single goal; to seek profits. In reality the business units that make up a manufacturing company each have their own criteria for success. Often there are conflicting goals within the organisation which are revealed more clearly when there is an attempt to develop integrated systems.

While currently our major clients are large investment banks it should not be forgotten that many of Strategic Systems Solutions' employees come from manufacturing backgrounds. We have also been working with a multinational automobile manufacture since 2001.

In this document we look at the main business areas that are involved in the manufacturing process and we consider how Strategic Systems Solutions employees have helped clients to improve the efficiency and integration of their associated computer systems.

Indeed, our value proposition is that as an organisation, we have a considerable number of the key staff who developed and maintained the core manufacturing systems, from order take through to warranty, used by a global automobile manufacturer whose UK production base is in Sunderland, Tyne and Wear. We're confident that combining the intellectual capital of our experienced staff with the very competitive professional business day rates we offer, puts us in a unique position within the IT service provision marketplace in the United Kingdom and beyond.



Overview

The Business Area

There are two acronyms which appear frequently when discussing software integration for manufacturing processes; ERP and SCM. The definitions of the terms are at best flexible, possibly even vague, and still in a process of development. The definitions below should be sufficient for the discussion in this document.

ERP or Enterprise Resource Planning has been developed from the Manufacturing Resource Planning (MRP) systems that were the core systems of the past. The typical ERP system has a wide scope and attempts to integrate all of the computer systems of the company such as parts purchasing, inventory control, sales, product distribution, order tracking even finance and human resources.

SCM or Supply Chain Management is another attempt to integrate the majority of business processes. The focus of SCM is more external than that of ERP. It attempts to give visibility and control of the flow of parts from suppliers into the manufacturing process and then into the distribution of the finished product to the end customer. SCM can provide benefits by helping to reduce costly stocks of parts and finished goods and by reducing lead time. SCM can take integration even further by providing links into both supplier and retailer computer systems.

ERP and SCM systems can, and should, merge so that a seamless flow of information is available. Not only can the current situation be monitored but future situations can be modelled and actions taken to avoid predicted problems. The challenge is to use the information to shift focus from short-term internal targets and to consider how the needs of the whole business can be met.



Manufacturing Business Processes

See *Appendix A: Manufacturing Systems* for a diagrammatical overview of the integrated manufacturing systems.

Demand Planning

Focusing on the needs of the customer we look first at the demand planning process. In large manufacturing businesses, such as vehicle production, there are often long lead times associated with the supply of crucial parts, the introduction of new models or changes in production capacity. This makes it necessary to forecast demand. Long-range forecasts are made in terms of less precise periods, months as opposed to days, and the sales product specification omits details such as colour and exact model.

Sales forecasting is usually over-optimistic. A reluctance to abandon sales targets sometimes gives rise to unrealistic sales forecasts for the final months of the year.

Capacity Planning

Capacity changes in the medium to long term are possible by hiring or “firing” staff and by investment in or sale of plant and machinery. In the short term capacity increases are usually only possible by working overtime. Capacity reductions are also primarily achieved by changes in line speed or working hours. There are often conflicting manufacturing and sales objectives. Manufacturing objectives are often set in terms of cost reduction such that management are reluctant to increase costs by paying overtime or to reduce efficiency by working under optimum capacity - even if that is the sales requirement.

Strategic System Solutions Project

We were involved in creating a long-range Car Flow planning system allowing monthly forecasts by model to be created for several years ahead with the focus on the period from three to six months in the future. The system integrated sales forecasting and capacity planning. It allowed sales and capacity forecasts to be modelled through iterative cycles until agreement was reached. It also aided the process of sharing limited capacity amongst a number of markets. The final result contributed towards the Sales Pipeline figures.

- Technology
 - Web front-end
 - Proprietary middleware using XML
 - Natural/Adabas business logic
- Roles
 - Business Analysis
 - System Designer



Sales and the Supply Chain

SCM sales systems attempt to automate the placement of an order and move the process nearer to the customer. The current ideal is for the customer to be able to place the order himself via the Web. The system should guide the customer to determine the correct product specification and calculate the delivery date. In order to do this the sales system must be aware of production plans and product availability.

Strategic System Solutions Project

A number of people worked on a vehicle dealer ordering project. This was designed in a highly modular way to support a web interface. The product availability search was complex because not only was finished product considered, but also planned production. With planned production the specification had some flexibility so the matching criteria were complex. The delivery date calculation was also an involved process, dependent on lead-time and routing information from the supply logistics area. The choice offered to the customer depended on rules that could be maintained by the controllers of the system. These rules attempted to choose the optimum source of supply by taking into account transport and storage costs etc so that in some circumstances old stock would be chosen even if transportation costs were higher.

- Technology
 - Web or Terminal front-end
 - Proprietary middleware using XML
 - Natural/Adabas business logic
- Roles
 - Team Leader
 - Programmer

Sales/Production Pipeline

An essential feature of SCM systems is a highly visible sales and production pipeline. All relevant parties should be able to locate finished products, track orders and place new orders against planned or finished production. See *Appendix B: Product Supply Pipeline*.

