INTEGRATED SUPPLIERS

ECR IS ALSO FOR SUPPLIERS OF INGREDIENTS, RAW MATERIALS AND PACKAGING

ECR Europe
Efficient Consumer Response

Fraunhofer Applications Center
Transport Logistics and
Communications Technology

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1 INTRODUCTION AND ACKNOWLEDGEMENTS

"ECR is also for suppliers of ingredients, raw materials and packaging."

The goal of this booklet is to promote the use of the ECR improvement concepts upstream in the supply chain. Manufacturers of fast moving consumer goods and suppliers of ingredients, raw materials and packaging should work together to add value and reduce costs on both sides. Based on existing case studies spread over Europe it is demonstrated that suppliers play an important role in "working together to fulfil consumer wishes better, faster and at less costs". This booklet is based on the work of the ECR Europe working group which analysed the possible improvements related to the concept of Integrated Suppliers.

F. Kempkes (Unilever), chairman of the working group, would like to thank the Fraunhofer Applications Center for Transport Logistics and Communications Technology, Nuremberg, who provided the supply chain management expertise and carried out the research on the case studies. He would also like to thank the representatives of manufactures, suppliers and related organisations for their substantial help and support of the work:

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2 EXECUTIVE SUMMARY

"Integrated Suppliers is a concept for improving the part of the supply chain between manufacturers and their tiers of suppliers of ingredients, raw materials and packaging. By sharing information both parties are able to exercise judgement on costs, quantities and timing of deliveries and production in order to streamline the product flow and to move to a collaborative relationship."

Background

Since the formation of ECR Europe in 1994, different projects and applications have been developed which have had a tremendous impact on the industry. Up to now most of the work focused on the part of the supply chain downstream from the manufacturer to the retailer and consumer. To be more focused on the benefits of an integrated supply chain and to analyse and show that ECR concepts can improve the upstream supply chain between manufacturers and suppliers a working group was established in 1998.

Objective

The objective of the working group was to analyse the key concepts for integrating business processes upstream and to develop a scorecard for Integrated Suppliers. The scorecard enables companies to identify their current status in implementing the key concepts and to identify areas for further improvements.

The working group expanded the activity list developed by the Profit Impact of ECR Task Force (PIETF) to the requirements of the industry upstream. The activity list is the core element of the PIETF ABC-cost quantifier which supports companies and partners to determine the current costs related to the processes and to identify the potential profit impact of improvements.

Approach

Two approaches were selected to investigate the key concepts of Integrated Suppliers and their configuration:

First, in four case studies, with 13 different sites involved, current challenges and practices of integrating suppliers were studied. The companies and cases were selected because of their experiences in integrating suppliers. The case studies showed that all of them are successful in working together and that they have experienced a big impact on their supply performance. Additional to the case studies inside the industry, case studies outside were made to learn from other industries on working together.

Second, supply chain theory as well as existing information sources like publications from ECR Europe and EAN International were used to mirror and enhance the learning's from the cases and to learn from the findings of other studies and projects.

Key Concepts

According to the definition of Integrated Suppliers, the underlying key concepts cover the total supply process from the demand flow via the fulfilment flow up to the payment flow.

Closely linked to the demand flow are the key concepts "Demand Communication and Management" and "Efficient Product Change Management". Over all, these concepts focus on efficient transfer and integration of downstream demand (translated into material requirements) to the supplier.

"Synchronised Production", "Supplier Managed Inventory" and "Reliable and Efficient Supply" aim to optimise the fulfilment flow between the trading partners. Related to Synchronised Production are reliable material requirements forecasts with a reasonable planning horizon which enable the supplier

to plan his production considering both the needs of the manufacturer as well as the efficiency of the production. Supplier Managed Inventory aims to drive the replenishment of items by the real usage rate of the manufacturer. Reliable and Efficient Supply is linked to the physical flow of the supply to the manufacturer. The purpose of this concept is to achieve a supply which is on-time, in full and without errors by sharing information and controlling the process on the base of joint performance measures.

The last key concept called "Self Billing" targets the efficiency of the payment flow. At present Self Billing has been proven to be the best way to organise payment most efficiently, but legal requirements concerning the billing process in the different European countries have to be considered.

To support Integrated Suppliers, the relationship depends heavily on trust between the partners. If trust and honesty are not present, it is nearly impossible to work with the concept and as a consequence, to realise the benefits.

Technology is another basic element to support the business processes of Integrated Suppliers. Because it is critical for the processes that the "daily" communication is reliable and efficient, the need for standardisation arises. Only when the partners and the industry can apply standards concerning the identification, the messages and the means of communication, they will then be able to realise the full technological support for their processes.

Benefits

All the concepts have a common goal: to improve the supply chain in terms of efficiency and reliability. What are the benefits in a supply chain upstream with Integrated Suppliers? Analysing the case studies, all of the 13 sites working with the Integrated Suppliers approach realise significant benefits such as:

- Reduction of inventory levels of up to 40%
- Reduction of administrative costs in the involved departments of up to 20% on the manufacturer's side and of up to 5% on the supplier's side
- Reduction of lead times of up to 40%
- Reduction of production costs of up to 6%
- Service level approaching 100%

The results from the case studies are a sound indication of the profit impact achievable through implementing the Integrated Suppliers key concepts.

3 INTEGRATED SUPPLIERS

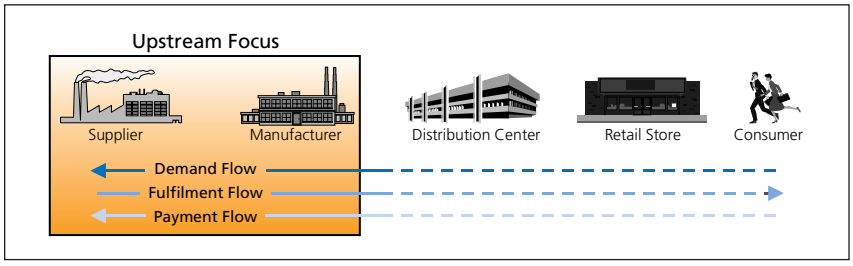
3.1 Efficient Consumer Response and Integrated Suppliers

"ECR Europe is a joint trade and industry body, launched in 1994 to make the grocery sector as a whole more responsive to consumer demand and promote the removal of unnecessary costs from the supply chain."

In the first years, ECR Europe promoted the Efficient Consumer Response concept for the downstream supply chain: from the manufacturers of consumer goods to the end consumers. To do so, they initiated and triggered many projects and studies regarding all aspects of enhanced supply chain management.

Thinking and working in supply chains, it is beneficial to extend the view on to the whole supply chain. The basic idea was to prove that the improvement concepts developed for downstream could be used back up the supply chain. The result should be a more efficient total supply chain offering enhanced quality and value to the end consumer. This idea was promoted by the ECR Europe VCA Study in 1996, which showed that the concept of Integrated Suppliers offered the greatest

Upstream Focus



source of cost reduction for the entire supply chain. In the middle of 1998 the ECR Europe Supply Side Steering Committee launched a working group consisting of manufacturers and suppliers to analyse the possible improvements related to the concept of Integrated Suppliers.

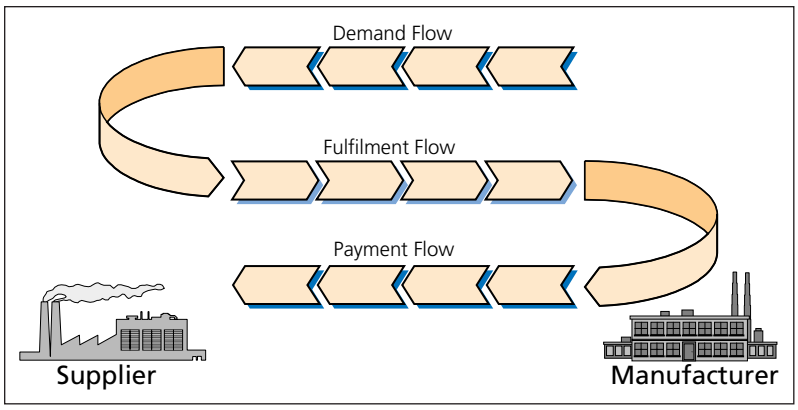
3.2 Definition of Integrated Suppliers

"Integrated Suppliers is a concept for improving the part of the supply chain between manufacturers and their tiers of suppliers of ingredients, raw materials and packaging. By sharing information both parties are able to exercise judgement on costs, quantities and timing of deliveries and production in order to streamline the product flow and to move to a collaborative relationship."

Accordingly Integrated Suppliers covers the whole supply process:

- Transfer of the material requirements to the suppliers in the demand flow as well as integration of these signals into the planning of production and supply
- Fulfilment flow
- Payment of the goods

Basic flow of Integrated Suppliers



Looking into "traditional" upstream supply processes it appears that the following steps are carried out in many relationships:

Order of goods ⇨ confirm order ⇨ plan production and delivery according to received orders ⇨ produce order ⇨ check quality of produced goods ⇨ stock ⇨ deliver ⇨ check quality of received goods ⇨ invoice ⇨ check of invoice and resolve of disputes ⇨ payment.

The result of this traditional process design is quite clear: the trading partners face long lead times, high administrative costs, high inventories and out-of-stock situations.

The Integrated Supplier concept aims to eliminate all activities in the relationship which waste time and money through establishing strategic business relationships between manufacturers and suppliers. An integrated process is the best way to serve the needs of the consumer, while at the same time optimising costs and flexibility of the supply chain.

3.3 Benefits of Integrated Suppliers

The implementation and application of the Integrated Suppliers concept aims to streamline the processes by lowering the stock levels in the partnership, to improve the service level of the supply chain and to be most efficient to obtain low costs. In more specific terms, the main benefits for the suppliers and the manufacturers are:

- **Reduction of inventories**
  One of the main factors to improve the efficiency of the supply chain is based on reducing and optimising the stock levels. The impact of high stock levels on the costs is multilateral: high working capital, cost of administration, handling and storage and the costs related to the waste of obsolete goods.

- **Reduction of administrative costs**
  Many practices in Integrating Suppliers aim to remove complexity from the relationship through the integration of processes, the elimination of double work and non-value-adding process steps. This will result in reduced administrative costs in departments involved in the supply process. Moreover, the use of efficient and reliable communication media reduces the need for manual work and the likelihood of time consuming clarifications.

- **Reduction of lead times**
  Sharing the forecast with suppliers enables them to plan in advance according to the needs of the manufacturers. Consequently this will lead to a reduction of lead times. Moreover, the use of efficient communication media and the streamlining of the whole supply process will lead to a further reduction in lead times.

- **Reduction of production costs**
  The improved transparency of the future demand enables the supplier to optimise production planning in terms of capacity utilisation. This will lead to a significant reduction of the costs for production without adding unnecessary inventories or risking stock out situations to the supply chain.

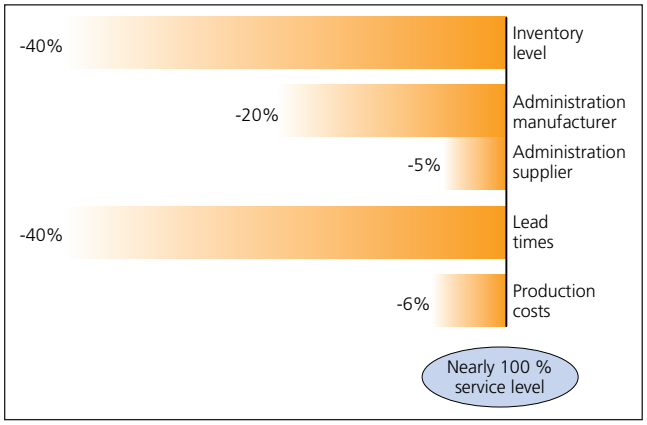
- **Improved service levels**
  The availability of the supply at the right time, at the right place and in the required quantity and quality is crucial for the success of the relationship. The study shows that in mature relationships of Integrated Suppliers the service levels will be very close to perfect!

All the benefits are closely linked together and can only be achieved to the full extent when all the key concepts of Integrated Suppliers are fully implemented in the relationship.

One objective in the study was to measure the benefits experienced through Integrated Suppliers among the case study participants. The results from the four case studies with 13 different sites involved are a sound indication of the profit impact achievable through implementing the Integrated Suppliers key concepts:

- Reduction of inventory levels of up to 40%
- Reduction of administrative costs in the involved departments of up to 20% on the manufacturer's side and of up to 5% on the supplier's side
- Reduction of lead times of up to 40%
- Reduction of production costs of up to 6%
- Service level approaching 100% in all Integrated Suppliers relationships

Case studies: potential benefits of the Integrated Suppliers concept



However, analysis of the cases showed that the highest profit impact can be achieved through implementing an efficient, reliable and transparent flow of demand information in order to optimise the following processes based on this information. The major challenge in this step of the supply chain is the planning of the production in order to lower the inventories, to reduce the production costs, and to meet exactly the downstream demand.

The impact of efficient delivery and payment is not as high as downstream, because of high volumes of supply, low numbers of daily transactions between the partners and small numbers of relationships (key supplier - key customer relationships). Nevertheless, all key concepts should be considered in order to create an efficient system.

All indicated benefits can only be achieved, when the involved parties have the willingness, the belief and the openness to change the relationship from a traditional competitive or conflict based supply-relationship to a relationship characterised by honesty and trust and the willingness to share the benefits fairly with all partners involved.

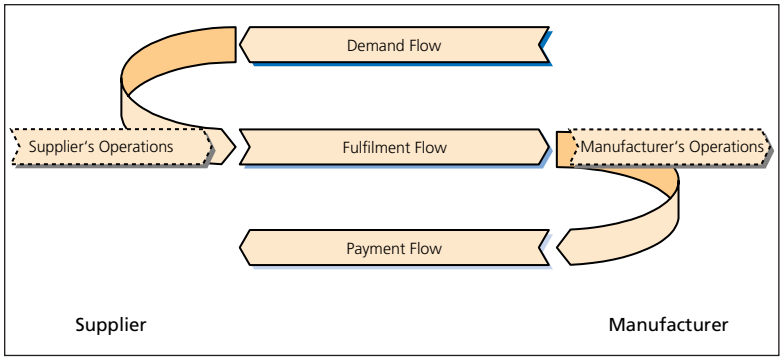
4 BASIC SUPPLY CHAIN MODEL FOR INTEGRATED SUPPLIERS

4.1 The Model – from Demand to Payment

Integrated Suppliers focuses on the upstream supply chain, the relationship between manufacturer and supplier. In establishing upstream key concepts, it was necessary to work with a generic process model that could be used to illustrate the supply chain. The model should cover the flow of information, the physical movement of products and the financial processes involved in the day-to-day relationship between supplier and manufacturer.

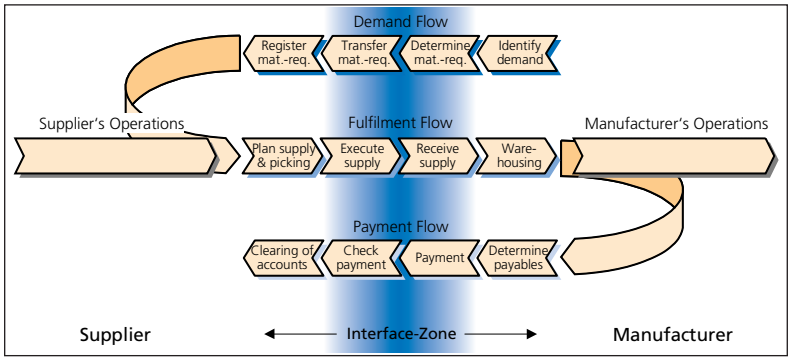
A flow-oriented generic model covering these basic processes is provided by the so called "Supply Chain S". It consists of five basic steps.

Supply Chain S model



These generic processes are applicable to every type of manufacturer-supplier relationship. For the analysis of upstream activities it is therefore an ideal starting point. For a detailed analysis of the underlying processes in the upstream supply chain further decomposition is necessary. Therefore a hierarchy of process steps and basic activities can be determined as illustrated by the example below.

Second level of the Supply Chain S model



The analysis of cases in this study was conducted using this supply chain model. The model takes a unique approach in focussing on the relationship between partners in the supply chain. In contrast, traditional process models typically start by investigating the processes within each organisation and in doing so generally neglect the importance of the interface, which is critical for the co-ordination of a supply chain.

As the model explicitly addresses the relationship, the existing interface between the partners has to be taken into account. But it is not possible to generally identify one specific interface, because of the large number of possible configurations of a relationship determines which partner will fulfil which activity. Therefore it is only possible to determine a so called "interface-zone" between the manufacturer and the supplier.

4.2 Key Concepts of Integrated Suppliers

The Integrated Suppliers study revealed six key concepts in the upstream supply chain:

Demand Communication and Management

The manufacturer identifies future demand based on actual sales and reliable demand forecasts. Future material requirements and inventory levels are regularly communicated to suppliers.

Efficient Product Change Management

All product changes are managed in a standardised, integrated and time oriented process. All responsibilities within the product change process are well defined with suppliers involved at an early stage.

Synchronised Production

The ability to integrate manufacturer demand signals into the planning and production process of the supplier.

Supplier Managed Inventory

Suppliers take responsibility for the replenishment of their products to the manufacturer. Replenishment of products is driven by the real usage rate. Responsibility for the management and ownership of the inventory may be determined between the trading partners.

Reliable and Efficient Supply

Methods and tools are in place to monitor and improve the reliability and efficiency of the supply. Supply of items is made in the right quantity, in time and without quality failures.

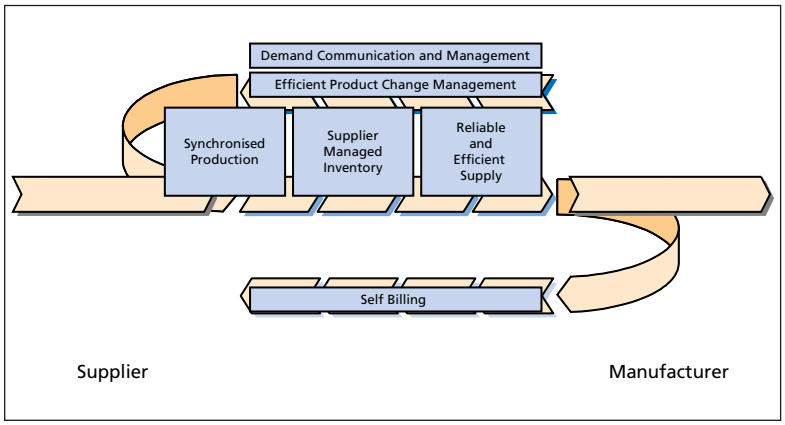
Self Billing

Settlement of payments where no invoice is issued by the selling party of the goods but the receiving party pays automatically.

4.3 Link of the Key Concepts to the Supply Chain Model

Key concepts can be linked to the supply chain model as shown in the diagram below.

Link of key concepts to the supply chain model



Demand Communication and Management can be seen as the concept that deals with providing information relevant to planning and fulfilment. It therefore provides input into the other concepts.

Typically, other concepts do not relate to a single process-step in the Supply Chain S model. Synchronised Production, Supplier Managed Inventory and Reliable and Efficient Supply are linked to the information flow of the demand planning process as well as to the corresponding physical fulfilment processes.

This booklet provides an integrated view of the upstream supply chain using a systematic process model. Each key improvement concept, as well as practical recommendations for implementation will be covered in the following analysis.

5 KEY CONCEPTS OF INTEGRATED SUPPLIERS

5.1 Demand Communication and Management

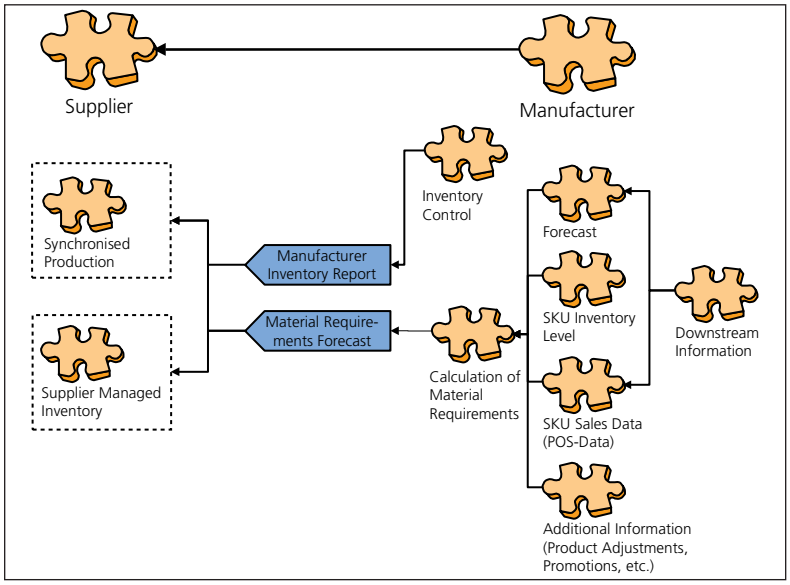
5.1.1 Definition and Basics

The manufacturer identifies future demand based on actual sales and reliable demand forecasts. Future material requirements and inventory levels are regularly communicated to suppliers.

Benefits

Demand Communication and Management is a key concept for achieving benefits in supplier integration. Long lead times in production, high set-up times, high investments in production assets and long sourcing periods characterise the upstream supply chain. The exchange of information about future demand enables the optimisation of the supplier's plans and will result in the reduction of production costs, lead-times and inventories ("information replaces inventories!").

5.1.2. Configuration and Options



The concept is primarily related to gathering, interpreting and distributing information. Information technology, therefore, is the major enabler for optimising these information processes. It enables regular (daily or weekly) forecasting on SKU-levels. These forecasts have to be transferred into material requirements for immediate communication to the suppliers. Further information about actual stock levels is required for short-term forecasting of replenishment requirements.

For implementing an efficient Demand Communication and Management system, three important issues have to be considered:

- Content of the communicated information
- Quality of the communicated information
- Time restrictions for the planning periods

Content of the information
The information that is important for the demand communication process is characterised by two dimensions: "type" and "time", which are connected to each other.

Type ⇨ ⇩ Time	Material Requirements Forecast (actual demand & forecast)	Manufacturer Inventory Report	Information about product changes
Today	✗	✗	✗
One week	✗		✗
One month	✗		✗
One month	✗		(✗)

Possible types of information are the Material Requirements Forecast including the actual demand (e.g. confirmed orders) and the short to long-term forecasts and the Manufacturer Inventory Report. The "time"-dimension of information cannot be seen separately from the type of information. It is related to the „level of uncertainty", which the user has about the information and which is a function of time. The uncertainty of different types of information restricts the usefulness of this information – it increases the further the information reaches into the future. Therefore with increasing certainty of the information the danger of planning failures decreases and excess inventories or stock-out situations become less likely.

Any changes to existing products and new products have to be communicated to the supplier with expected requirements dates and quantities. This can be achieved with different article-numbers or comparable attributes for different versions of the same product.

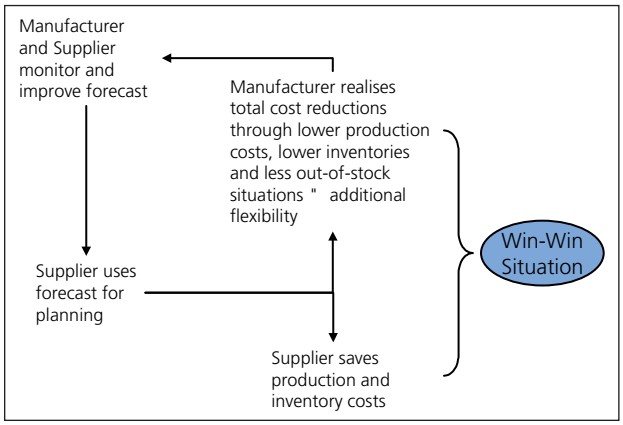
To reduce unnecessary complexity in the communication process it is important to transform the demand signals (actual and forecast) on SKU-basis on the manufacturer's side into Material Requirements Forecast. Only the aggregation of this data is communicated to the supplier as the supplier usually does not need information about each SKU for his planning-process.

Quality of the information

In addition to the content of the communicated information, the quality (in terms of reliability) of the information is important. Low quality and therefore low reliability (e.g. forecasts relying on incorrect data, inaccurate inventory levels, etc.) force the supplier to forecast by himself and neglect possibly valuable information from downstream.

One important aspect in quality assurance is the continual tracking of the performance of forecasts. By analysing the historic forecasts in order to improve the actual forecasts a "self-supporting" loop may be achieved.