Strategic System Solutions Project

The pipeline project was all about interfacing and stepwise refinement of data quality. The period within the long-term schedule, between three and six months ahead, consisted of a weekly production plan with data updated on a weekly basis. In the shorter term, daily production plans were updated with overnight batch processes. Once production began the pipeline was updated in real time using information from manufacturing process control computers. The finished product was tracked throughout the delivery process using data from supply logistics systems.

- Technology
 - Terminal front-end
 - EntireX interfaces
 - Natural/Adabas business logic
- Roles
 - Business Analyst
 - System Designer
 - Programmer



Supply Logistics

SCM systems emphasise the role of supply logistics in reducing stock holding costs and in adding to customer satisfaction by timely delivery. Supply chain integration allows the retailer to monitor expected delivery dates. Accurate information about planned production means that costs can be minimised by planning full utilisation of the available transportation facilities. The notification of delivery is often a trigger to financial systems to raise invoices.

If the correct key performance indicators (KPI) are not set carefully there is a tendency for logistics to attempt to move product as quickly as possible. Early delivery can be as bad as late.

Strategic System Solutions Project

A new centralised vehicle logistics system was developed to replace several regional systems. The new system allowed lead time reduction by using more flexible routing. We were involved in the design of lead time databases and processes and in the system that controlled parking and retrieval of vehicle stock.

- Technology
 - Terminal front-end
 - Natural/Adabas business logic
- Roles
 - System Designer
 - Programmer

Production Scheduling

Production scheduling systems take high level sales plans and produce a build plan showing what will be built in each time period. The lowest level of detail is the short-term build plan which specifies the sequence and timing of manufacture. This level of detail allows for Just In Time (JIT) parts delivery from suppliers.

Strategic System Solutions Project

The existing system was replaced to produce a long-term schedule in terms of weeks rather than months to allow for more accurate delivery predictions while at the same time the length of the short-term fixed plan was decreased to allow more flexibility. Colour and minor specification changes can now be made at a later stage. The schedules from several plants were interfaced with the central production pipeline.

- Technology
 - EntireX interfaces
 - Natural/Adabas business logic
- Roles
 - Business Analyst
 - Programmer

Bill of Materials

The Bill of Material or BOM is what converts a production schedule into a parts schedule. This process is commonly called a parts explosion. The database structure of a BOM is often a fairly simple iterative hierarchy: assembly A consists of assembly X, Assembly Y and part Z. Complications arise because relationships change over time therefore each relationship is qualified by start and end dates. Also the database structure is too slow to be used for the actual explosion process and has to be converted temporarily to a flat file format.



Material Requirements Planning and Parts Ordering

MRP is responsible for determining what parts are needed and when. It takes a parts schedule and produces purchase orders by working out when the stock will reach the reorder point. The system must take into account current stock levels, future usage and planned deliveries.

The boundaries between MRP and Parts Ordering systems are often blurred. Typically a Parts Ordering system could be used to turn a part requirement into an order by rounding up the quantity required to meeting a package quantity or economic order level e.g. the MRP requirement may be for 35, but the part comes in pallets of 10 so 40 are ordered. The MRP required date can also be converted into a delivery date using delivery schedule information from the supplier. Parts Ordering systems also can act as the interface to the supplier by producing paper or electronic documentation.

If a predicted stock shortage is caused by late arrival of an order then MRP systems can also be used to notify users to take action to chase up the order.

As well as creating actual orders MRP can create forecast purchase orders which can then be made visible to suppliers to enable them to plan their production. This supply chain integration helps to reduce costs and ensure future supplies.

The data used by MRP can be made visible as a parts supply pipeline. Real-time links to goods receiving and manufacturing systems allow stock to be constantly monitored and therefore minimised.

Strategic System Solutions Experience

Several of the staff of the company have helped design and maintain MRP systems. They have in depth experience of the processes and algorithms that are at the core of these systems.

Manufacturing

The manufacturing process uses specific CAD/CAM systems, but in SCM/ERP terms it should be seen as the key process that transforms a flow of parts into a flow of finished product. When there is a smooth flow then stock holding can be minimised. Ideally the finished product is built to order and that product order has been converted to parts orders on suppliers so that part arrival is synchronised with build time.

Strategic System Solutions Project

We were involved in introducing a system to measure and report on new key performance indicators to measure the effectiveness of Douki-Seisan (synchronised production) of vehicles. The system measured the timeliness of production with both early and late production being seen as failures. It also identified when vehicles were built out of sequence so that the tendency to move problem vehicles to one side to achieve time targets could be measured.

- Technology
 - Natural/Adabas business logic
 - FTP downloads
 - EXCEL based graphical reporting
- Roles
 - System Designer
 - Programmer



Warranty and Service Parts

Although not a core manufacturing system warranty is part of the product and an integrated warranty system provides information that can be used to improve the quality of both suppliers and the finished product.