Self-supporting loop of quality

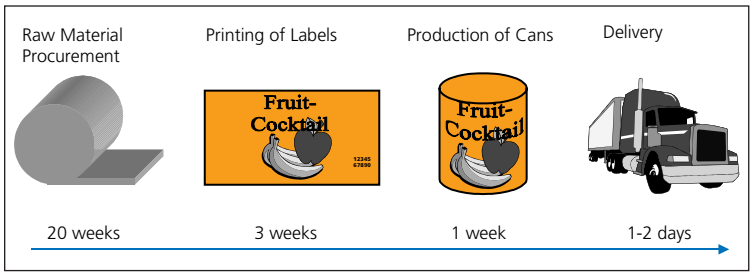


Another aspect of information quality relates to actual inventory-level-data which is essential for the key concept of Supplier Managed Inventory. It is important to ensure and improve the correctness and timeliness of the communicated inventory levels. Online access and real-time documentation of the usage and deliveries are possibilities to achieve this.

Time restrictions for the planning periods

The usual supplier's fulfilment process consists of different process steps: e.g. procurement of raw material, different production steps and delivery. These steps define the supplier's total lead-time. Different "mile-stones" in this process can be identified with related lead times. The supplier will use these "mile-stones" as restrictions for his planning of procurement, production and delivery. Demand Communication and Management has to take these planning requirements into consideration and deliver the according time horizon to the supplier.

"Mile-Stones" in the fulfilment process



For example, to enable the supplier to plan his raw-material requirements, the communicated forecast has to contain information reaching as far into the future as the lead-time for procurement of raw material. This may result in extending the forecast on the manufacturer's side. Another example may be defining a deadline for product changes to be communicated to the supplier. If this is not done the supplier cannot meet the desired delivery date because of his lead times.

Taking these "mile-stones" into account results in a reduction of inventories of the supply chain because of regularly updated demand information which over time continually converges to the actual demand, while allowing the supplier to use this information for synchronisation of his fulfilment processes.

5.1.3 Recommendations

To gain the most in the short-term from this concept it is helpful to pioneer such an extended system with key trading partners. It is best to start with suppliers who supply high volumes and who are in need of an extended planning horizon. The willingness to learn to work with the new system is another important aspect to note.
Establishing a forecast „owner" ensures one point of responsibility for all used forecasts in a company. Regular cross-functional meetings for the planning of sales and production help to understand each others business and solve problems, especially when they are not only conducted internally but also externally with suppliers.

Content – improvement

- Focus on defining the needed types of information for communication to the suppliers (forecasts, inventories, additional information on products, promotions, etc.). Approaches exist to include sales-data (POS-information) into the demand communication process upstream, but this study was not able to determine whether or not this has a considerable impact on the following processes.
- Determine necessary dimensions of time – what periods are of importance
- Take an incremental approach and begin with a defined scope of content. Improve gradually on a regular basis.

Quality – improvement

- Use statistical tools which can combine time-series, regression and qualitative techniques for forecasting.
- Forecast every SKU individually and automatically with individually optimised parameters. Add qualitative adjustments where necessary.
- Track forecast errors regularly and identify the causes – optimise parameters and methods accordingly.

Time restrictions – improvement

- Take „mile-stones" of the supplier's fulfilment process into account and define, depending on the related lead times, necessary restrictions for demand communication (e.g. content of forecast and dead-lines)

Furthermore do not try to improve the form of communication first – always start with the content and quality. Information Technology is only the enabler which optimises the communication process, but not the management process.

Do not calculate hidden security stocks into forecasts and inventory levels – it undermines the trust-based relationship, drives up costs unnecessarily and is counter productive for further optimising the supply chain.

A final advice: finance should not drive the forecasts – it tends to be too conservative and too aggregated in its' findings because of financial reasons. These forecasts are not an appropriate basis for a sound planning of production and distribution. Better let a cross-functional team of experts do the forecasting, which should consist e.g. of marketing, logistics and production experts.

5.2 Efficient Product Change Management

5.2.1 Definition and Basics

All product changes are managed in a standardised, integrated and time oriented process. All responsibilities within the product change process are well defined with suppliers involved at an early stage.

Packaging is especially subject to permanent changes, because of its important function in the communication with the consumer. These changes of established products often have a major impact on the replenishment process, as they initiate a process critical in many respects:

- Product change management is a process of business readiness. Disturbances of the process will be multiplied and reach out into the "daily" replenishment process.
- Beside the supplier and the manufacturer, various other institutions and functions, as design agencies or litho suppliers are involved in the process.
- Product changes cause a significant increase in the lead-time compared to the production of packaging with existing design because of additional and time intensive process steps.

Benefits
A standardised, integrated and fast product change management process leads to various benefits:

- Significant reduction of the lead time of product changes
- Smooth product change process flow instead of permanent and expensive fire fighting
- Sensitivity for the critical steps of the process among all participants
- Less disturbances of the "daily" replenishment process through the product change process

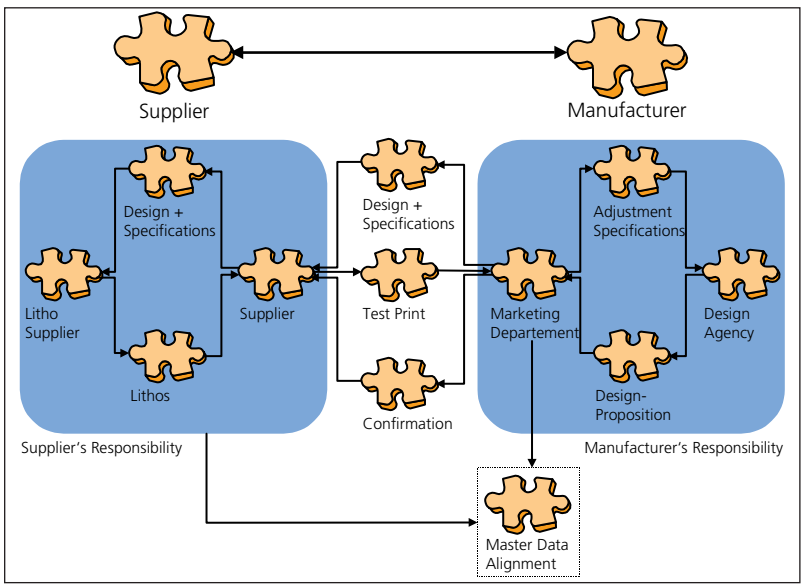
5.2.2 Configuration and Options

The Efficient Product Change Management concept provides a process that focuses on the critical aspects of product changes. It is set up as an independent process to support immediate processing of product changes. The various process steps are assigned to two areas of responsibility, defined according to the specific competence and knowledge.

Changes of specifications, for example design changes in packaging, are regularly initiated by the marketing department of the manufacturer. The manufacturer is responsible for the provision of the new design, including all specifications for further processing.

The supplier has to process these inputs and provide a first test print. The supplier is responsible for the fast and smooth realisation of the necessary activities. For the interactions between the two areas deadlines are defined which assure the participants' sensitivity for the steps of the product change process.

Efficient Product Change Management (packaging)



Areas of responsibility
In both areas an efficient organisation of the various process steps is necessary.

The reduction of participants reduces communication problems and time consuming feed-back loops. This may be done through centralisation of activities and competencies at a single product change management function or department.

Although the areas of responsibility indicate an internal integration, external partners are most likely to be involved (e.g. litho-supplier), but co-ordinated through the responsible part. The involvement and commitment of these external partners has to be assured through a trust based, long-term relationship which facilitates communication, as well as standardised means of communication for the transfer of the various intermediate products of the new design.

Intersection between the areas of responsibility
For the co-operation between the two areas the same advice applies. A trust based relationship and standardised means of communication help to improve the co-operation.

Besides this, an agreement on and commitment to the defined deadlines is crucial for the performance. They are dimensioned by the lead times of the different process steps.

To speed up the process, possibilities of parallel work should be considered and non-value-adding steps should be eliminated. This process of improvement should be supported through continuous monitoring of the process and the search for reasons of failure.

5.2.3 Recommendations

Overcome resistance
The successful introduction of the Efficient Product Change Management concept depends not only on the configuration of an efficient process. Also important is the commitment of all participants on the objective to set up and work according to the new tight process. It is likely, that some of the involved parties will resist for some reasons. Therefore it is essential to calculate and to overcome their resistance and to pay extra attention to commitment.

Master Data Alignment
Another important element is the immediate change of the specifications in the master data. Master data is the basis for all standardised communication and the alignment of the master data ensures that all users have the same knowledge and understanding about current data. In the demand communication process (see 5.1 Demand Communication and Management) the precise identification of packaging changes is essential. Therefore the communication of new article numbers, changed product descriptions and introduction dates to the master data is part of the manufacturers area of responsibility, while the supplier is responsible for the communication of all changes in his process which have an impact on the master data.

5.3 Synchronised Production

5.3.1 Definition and Basics

The ability to integrate manufacturer demand signals into the planning and production process of the supplier.

The Material Requirements Forecasts and the actual inventory levels are the information basis for the production planning of the supplier. Combined with the constraints of the supplier's production process and the level of capacity utilisation, the production will be synchronised to the demand signals in the most efficient way.

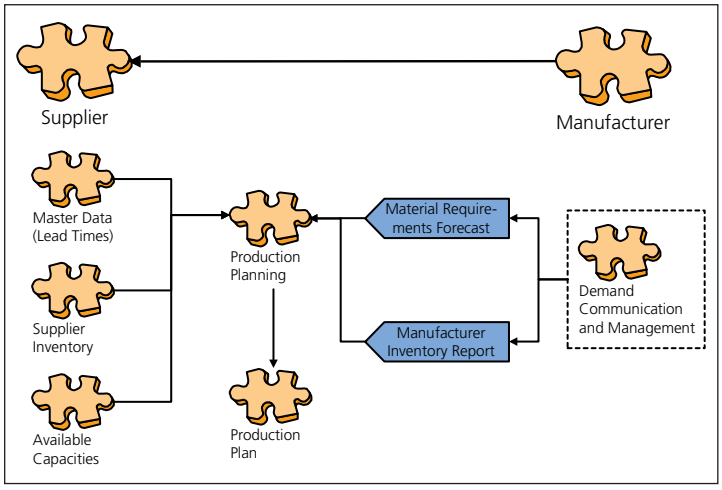
Benefits
The synchronisation of the production to the demand signals of the customers will lead to significant benefits:

- Reduction of stock levels
- Extended planning horizon supports a better capacity utilisation. Production planning can level the batch sizes between small batches close to actual demand and large batches for improved capacity utilisation.
- The far-reaching information about the future capacity requirements enables the supplier to level the production, so that ups and downs of utilisation are less likely to occur.
- Significant reduction of "very urgent orders" avoid expensive troubleshooting, such as overtime or very small batch sizes.

5.3.2 Configuration and Options

Typically, the industry in the upstream supply chain is characterised by production processes with high changeover times, high investments in fixed assets and a low degree of flexibility. Following this, a totally synchronised production to the actual demand is hardly achievable or even economically unreasonable.
There is always a trade off between small batch sizes close to the actual demand and low inventory levels, and large batch sizes, which improve the capacity utilisation due to longer production runs per change over. This situation requires a differentiated production planning that takes the specific constraints of the suppliers production process into account.

Synchronised Production

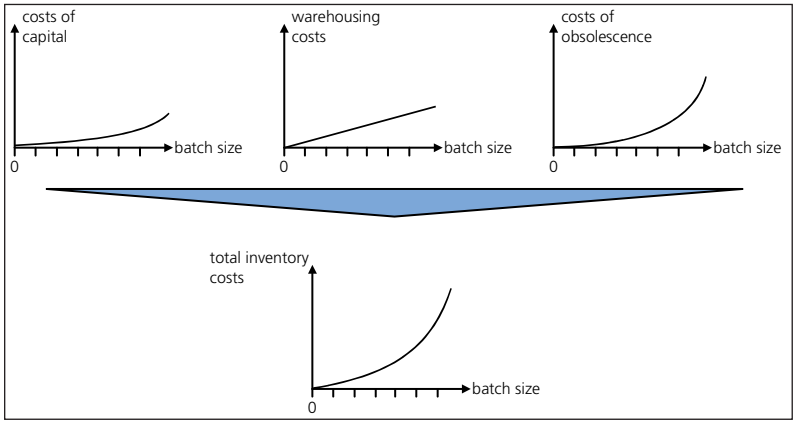


In the basic Synchronised Production model, the supplier determines the optimal production plan due to inventory costs, capacity utilisation, lead times, Material Requirements Forecasts and inventory levels.

Batch size determination
For the determination of the batch size, as one basic element of the production plan, the inventory costs of the products and the actual capacity situation has to be taken into account.

Inventory costs
The total inventory cost are all costs which are dependent on the actual stock levels. Mainly relevant in the calculation of inventory costs are three different types of costs: the costs for financing the stocks, the costs for warehousing and the costs related to obsoletes. The last type of costs is to be calculated as the value of items multiplied with the probability of obsolescence.

Inventory costs



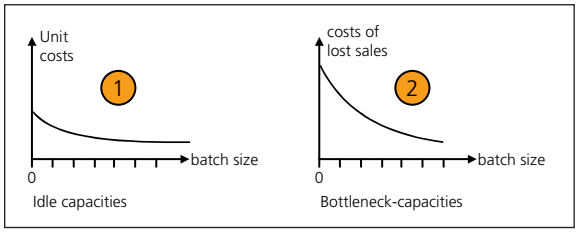
Capacity utilisation

Capacity utilisation is a key factor of efficient production for most suppliers. The conventional idea that large batches lead to low production costs has to be put into perspective of the capacity utilisation. Concerning capacity utilisation, two different basic situations should be considered:

1. Idle capacities:
Production facilities with over capacities compared to the average demand are predestined for the production of small batches, because the changeover times do not reduce valuable production time. Only fixed costs directly linked to a change over or a production lot have to be taken into account. Therefore these facilities can be operated very close to real demand.

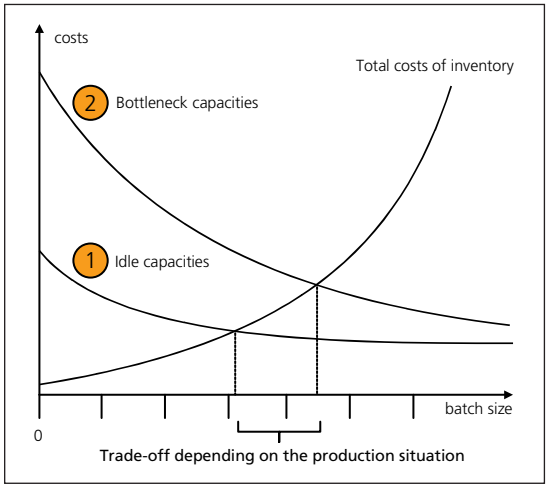
2. Bottleneck capacities:
Production facilities which can not meet the average demand are more sensitive to the batch size. Long change over times due to small batch sizes reduce real production time and therefore limit sales. In this case, all possibilities to decrease the waste of valuable production time should be used. This includes the increase of batch sizes to free up production time.

Capacity utilisation



Trade-off: by determining the optimal batch size the trade-off between total inventory costs and capacity utilisation has to be found.

Trade-off for optimal batch size



Production scheduling
Beside the determination of the batch size the other basic element of the production plan is the scheduling of the production. The start of a production run is mainly determined by the length of the production lead-time, the forecasted material requirements and the actual stock level in the relationship. Taking these three factors as well as the batch size into account the latest possible start of the production run can be determined. Additionally, there may be a time buffer for unexpected demand changes. However, the availability of production capacities might make an earlier start of the production run necessary.

5.3.3 Recommendations

In an Integrated Suppliers relationship, traditional orders will disappear. Basically, this could increase the risk of obsoletes on the suppliers side significantly, because the supplier has no guarantee of acceptance. Therefore, the introduction of "production windows" is a reasonable solution for sharing the risk. A production window gives the supplier a frame within which he has a guarantee of acceptance from the manufacturer for the forecasted requirements, e.g. the next four weeks.

The dimensions of this window should be calculated carefully. A window too large destroys the self-steering mechanism of synchronisation in the concept because then the supplier will be less likely to lower stock levels in the supply chain while a window that is too narrow will shift too much risk on to the supplier's side. The "best" production window has to be determined in the specific relationship. However, two important factors for the determination of the production window are the production lead time and the supplier's optimal batch size. It seems reasonable that the manufacturer guarantees at least the acceptance of the stocks necessary to cover the production lead time. The upper end of the production window will be determined by the optimal batch size of the supplier, especially when the supplied material is customised.

Another important issue in implementing the concept is the transfer of the total planning horizon and the additional information into the present product planning system and structure. Especially in the context of conventional ERP-Systems, the benefits can be difficult to realise (see 6.3.4 Basic Software Requirements).

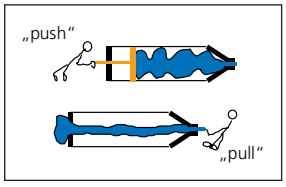
The permanent maintenance and improvement of the constraints is a further issue after implementing the concept of Synchronised Production. The lead times, the change over times, and the procedures for calculating production capacity must always be kept up-to-date. A continuous monitoring and improvement of the constraints described above should be the target. Joint projects, which are launched in regular intervals may offer a good opportunity for systematic research on further improvements.

5.4 Supplier Managed Inventory

5.4.1 Definition and Basics

Suppliers take responsibility for the replenishment of their products to the manufacturer. Replenishment of products is driven by the real usage rate. Responsibility for the management and ownership of the inventory may be determined between the trading partners.

The application of the Supplier Managed Inventory concept is a central key concept in Integrated Suppliers. The supplier manages the stock levels and decides about the quantity and time of replenishment. Because nearly all stocks in the relationship are visible for the supplier, the replenishment of the products is most likely to be driven by the real usage rate of the products and materials. Therefore, Supplier Managed Inventory is one important step to switch the supply logic from "push" to "pull".



"Push" means that the product flow is, for example, determined by orders and "pull" by actual demand on the market. Orders are more likely to include other parameters than just the usage rate. The usage rate is supposed to be linked closely to the actual demand on the market. Therefore, replenishment triggered by the usage rate rather than by orders is a move from "push" to "pull" logic.

Benefits

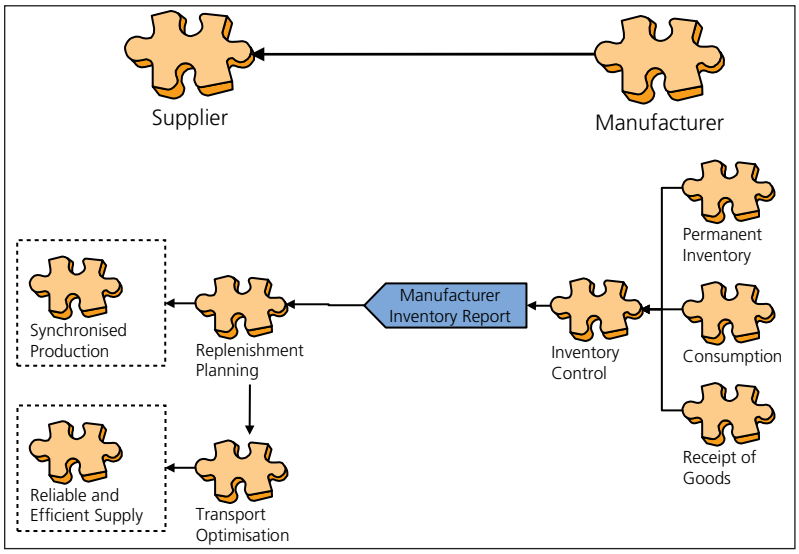
Directly related to the application of this concept are some significant benefits. The supplier can reduce the transportation costs, because he will take transportation aspects like truck fill rates into account when determining the delivery size to the manufacturer. Second, there will be a significant reduction of the stock level in the relationship, because there is only one security stock managed by the supplier.

It is most likely that the administrative costs will decrease, because the complexity of order processing and deciding on stock levels is shared.

5.4.2 Configuration and Options

In the basic Supplier Managed Inventory model the warehouse or silo is close to the production site of the manufacturer. The actual stock or silo levels are tracked in an inventory control system and communicated to the supplier on a regular basis, typically daily or weekly, for each material number. The supplier decides on time and quantity of replenishment. In addition to the agreements of both parties about necessary stock levels, optimisation of the transport will be taken into account by determining the optimal delivery size.

Supplier Managed Inventory



Owner of the stock
The basic philosophy behind Supplier Managed Inventory is the supplier's responsibility for the replenishment of the products indicated by the real usage rate of the product in the supply chain. To support sound and reasonable decision-making, as well as to reduce complexity and the need for agreements in the partnership, it seems a logical step to work with consignment stock. Then a full integration of decision making, responsibility and ownership on the supplier's side is achieved.

If the partners work with consignment stock, it is not unlikely that the manufacturer tends to push the minimum stock level up, because he does not have to finance high stock levels directly. However, one major benefit of Supplier Managed Inventory comes from a reduction of the security stocks to a minimum and not from shifting the costs of financing the stocks upstream.

For materials and products which are of strategic meaning for the manufacturer, it seems best that the manufacturer owns the incoming stock.

Although there are some reasons for working with consignment stock, it is surely not a critical success factor for implementing Supplier Managed Inventory and has to be determined in the specific partnership. However, a sound and reasonable decision making can also be achieved by setting agreed planning parameters.

Multiple supplier concepts
Traditionally, Supplier Managed Inventory concepts are realised in one product - one supplier relationships. New developments in the industry prove that it is not a major problem to work with multiple suppliers. One way is to split the total volume which has to be supplied. This quota has to be applied for the minimum and maximum stock levels, and for the usage rate when it is not feasible to identify the supplier after the storage of the goods, e.g. with raw material stored in silos. Finally, the split rate has to be applied on the future demand when communicated to the supplier.

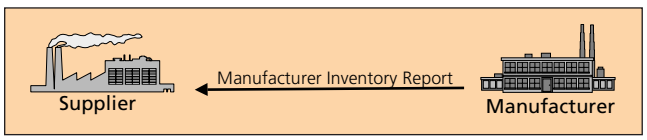
The application of multiple supplier concepts in connection with consignment stock seems only possible if the supplier can be identified after storing the products. If not, there are potential problems to claim, for example, quality problems.

Planning parameters
In the basic Supplier Managed Inventory configuration only the actual stock level is communicated. Additionally, agreements are necessary about minimum and maximum stock levels. The minimum stock level indicates quantities required to compensate for short term demand and production plan changes. The maximum stock level should consider the regular delivery cycles, the optimal transportation size and the quantity which will be surely needed and purchased by the manufacturer, especially when working with consignment stock. Last but not least, the maximum stock level is limited by the physical restrictions of the shelf or silo. However, if the difference between minimum and maximum stock level is to narrow, then the supplier has no real space for decision making about the quantity to replenish.

Both, the minimum and maximum stock levels should be reviewed and, if necessary, adjusted on a regular basis in order to take demand shifts into account. This may be done by linking the minimum and maximum stock levels to two time periods of the Material Requirements Forecast. Then the stock levels will be adjusted "automatically" to the expected demand shifts. For example: the partners agree, that the supplier ensures that the manufacturer has at least the material in his warehouse covering the material requirements of the next two weeks (=minimum stock level) and that he is allowed to stock the quantity covered by the material requirements of the next 6 weeks (=maximum stock level). However, even if minimum and maximum stock levels are linked to the forecast, it is necessary that both partners review on a regular basis the planning parameters in order to ensure the performance of the system.

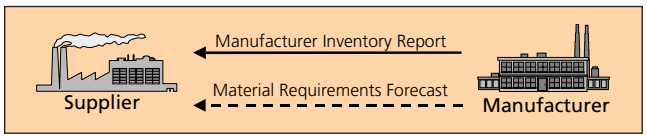
Supplier Managed Inventory information scenarios
The specific conditions in the relationship might lead to the need for further information to be exchanged. The following scenarios show the various messages which may be exchanged additionally to improve the performance of Supplier Managed Inventory.

Basic Supplier Managed Inventory scenario



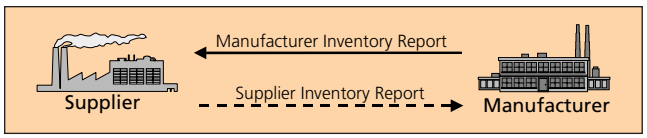
In the basic Supplier Managed Inventory scenario the manufacturer communicates only the actual stock levels to the supplier using the Manufacturer Inventory Report. The supplier requires no further information other than the actual levels as well as the agreed minimum and maximum stock levels to decide on time and quantity of replenishment. Additionally the supplier has the possibility to take the past usage rate of the manufacturer into account.