SCM concepts are important for Warranty systems particularly in a motor manufacturing environment. Failed parts need to be collected from dealers and returned to the plant or supplier for analysis. Also replacement parts need to be dispatched, although often this is done using the facilities in a separate Service Parts system.

Strategic System Solutions Project

We were very heavily involved in the design, programming and implementation of a Warranty Part Control system. The system contained functionality to;

- Request affected parts - flexible criteria for requesting parts
- Dispatch affected parts - tracking
- Process received parts
- Analyse received parts
- Recover part costs from suppliers
- Technology
 - Natural/Adabas business logic
- Roles
 - Business Analyst
 - Programmer

Strategic System Solutions Project

We were instrumental in the design and programming of a common dealer warranty system and we are now in the process of implementing the system throughout Europe. The system is multilingual and multi currency and is used by over 5000 dealers in six European countries and is planned to be rolled out to another 6 countries.

- Claim validation - Table and rule based
- Pre-authorisation - rule based
- Supports many claim types including service contracts and campaign
- Calculates claim totals based on part prices and labour rates
- Manages campaigns and affected vehicles
- Technology
 - Natural/Adabas business logic
 - Dreamweaver Web design
- Roles
 - Business Analyst
 - Team Leader
 - Programmer
 - Implementation Manager
 - Training material creation (WEB and Mainframe)
 - Production Support



Summary

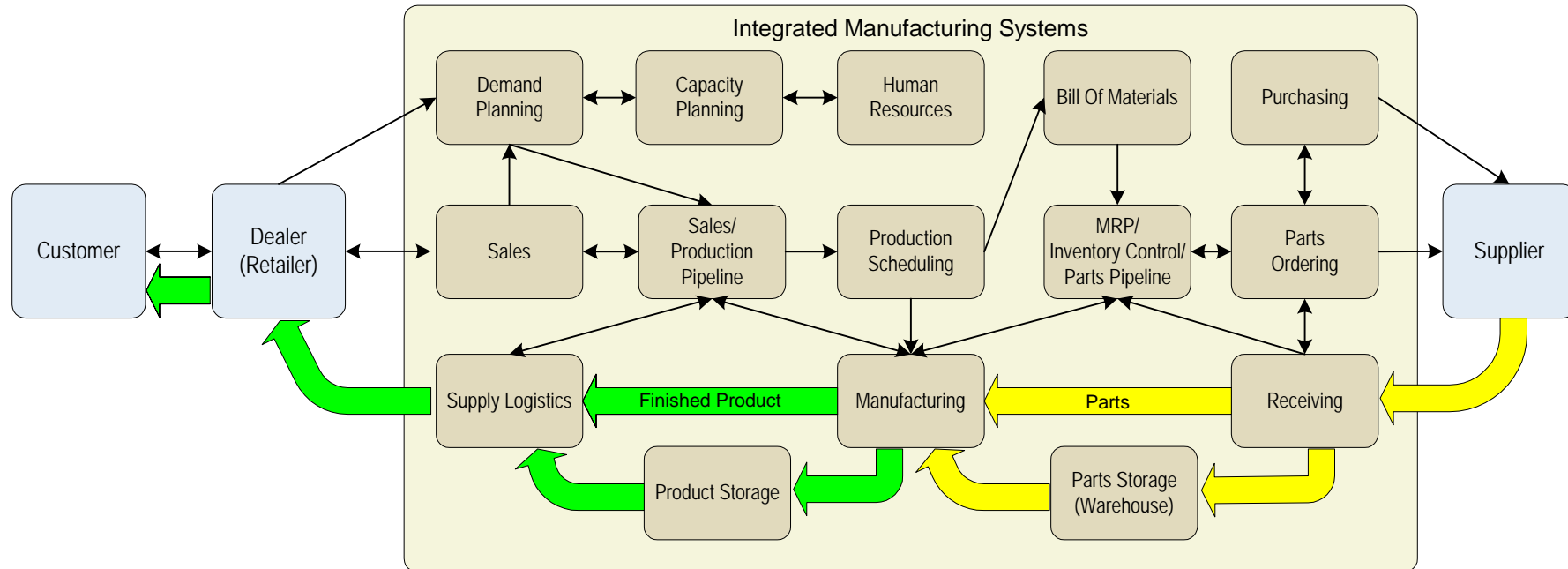
The Supply Chain Management concept gives rise to a new term, "extended enterprise". This represents the concept that a company is made up not just of its employees, its board members, and executives, but also from its business partners, its suppliers, and even its customers. The extended enterprise can only be successful if all of the component groups and individuals have the information they need in order to do business effectively.

Applications can span company boundaries and include a web of relationships between a company and its employees, managers, partners, customers, suppliers, and markets. With such systems it is possible to know a suppliers' stock conditions in real-time. Customers and partners can find out about the latest products or services as soon as they're available. The company management can have the latest financial information at their fingertips in order to make appropriate decisions about the company's future. The extended enterprise is an intricate, interconnected network of information.



Appendices

Appendix A: Manufacturing Systems





Appendix B: Product Supply Pipeline (Vehicle Manufacturing example)