Material Requirements Forecast scenario



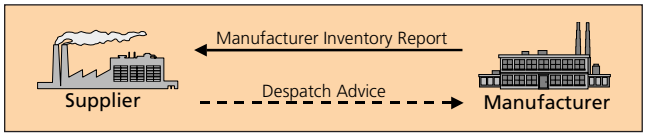
In the Material Requirements Forecast scenario beside the manufacturer's actual stock levels information about the future material requirements are communicated to the supplier. This might be necessary when the future material requirements are strongly fluctuating per item and the supplier is not able to cover these fluctuations in the short term because of long lead times. The future material requirements will be communicated to the supplier as a Material Requirements Forecast.

Supplier Inventory Report scenario



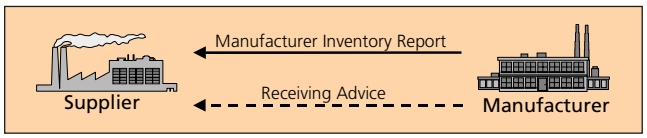
In the Supplier Inventory Report scenario the manufacturer needs to be provided with more transparency and certainty. Therefore the supplier communicates the stocks on his side of the relationship to the manufacturer, such as inventories on hand, in production or in release. If the manufacturer knows the inventories on the supplier's side, he may be able to make short term adjustments to his production plan by taking the supplier's inventories into account. Additionally, the sales or marketing department may have the need to know the stock levels on suppliers side for their planning e.g. of product changes or promotions. The inventory levels will be communicated to the manufacturer with the Supplier Inventory Report.

Stocks in Transit scenario



In the Stocks in Transit scenario the supplier communicates the actual stocks in transit to the manufacturer. The knowledge of the stocks in transit will enable the manufacturer to make short term adjustments to his production plan. The need for this information increases with the delivery time. Additionally, the warehouse may plan the receiving up front and base the receiving process on the communicated information. Usually, the stocks in transit will be communicated to the manufacturer by sending the Despatch Advice.

Last Receipt scenario



In the Last Receipt scenario the manufacturer communicates the last delivery received on his side to the supplier. With this information, the supplier knows which deliveries arrived on the manufacturer's side and are already included in the communicated stock levels.

The need for this information increases with a short transportation time and a high frequency of deliveries. This information is communicated by exchanging the Receiving Advice.

Combined information

All the additional information exceeding the Manufacturer Inventory Report may be combined in any possible way and thus allows a detailed configuration of the Supplier Managed Inventory concept to the specific situation.

5.4.3 Recommendations

One major issue in implementing Supplier Managed Inventory is to get accurate inventory information and to set the planning parameters, like minimum or maximum stock levels. However this shouldn't be a specific issue of Supplier Managed Inventory, it is merely the very first step of starting to work with it. In many cases, the task to get accurate data is underestimated.

An important decision concerning the configuration is which information has to be shared with the partner apart from the stock level. Which information is needed depends, as mentioned before, on lead and transportation times, on the regular planning cycles of the partners, the product and the probability of demand or production changes. However, there is no single best information set, the information that the partners need to properly manage the inventories within the framework of the relationship has to be determined individually.

When starting to work with Supplier Managed Inventory, it is best if the supplier develops a suggestion about the delivery size based on the information obtained from the manufacturer. The suggestion should be shared and discussed with the manufacturer in order to find out, whether the manufacturer shares the decision or if there is a significant difference in planning. It is very important that both partners have the willingness to learn and work with the new system and that both understand the decision making process of the other party.

5.5 Reliable and Efficient Supply

5.5.1 Definition and Basics

Methods and tools are in place to monitor and improve the reliability and efficiency of the supply. Supply of items is made in the right quantity, in time and without quality failures.

The concept of Reliable and Efficient Supply focuses on the process steps starting at the end of the supplier's production line and finishing with the physical availability of the supplied goods at the production line of the manufacturer. Efficiency and reliability of the basic operations in warehousing and transport are regarded as baseline in supply.

According to the philosophy of "total cost of ownership", Reliable and Efficient Supply highlights specific aspects within this stage of the supply chain. The conventional approach of lowest cost within acceptable service levels is expanded to totally reliable service levels, i.e. achieving supply which is on-time, in full and without errors, by sharing information and joint performance measuring. Efficiency is not only regarded as an issue of the single transaction or of the single partner of the relationship, but as an issue of the process in total - supported by both partners.

Benefits
Early and quasi real-time sharing of supply information as well as permanent monitoring and measuring of the performance leads to increased transparency, consistency and thus reliability and efficiency of the supply process.

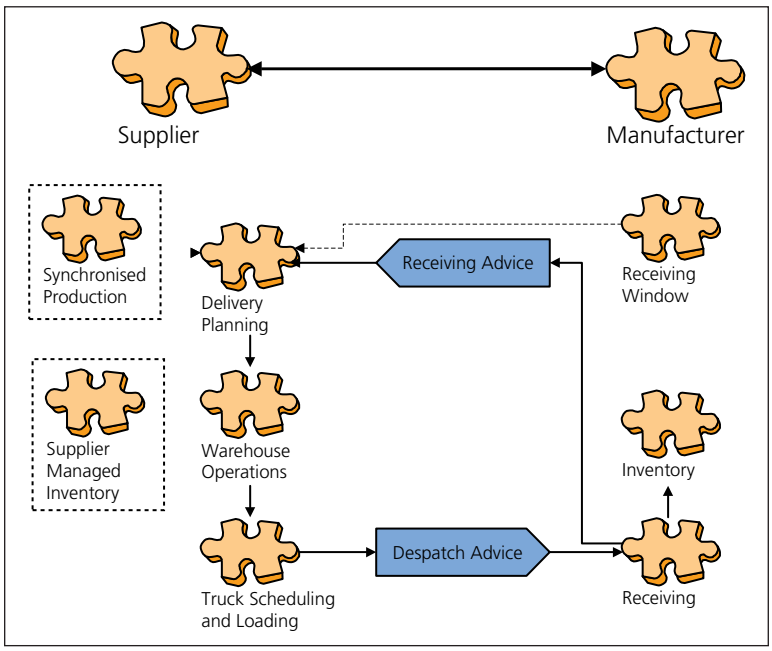
- Reduction of lead times
- Reduced necessity of security stocks and therefore lower inventory levels
- Avoidance of expensive and ineffective troubleshooting
- Lower administrative effort
- Lower transportation costs

Finally the reliability in supply is a necessity to gain the benefits of other concepts like supplier managed inventory.

5.5.2 Configuration and Options

Structure of the supply network
In comparison to the downstream process from manufacturers to retailers the upstream processes from suppliers to manufacturers typically differ heavily regarding number of stops, volumes and frequency of the shipments. On tendency, there are less sources and less destinations involved as the Integrated Suppliers concept includes the basic idea of working with key suppliers. Volumes per shipment are relatively higher and the frequency of shipments is lower than in the downstream process. Therefore concepts like cross-docking do not have the same potential as downstream. Nevertheless, there exist tendencies to

Reliable and Efficient Supply



more Just-in-Time supply and smaller delivery units. Ideas like bundling and pooling of suppliers or cross docking should at least be kept in mind for transport optimisation.

Location of the warehouses
Traditionally both supplier and manufacturer run a warehouse for manufacturer's supply. Concepts like Synchronised Production and Demand Communication and Management may support ambitions to concentrate supply in just one inventory. The more distant warehouse and manufacturer's operations are, the more important is the reliability of the supply and thus sharing of information on the supply process.

Ideally there would be „one" warehouse close to the consumption point of the manufacturer allowing to call off smaller quantities in higher frequency - and faster when time is critical - without counteracting transport efficiency. The supplier may replenish the warehouse by "storing away" its production in a kind of "shuttle traffic" with a tendency towards full truckloads.

Carrier of shipping and warehousing
Transport can be fulfilled by a company owned fleet either of the supplier or the manufacturer, or alternatively by a forwarder or logistics service provider. Owned company trucks raise the problem of return load and supplier backhauling.

Outsourcing of transportation to a forwarding company will eliminate the need for optimising the return load. Additionally, the forwarding company regularly bundles shipments less than truckload in their transshipment point networks.

It may be an option to integrate the Logistic Service Providers as a third party not only for transport, but as well for warehousing and, if feasible, bundling different suppliers and manufacturers in the warehouse operations. This would be especially beneficial for supplies where efficient truck loads are regularly not feasible. However, working with a Logistics Service Provider adds one more player to the chain who has to be integrated to ensure reliability of the process.

Receiving and quality controls
The actual receiving at the location should be organised with receiving windows to allow planning and better utilisation of personnel and equipment at the receiver and reducing waiting time of the shipper. The windows should be applied and agreed by all parties involved, and also changes should be communicated as early as possible.

By using certified suppliers double quality controls are avoided. The quality control should be as early as possible in the supply process in order to avoid trouble shooting later in the process, as well as further processing of low quality items. Therefore quality controls should be done on the supplier side at the end of the production line. In an Integrated Supplier relationship the manufacturer may need absolute reliance of the quality of the supplied products.

5.5.3 Recommendations

Communication
When there is a high number of daily supplies or the need for more transparency of the stocks in transit, the suppliers should transmit the Despatch Advice as soon as the vehicles are loaded to the receiving location. This will enable the receiver to plan personnel and equipment in front and to schedule the incoming deliveries. Automatic integration of the Despatch Advice in the receiver's ERP system reduces significantly manual work as well as the probability of failures. When receiving, incoming supply can be scanned and matched with the Despatch Advice online.

In order to reduce the need for clarification on discrepancies with the trading partners, a confirmation of the goods received should be generated by the system. Confirmation should be transmitted as Receiving Advice to the supplier. In case of discrepancies, an agreed exception routine for troubleshooting should be triggered immediately. Reception status should be automatically entered into the system of the supplier to keep the status of the records up to date.

Object identification
Identification of the objects throughout the chain is vital for efficient tracking and tracing as well as for efficient operations. The more parties involved the more standardisation is necessary. Common accepted logistics labels may be applied to avoid double entry, manual entry and thus avoiding work and time delays, and equipment for producing new labels not creating additional value. Common standards give the opportunity for efficient tracking and tracing, thus providing higher transparency throughout the supply chain and support performance measuring as well as the clearance of liability disputes.

Agreement on performance measures
The agreement on a few accepted Key Performance Indicators to monitor the performance of supply continuously is the base for early warning of disturbances in the supply system. Both sides should communicate the performance in an open manner and work collaboratively and continuously on improving performance.

5.6 Self Billing

5.6.1 Definition and Basics

Settlement of payments where no invoice is issued by the selling party of the goods but the receiving party pays automatically.

Benefits
A major benefit of Self Billing is the elimination of superfluous communication flows between the partners. Self Billing enables a reduction in paper work or, in an electronic based communication process, a reduction of messages by adapting those which are still necessary to the economic process. Thus, the benefits are savings in administrative work as well as in communication costs like post and paper costs or the costs for electronic messages.

Second, the invoice will be issued relatively late in the fulfilment process. The benefit here is, that the data needed to determine the payment amount is more likely to be correct. For example: in a traditional payment process the invoice is issued by the supplier based on the order or delivery note. However, at this process step, it is not certain if the supply will arrive in full and the expected quality on the recipient's side. This increases the probability of disputes in connection with the necessary correction of data and documents or messages. With self-billing, the assembly of the payable information will be based directly on the result of the logistical process e.g. the stock-receipt control. When the partners work with Supplier Managed Inventory, Self Billing will make it more easy or even possible to work with consignment stock.

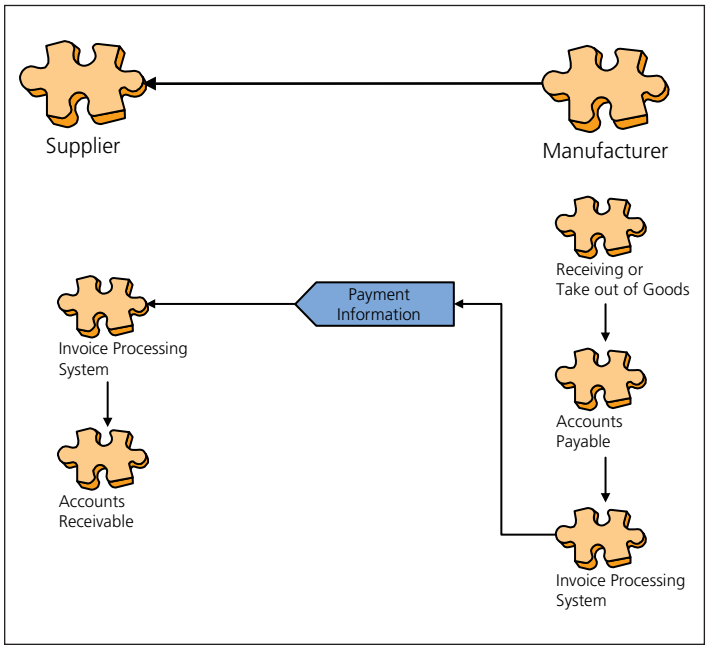
Comparison of traditional invoicing system with Self Billing *(S= Supplier, M= Manufacturer)*

	Traditional		**Self Billing**		
Process steps	S	M	*S*	*M*	**Benefits of Self Billing**
Issue delivery note	■		■		
Check delivery note against physical delivery		■		■	Because the assembling of the Payment Information is based directly on the physical check of the delivery, invoice differences will be less likely
Assemble payables information	■			■	
Issue invoice or document with the payment information	■			■	
Check payables against order and/or delivery documents		■			Eliminated
Issue payment		■		■	
Check payables against order and/or delivery documents	■		■		
Resolve disputes	■	■			-Less likely (see above) / -Less reminders and reconciliation

The final benefit of Self Billing is that it is more likely that the payment will be done faster and on time, because the likelihood of time consuming clarification steps decreases significantly. Therefore, the supplier's financial planning will be improved. The majority of supply is paid for on time, only arbitrages will be delayed due to later clarification steps.

5.6.2 Configuration and Options

Self Billing



Best basis for payment
In principle there are three major process steps which can trigger the payment process:

- Receipt of the goods at the manufacturer's site or warehouse,
- Take out of material from the warehouse for production,
- Sales by the manufacturer.

The last seems least suitable in the industry, because the goods will be further-processed by the manufacturer. Therefore it would be "unreasonable" to pay the supplier according to the sales of the manufacturer. Thus it seems best to base the payment on the quantity received at the warehouse or taken out for production, especially when working with consignment stock.

Information of the supplier
The supplier has to be informed by the manufacturer about the consistency of the payment. When the payment is based on receiving, the manufacturer has to inform the supplier about the deliveries covered by the payment and therefore about the differences to suppliers delivery notes such as unaccepted goods, if there are any. Normally this would be done by an "invoice" from the manufacturer to the supplier which is based on the booking of the receipt of goods.

In the second case, when the payment is based on taking out the goods for production, the manufacturer has to inform the supplier about materials, quantities and dates. The resource for this information will be the booking of the goods taken out.

In a traditional invoicing system, both partners have to agree on the payment terms such as cycles, currencies, prices and discounts. However, in a Self Billing environment the responsibility of applying the payment terms is shifted mainly to the manufacturer. Therefore, it is critical to the success of the system that both partners can trust in each other's system and, especially regarding prices and discounts, that these are clearly defined between the partners and always transparent for both.

Tax and legal issues
In principle, Self Billing is currently allowed in all Member States of the European Union by law or administrative practice, but the different national conditions surrounding it sometimes make transactions necessary, e.g. the necessity to add an invoice to the delivery, which have not pure economic reasons.

However, to discuss all the requirements and legal aspects in the different countries is not appropriate in this booklet. But there are two major practices in order to apply the principles of Self Billing and to fulfil the legal aspects. Which of the both is applicable in a specific country can only be answered through the national tax and government institutions:

First, in the majority of the Member States it is not necessary that the seller sends an invoice to the buyer. It is allowed that the buyer sends a document or message to the seller which has all the "normal" invoicing information. The common requirements on the invoice are date of issue, identification number, identity of seller and buyer, date of supply of goods or completion of service, description of goods or services, and VAT amount and rate. Additionally, the buyer will add the number of the delivery note to support the seller in the allocation of the invoice. This document can be an evaluated and converted Receiving Advice of the buyer.

Second, only in a few countries the seller must inform the buyer about the acceptance of the invoice. This can be done in two ways:

- The seller signs or certifies the document and informs the buyer about the certification.
- The seller converts the Self Billing document of the buyer directly into an invoice which will be sent again to the other party.

Moreover, in cross border supply the seller has to enclose a commercial invoice and the corresponding customs papers for the delivery as previously for customs processing. Then, a copy of the delivery note is added with the necessary invoicing information which becomes in fact an invoice from the seller to the buyer.

Finally, in some nations it would be necessary that there is a written agreement between the partners up front about the application and set up of the Self Billing process.

Without doubt, every additional transaction compared with the basic configuration might reduce the benefit regarding the reduction of transactions between the partners.

5.6.3 Recommendations

As mentioned above, there is no best practice about which logistical process the invoicing or payment process should be based on. This depends on the specific relationship, such as consignment stock. However, first of all, the technical requirements have to be built. The booking of the goods received (or taken out) has to be assessed with the financial data and to be converted into a booking in the accounts payable. Based on this booking a document or message has to be generated which includes all the necessary payment information of a "normal" invoice.

To identify the best partners for starting with self-billing, three major principles have to be considered:

- Willingness of both partners to work with the new system
- High potential for benefits (e.g. high number of paper invoices)
- Stability and transparency of prices and conditions

At the beginning, the financial process and the booking on the accounts has to be monitored very closely by both partners.

5.7 Key Learnings

Demand Communication and Management	■ The content and the quality of the information is more important than the form of communication. ■ Knowledge about the partner's processes on both sides is significant, because it determines the necessary content and quality of the information exchanged. ■ Regular communication of all agreed upon information, as well as regular updating and improving of the information, is the basis for the optimisation of the physical fulfilment processes.
Efficient Product Change Management	■ Define responsibilities between supplier and manufacturer for specific process steps of the product change process and control the process through using definite dead-lines for both partners. ■ Ensure commitment by all participants on the tight new process but expect resistance.
Synchronised Production	■ Permanent monitoring and improvement of the planning parameters is essential for synchronising the production to the demand signals. ■ Ensure the utilisation of the wider planning horizon and the additionally available information for production planning. ■ Harmonisation of the economical risks between the partners is important to ensure involvement of both parties.
Supplier Managed Inventory	■ Don't overlook data integrity. Assuring accurate data is the very first step of sharing information. ■ Consider and provide the necessary information and planning parameters to the trading partner which he requires to manage stock and to plan his processes, and review them regularly. ■ Ownership of inventory has to be determined between the trading partners.
Reliable and Efficient Supply	■ Reliability and efficiency in supply is not only regarded as an issue of the single transaction or of the single partner of the relationship, but as an issue of the process in total to be supported by both partners. ■ Basic considerations for the actual configuration of a supply network are the structure (number of sources, destinations and shipments), the location of the warehouses and the decision about responsibilities for handling of shipments and warehousing-operations. ■ Improving the reliability and efficiency of supply involves certifying suppliers, communicating delivery information in advance and communicating the receiving information back to the supplier. The physical flow is connected to the information flow through the use of standardised identification techniques.
Self Billing	■ Self Billing should be based on goods received from the supplier or on goods taken out from the warehouse for production. Which process fits best depends on the partnership. ■ Consider the legal and tax restrictions of Self Billing. The best source for specific requirements are the national tax and government institutions. ■ The responsibility of determining the correct payment amount is shifted to the manufacturer. Therefore, it is critical that prices and discounts are clearly defined between the partners and always known by the manufacturer.

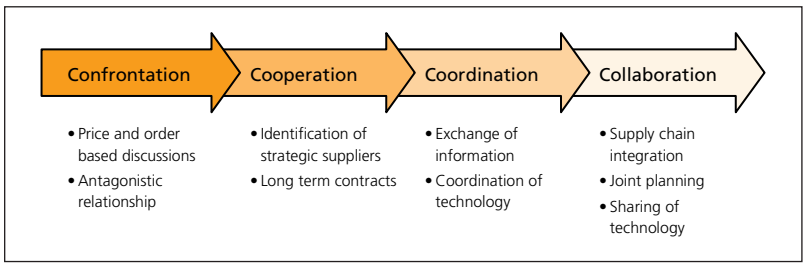
6 SUPPORTING CONCEPTS OF INTEGRATED SUPPLIERS

6.1 Trust Based Relationship

The various concepts of Integrated Suppliers have one basic principle in common: sharing information to excel in supply chain planning and execution, and usage of efficient technology to support the daily process of information sharing. But both are only feasible with humans providing the needed information and companies willing to implement and use reliable and efficient technology.

In many relationships the weakest part is not the lack of information or technology, but it is the lack of trust between the human beings that control the flow of goods and information. However, to excel in an Integrated Supplier relationship, the parties have to move from confrontation based on mistrust, to collaboration distinguished by trust between the partners.

4C-stages of partnership



Accordingly, the establishment of trust in the company and between the trading partners is essential to succeed in supply chain management and integration. All those involved, from the senior executives to the people on the operational level, have to trust their business partners. Of course, trust can not be implemented like a technology, but it can be supported through the corporate mission, the focussing on processes instead of functions, the corporate culture, and the daily behaviour of the people involved.

Corporate mission
If there is no corporate mission that clearly focuses on the integration and improvement of the supply chain, then the people involved do not know where to go and it is likely that the "individual missions" will differ from each other. That will lead to mistrust. Therefore every company should have one clearly defined and easy to understand mission focused on serving the customer and integrating the suppliers to work towards the mission. The mission has to be communicated frequently within the company and to the partners in the supply chain. All have to understand and know the joint goal of all daily actions.

Focussing on processes not on functions
Reshaping the processes according to the flow of information and goods through the company and the supply chain is essential for integration. This makes it necessary to think and work cross-functionally. In many organisations functions are still more powerful than the processes. This discrepancy will lead to mistrust and hinder supply chain integration. For example: at least the purchasing department and replenishment planning operations are likely to be responsible for the daily supply flow. It is not unusual, that the performance of procurement will be measured by the price and that replenishment planning is measured by the achieved inventory levels. Because these two performance measures are in conflict, mistrust will occur.

Building cross-functional teams responsible for the flow of goods and information in the supply chain will reduce the likelihood of conflict and mistrust. Accordingly, the goals have to be linked to the processes and not to the functions.

Moreover, all projects focused on improving the processes in the company and between the trading partners have to be staffed cross-functionally, and in some cases with people from external partners in the supply chain (e.g. transport providers). Then the achieved improvements are more likely to be best for the supply chain and not sub-optimal driven by functional goals.

Corporate culture
The shape of the internal culture in a company will be mirrored directly to the external relationships. When the culture is characterised through political games, egotism, no willingness to share information and a low degree of honesty, then trust will never flourish. In a culture, where information is easily accessible for all involved people, political game-playing will become more difficult. An open and collaborative culture has to be established in the whole organisation from top management to the people on the operational level, across all functions and processes.

Daily behaviour
Last but not least, creating trust within a company and between companies, comes down to the people managing the processes and dealing with information. Again, trust can not be implemented like a technology, but building trust starts with the daily behaviour of the people involved. Although building trust in the daily business is a complex issue, thinking of some basic rules will help to build trust:

- Say what you mean and mean what you say!
- Say what you plan and do what you have said!
- Make your decisions transparent to all people involved!
- Stick to your decisions!
- Do not hesitate to reverse wrong decisions, but explain why!

6.2 Master Data Alignment

The importance of communication in the Integrated Suppliers concept is the reason for the importance of Master Data Alignment as a key function for a successful realisation of information sharing. The impact of Master Data Alignment will increase through the use of advanced communication technologies as described in the next chapter.

If analysed, many of the problems that arise in the everyday communication can be attributed to the failure to properly align data.

Tasks of Master Data Alignment in the Integrated Suppliers concept.
The activities of Master Data Alignment in the Integrated Suppliers concept differ slightly from those known from the manufacturer-retailer relationship. Instead of a standardised product that is supplied to the retailers, the goods in the supplier-manufacturer relationship have a higher degree of specification. Very often in this part of the supply chain one product is made for one manufacturer and therefore a one-to-one alignment of the master data has to be achieved. Even in multiple supplier concepts there are less parties to be considered for the alignment of the master data compared to the complexity of manufacturer-retailer relationships.

In the Integrated Suppliers concept a special task is the alignment of data changed during the Efficient Product Change Management process. Therefore information about changed product identifications (including article number and product description) has to be communicated from the manufacturer to the supplier and information about data changed by the supplier (e.g. logistical specifications) has to be communicated into the opposite direction.

Master Data Alignment techniques
When changes to master data have to be communicated users have to choose one of two ways to achieve this. The first possibility is to communicate the full set of data related to the product (i.e. both changed and unchanged data) whereas in the second possibility only changed data is communicated. The choice as to which method is applicable will depend on agreements between the trading partners.

Depending on the business relationship, different variations of these possibilities may apply: a technique suitable for multilateral relationships, or as an advanced technique for several parallel bilateral relationships, is the central data pool. Central data pools provide a platform where master data can be stored. The source of the data is responsible for recording the details of its products in the central pool, while the users can access data in the pool, and if necessary, use it as the basis to update their own local data bases. To date, central data pools have only been established for manufacturer-retailer relationships.

Another technique that might also be suitable is the bilateral communication of master data. This involves the direct transfer of data from the data source to the data user.

Master Data Alignment Information
Due to the varying structures of databases, both techniques require the definition of standardised messages for the transfer of the Master Data Alignment Information. Depending on the chosen way of Master Data Alignment the message either contains the full set of data represented in the product database, the price database or any other database which was subject to changes or it only contains the set of changed data.

For details on the standards for Master Data Alignment see 6.3.2 Standardised Messages.

6.3 Technology

6.3.1 Standardised Means of Communication

Standardised means of communication describes the alignment of the technical communication resources between trading partners and defines the first dimension of a standardised communication. This is an essential enabler for efficient communication in the Integrated Suppliers concept and provides the basis for standardised messages and standardised identifications as further dimensions.

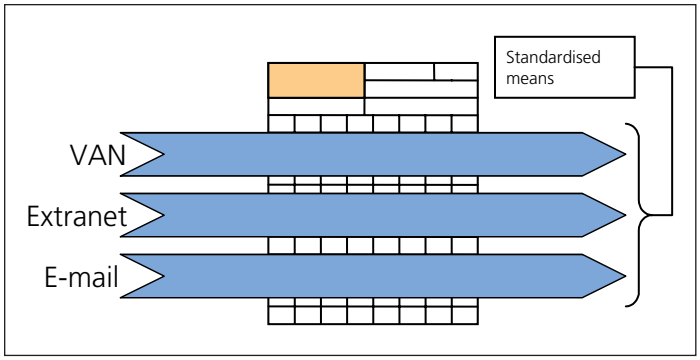
For example: a standardised means defines whether to send the message via e-mail or fax.

The impact of standardised means of communication on the efficiency of the communication process is directly related to the number of partners involved in this process. The more partners actually or potentially involved in the communication network, the greater the need for standardisation of the means of communication is.

Benefits

- Significant reduction in the effort required to handle multiple non-compatible means
- Enabler for automatic processing
- Faster and easier integration of new partners into the communication network

Standardised means of communication



Alternative Means of Communication

EDI
EDI or Electronic Data Interchange can be conceptualised as paperless trading.
A common and useful definition for EDI is:

"the transfer of structured data, by agreed message standards, from one computer application to another by electronic means and with a minimum of human intervention."

EDI provides trading partners with an efficient business tool for the automatic transmission of commercial data from one computer application directly to another. Through the use of EDI message standards like EANCOM® (see 6.3.2 Standardised Messages) data may be communicated quickly, efficiently and accurately.

EDI messages can be exchanged using a number of different communications media: Value Added Networks (VANs), bilateral connections, etc. The method chosen will depend on the level of security required, the volume of data to be exchanged, and the number of trading partners with which data will be exchanged.

EDI, when operated properly, is considered to be **application to application** in scope, which means that source applications can automatically generate the data, and receiving applications can understand the meaning of the data without human intervention.
A typical EDI solution is set up between trading partners exchanging high volumes of data in a relationship with a long estimated durability. The investments in the EDI solution are profitable due to the high benefits of the total automation on both sides.

Extranet
Extranet applications are applications that use the Internet for a limited group of users, usually for the exchange of information that is private and not to be accessed by everyone. Extranets use the public Internet as its transmission system, but limit the access by passwords or channelling techniques.

Extranet applications allow the secure exchange of information between manufacturers and suppliers using Internet technology. The connection to the internal system is usually catered for by copying the required information from the host application into the extranet according to defined routines and access to the information on request.

Extranets are considered to be **application to human** in scope, which means that while the source applications can generate the data automatically without direct human involvement, a human is required to process the messages at the receiving end. Currently no standardised applications exist to read these messages automatically.

A typical extranet solution integrates small and medium sized suppliers. In this situation the high investments of a fully automated EDI solution can not be justified on the supplier's side.

E-mail

E-mail is the transmission of messages over a communication network. For transmissions between a manufacturer and a supplier the Internet may be used as a network. No predefined structure exists for the message itself. E-mails can include data files (e.g. business documents, pictures, etc.) as attachments. The privacy of the data communicated by e-mail is more difficult to secure than with the other means.

E-mail is normally considered to be **human to human** in scope. This means that humans are required to create the messages at the source and to read and understand the messages at the point of receipt. Currently no standardised technology exists to generate and read E-mail messages automatically.

E-mail is typically used for the exchange of unstructured information during the implementation of Integrated Supplier concepts.

Fax

Fax is the communication of printed pages via telecommunication systems between remote locations. It is not suitable for the automated processing of electronic information from the supplier to the manufacturer. It is mentioned here only as an easy to realise means of communication during the introduction of the Integrated Suppliers concept and will not be included into the further descriptions.

Choosing the right Means of Communication

Although the described means of communication are in general suitable for all basic communications in the Integrated Suppliers concept, they vary in their applicability based on criteria which consider the needs of the situation and the characteristics of the means.

Choosing the right means of communication

When in your situation ...		EDI Extranet E-Mail	
... the implementation resources are ...	High		Low
... the frequency of the communication ...	High		Low
... the need for unstructured communication is ...	Low		High
... security is ...	Important		Not important
... the estimated durability of the relationship is ...	Long		Short
... the data volume is ...	High		Low
... the degree of standardisation of data is ...	High		Low
... the need for diffusion to support flexible access is..	Low		High

The best means of communication for a certain situation is thus determined by a high fit between the needs of the situation and the characteristics of the means.

6.3.2 Standardised Messages

Standardised messages as a second dimension of standardised communication describe the standardisation of the syntax, i.e. the structure of trading messages in the communication process.

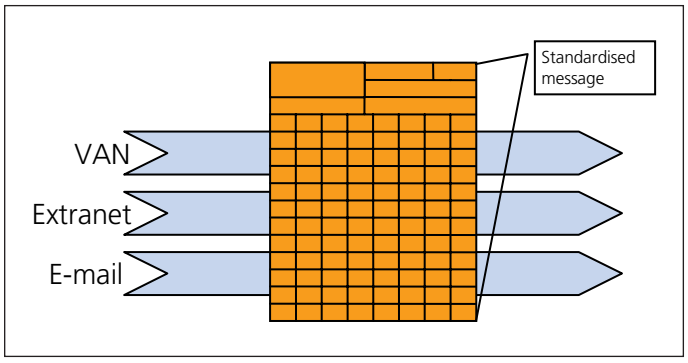
For example: in a standardised message the supplier and manufacturer identification are defined in certain fields of the message structure.

The benefits of standardised messages are related to the number of partners involved in the communication process. The more partners are actually or potentially involved in the communication network, the greater is the need for standardisation of the communication process and the syntax of the messages.

Benefits

- Precise, uniform, well documented syntax of the messages for all partners
- Improved efficiency due to less "translation" of multiple standards
- Enabler for automatic processing

Standardised messages



Integrated Suppliers messages

The **Material Requirements Forecast** is communicated from the manufacturer to the supplier in order to inform the supplier about future material requirements.

The level of detail varies along the time scale (e.g. a daily forecast for the next two weeks, a weekly forecast from then on). The maximum time horizon is determined by the described 'mile-stones' of the supplier's fulfilment process (see 5.1 Demand Communication and Management). The data is taken from the Material Requirements Planning System.

Overview *Material Requirements* Forecast data:

- Location identification
- Article number
- Forecasted quantities (in short-terms per day, in long-terms per week)
- Date / Period when required (per quantity)

The **Manufacturer Inventory Report** is communicated from the manufacturer to the supplier to inform the supplier about the actual stock levels at the manufacturer's site. The differentiation of the quantity per item enables the supplier to analyse the structure of the stocks, e.g. the actual security stocks. The input for the *Manufacturer Inventory Report* is generated by the manufacturer's warehousing system.

Overview *Manufacturer Inventory Report* data:

- Location identification
- Date of report
- Article number
- Quantities (e.g. on hand, actual accepted minimum and maximum levels, actual security stocks)

The **Supplier Inventory Report** is communicated from the supplier to the manufacturer to inform the manufacturer about the stocks available at the supplier's site. This information offers additional security to the manufacturer and allows the checking of material availability for short-term changes in planning. The differentiation of the quantity per item enables the supplier to describe the availability structure of the stocks, e.g. the quantities on hand separated from the quantities still waiting for release.

Overview *Supplier Inventory Report* data:

- Location identification
- Date of report
- Article number
- Quantities (e.g. on hand, in production, waiting for release, in transit)

The **Despatch Advice** is communicated from the supplier to the manufacturer to inform the manufacturer about incoming deliveries. Therefore only one message per shipment unit (truck) is sent. The input for the *Despatch Advice* is generated by the supplier's distribution system.

Overview *Despatch Advice* data:

- Shipment unit identification
- Sending and receiving location identification
- Shipping and estimated delivery date and time
- Included article numbers
- Included quantities per article number

The **Receiving Advice** is communicated from the manufacturer to the supplier as the responding message to the *Despatch Advice.* It is only sent to confirm the reception of the delivery. A standardisation of the communication of discrepancies is not recommended, because permanent discrepancies require research on the source of the problem instead of an efficient processing of the problem itself. The input for the *Receiving Advice* is generated by the manufacturer's receiving system.

Overview *Receiving Advice* data:

- Shipment unit identification
- Receiving date and time

The **Payment Information** is communicated from the manufacturer to the supplier to provide the supplier with the information required for checking the manufacturer's payment. Depending on agreements, the received / consumed quantities of a certain period are the basis for the payment. Therefore the input for the *Payment Information* is generated by the manufacturer's warehousing system. Tax and legal aspects also have to be considered for the selection of additional information.

Overview *Payment Information* data:

- Identity of supplier and manufacturer
- Date of issue
- Identification of payment related dates (date of supply / period of consumption)

For legal issues the following data might be needed:

- Identification and description of goods
- Quantity
- Price
- Tax qualifier
- VAT rate and amount

The **Master Data Alignment Information** is communicated from the data source to the data user to align the master data. Input for the message is provided by the Efficient Product Change Management Process or any other process causing changes in product identification, logistical specification, price information or any other commonly used data. When communicating changes to master data the users can choose one of two ways of achieving this: communicate the full set of data related to the product again (i.e. both changed and unchanged data), or communicate only the changed data. The choice as to which method fits best will depend on agreements between the trading partners.

Suitable EANCOM® messages

EANCOM® is the EAN International produced subset of the UN/EDIFACT standard. EANCOM® supports the maximum set of information required to facilitate the trade, distribution, and finance processes which can be reduced by the trading partners to the set of data required to support their processes. The following table provides a short description of suitable EANCOM® messages and links them to the described messages in the Integrated Suppliers concept.

Integrated Suppliers messages	Suitable EANCOM® message	Description
Material Requirements Forecast	DELFOR	The DELFOR message is sent by a buyer to a supplier to give short term delivery instructions and / or to provide medium and long term product forecasts for planning purposes.
Manufacturer Inventory Report	INVRPT	The INVRPT message enables a buyer and supplier to exchange information related to held and planned or targeted inventories, including opening stock, actual stock, in-transit stock and goods movements
Supplier Inventory Report		
Despatch Advice	DESADV	The DESADV is a message advising a consignee of the detailed contents of a consignment which will be or has been despatched.
Receiving Advice	RECADV	The RECADV message is sent by the recipient of goods to the consignor to communicate business needs related to the receipt of goods as the confirmation of the receipt of goods.
Payment Information	REMADV	The REMADV provides detailed accounting information between buyer and supplier relative to a payment.
	INVOIC	The INVOIC message may be sent by a buyer to the supplier providing information about the payment made. Compared to the REMADV message the INVOIC message allows to include additional information required for the respective legal issues
Master Data Alignment Information	PRICAT	The PRICAT message is used to exchange master data information, including descriptive, logistical and financial information.

6.3.3 Standardised Identification

A third dimension of standardised communication, standardised identification complements the benefits of standardised means of communication and standardised messages. It describes the standardisation of the identification of objects (e.g. materials, services, ingredients, shipping units, etc.) and parties (e.g. supplier and manufacturer).

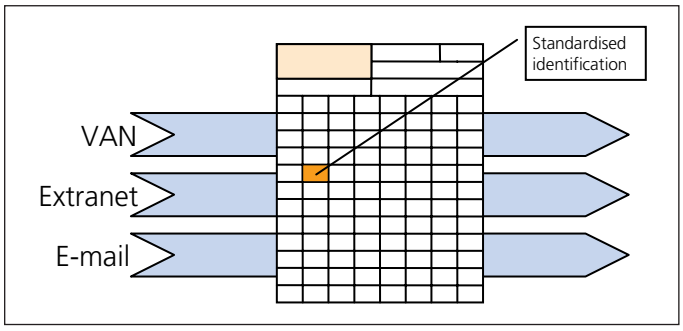
For example: a standardised identification assigns a single article number to a product. This number is known and accepted by all partners handling the product through the supply chain.

The greater the number of partners in the supply chain moving from proprietary identification systems to standardised ones, the greater the benefits for the upstream market as a whole.

Benefits

- Elimination of costly cross reference mapping tables between private and proprietary identification systems
- Significant reduction of communication about references

Standardised identification



Item identification – the EAN Global Trade Item Number

The objective of standardised item identification is to assign a unique identification to every good or product in the supply chain. Benefits are the possibility to identify every item anywhere in the supply chain by every party handling it, using a unique identification, which makes internal reference systems obsolete.

EAN International has developed the Global Trade Item Number, which guarantees this unique identification. Compared to the popular retail item numbering system, the Global Trade Item Number is specified for

the identification needs of trade items, which are items intended not to be sold to the end consumer. It is thus also applicable for the numbering of raw and packaging material.

More details on item identification can be obtained from EAN International.

Party identification – the EAN•UCC Global Location Number
A unique identification may not only identify the sender and receiver of electronic messages, it is also applicable for the identification of any legal, functional or physical location within a business or organisation, which facilitates the control of goods and information flows through the supply chain.

EAN International provides the EAN•UCC Global Location Numbers for this purpose. This numbering standard can also be used for the routing of the EANCOM® messages and can also be used for the identification of consignor and consignee on the EAN•UCC Logistics Label.

More details on party identification can be obtained from EAN International.

Logistics labelling – the EAN•UCC Logistics Label and Serial Shipping Container Code
A standardised unique form of logistics labels provides clear and concise information about the logistics unit, its contents, the sender, the receiver and the transport itself. By accompanying the physical flow the label enables every supply chain participant to identify the unit without extensive registration work or extra communication. It thus provides the basis for the efficient tracking and tracing of logistics units throughout the supply chain as well as for more efficient operations in warehousing, transportation and receiving.

EAN International provides the EAN•UCC Logistics Label which defines a unique form of all the information mentioned above. The existing EAN location numbering standard is combined with the Serial Shipping Container Code (SSCC) for the unambiguous identification of the respective logistics unit through the various steps of the logistical distribution.

More details on logistics labelling can be obtained from EAN International.

Identification bar coding – the UCC/EAN-128 symbology
Standardised messages enable a fast information flow through the supply chain by eliminating manual data entry efforts through the automated entry of the information into the respective systems. The physical flow needs a data capture process, which eliminates manual efforts in a similar way and supports the linking of the information flow and the physical flow in an efficient way across all supply chain partners.

Bar coding technology helps to fulfil this need. The EAN identification systems described above are represented in a barcode symbology which enables fast and reliable data capture with scanners. This efficient linking between the physical flow and the information flow has seen the barcode standards implemented in numerous applications with great success at all stages of the supply chain.

EAN International provides various bar coding standards. The UCC/EAN-128 symbology is one of the most complete, compact and reliable alphanumeric one-dimensional symbologies available today.

More details on identification bar coding can be obtained from EAN International.

6.3.4 Basic Software Requirements

Integrated Suppliers is a concept for streamlining the supply chain and improving management of material deliveries and production by sharing information. The previous chapters cover the concepts and techniques for communicating and exchanging the corresponding messages between the partners.

In order to provide and process the information contained within these messages some basic requirements for the software may be defined. These new requirements can be separated into two elements: The first element deals with the requirements on the source of the information, which has to provide correct and precise data reflecting the actual situation of all sides in the communication process.

More transparency, through the use of actual information can only yield a positive impact on time and profit when partners show the ability to translate the enhanced information into better plans and finally into action. The second element therefore deals with the functionality of the planning software and the need for a transfer of these planning procedures into operational support for the execution of the key concepts of Integrated Suppliers.

Integrated business process data
Intensive communication of data related to the various Integrated Supplier key concepts requires the availability and use of precise and up-to-date data. To ensure the same status of data for all included communication partners, real time processing or a

defined rhythm for processing transactions is necessary. The more parties involved, and the higher the frequency of communication, the greater the necessity to use real time processing.

These requirements usually are met by conventional Enterprise Resource Planning (ERP) systems, which have grown out of a variety of products such as single plant Material Requirement Planning (MRP) systems and financial systems. They are built upon an enterprise-wide data base to avoid redundancies where possible. By interpreting enterprise-wide activities referring to one event as a transaction, ERP systems have become enterprise-wide tools which capture data and reduce the manual activities and tasks associated with processing financial, inventory and customer order information. Their modular structure allows the ERP systems to be customised to the specific needs of the respective enterprise.

While meeting the requirements for integrated business process data, ERP systems show heavy drawbacks concerning their planning functionality. Usually they offer hierarchical planning routines based on the logic of batch processing and conventional MRP and MRP II concepts. Usually the planning routines are time consuming and generally run only once a day or even only once a week. Restrictions are considered only by using average values but not the actual values of the constraints (e.g. available capacities). Furthermore capacities are only taken into account in the last steps of the hierarchical planning sequence. Trade-offs and fine tuning for example between material and capacity planning are hardly achievable. This results in the fact that an ERP plan does not necessarily need to be feasible. While ERP systems meet the requirements of transactional systems as information sources, they are not sufficient to meet supply chain management requirements regarding planning functionality.

Advanced planning procedures

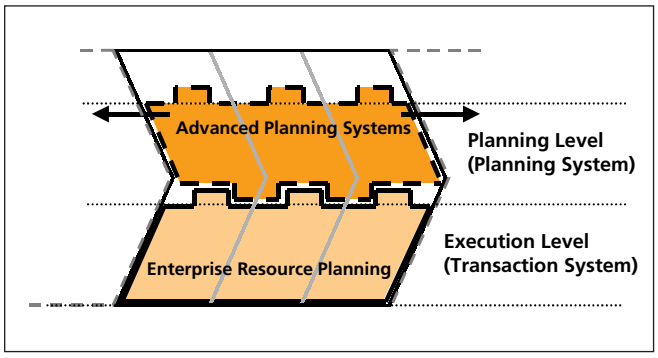
To fill the gap in planning functionality Advanced Planning Systems (APS) are offered by specialised vendors and more recently by leading ERP system vendors. APS are characterised by the following general properties:

- Typically APS are built on top of existing databases or, if available, ERP systems to retrieve data necessary for planning. They allow fast planning and what-if analysis separated from the real transaction system on the execution level. Only approved plans are rewritten into the transaction system (i.e. ERP system) where they change the relevant data at once.

The ability to integrate APS into different existing databases, legacy systems or ERP systems is a basic quality indicator of APS.

- Best of breed APS work with fast modern computer technology and solver algorithms that incorporate real world constraints as well as business goals. "Concurrent planning" allows for quasi simultaneous consideration and trade-offs between different restrictions like material availability and capacity.

APS on top of the execution system



- Real-time simulation, what-if analysis and the capability to update plans permanently provide decision support to the planner to generate feasible plans.

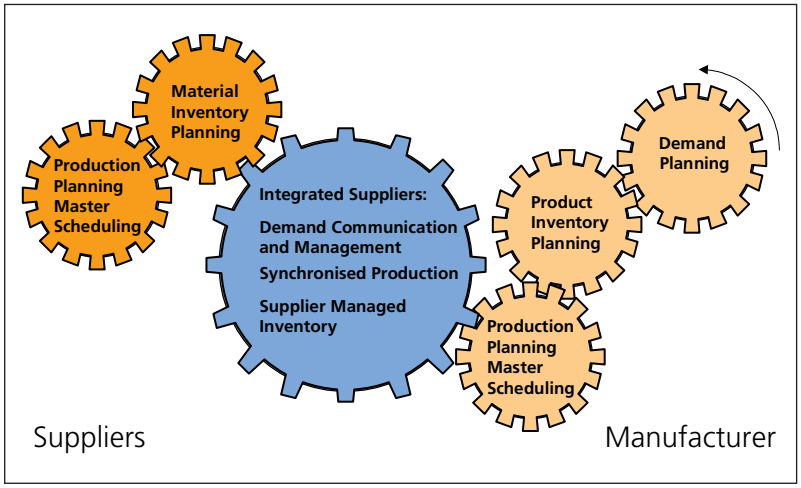
- APS suites are usually made up of different stand-alone modules that allow step by step implementation. Typical modules are Manufacturing Planning and Production Scheduling, Transportation Planning and Shipment Scheduling, Distribution Planning, Inventory Planning, Demand Planning, Sales & Operations Planning as well as additional functions like Availability-to-Promise and Supplier Managed Inventory Support which are discussed in more detail below.

Advanced planning for Integrated Suppliers
In the context of an Integrated Suppliers relationship, the extended impact of planning activities should be particularly considered for the concepts of Demand Communication and Management, Synchronised Production and Supplier Managed Inventory.

Instead of the traditional way of placing orders, which disguises the nature of the original demand, these concepts include the idea of manufacturer and supplier working together on managing supply which is streamlined to meet demand. Key to the success is the accuracy of the supporting planning data - particularly demand forecasts and inventory levels. Support of Demand Management and Communication by an adequate planning system can be seen as a basic software requirement. The planning parameters related to and affected by the Integrated Suppliers concepts are:

Key concept	Planning parameter
Demand Communication	■ Forecast ■ SKU inventory level ■ SKU sales-data ■ Additional information on product ■ adjustments, promotions, etc.
Synchronised Production	■ Material Requirements Forecast ■ Manufacturer Inventory Report ■ Supplier inventory ■ Production planning parameters
Supplier Managed Inventory	■ Manufacturer Inventory Report ■ Minimum / maximum inventory

In the Integrated Suppliers concept demand has to be translated into material requirements while streamlining the supply chain also means levelling "nervous" demand fluctuation by fine-tuning forecasts, inventory levels and production plans of both parties in the relationship.



Demand planning tools should assist management in understanding key drivers of demand and they should use historical data to forecast future demand patterns statistically. Sophisticated forecasting tools use multiple forecasting algorithms and simulation, multiple time horizons and aggregations, and the incorporation of promotional demand. They offer a configurable level of detail (per item, group, customer). Another important issue is the opportunity to graphically represent demand data to support decisions of planners and to communicate forecasts more efficiently. Other value offerings of demand-planning tools, although not basic requirements, include product lifecycle modelling, exception-based performance indicator tracking, reporting and management, and tracking and reconciliation of multiple internal forecasts (marketing, financial, annual etc.). Best-of-breed tools allow to integrate external forecasts (such as from customers, suppliers, industry) into their calculations.

While usually **Inventory Planning** and **Production Planning** will remain under the direction of each individual party (and therefore are not further detailed in this report) there is a need to build interfaces to the transaction systems for taking inventory levels and manufacturing restrictions of both parties into account where necessary. Most of the leading APS address this issue. In addition some APS vendors offer the opportunity to integrate external enterprises on a large scale into ones own planning system.

On a lower scale, fine-tuning of partners may also be supported by the Availability-To-Promise (ATP) or Capability-To-Promise (CTP) functionality offered by the leading APS tools. ATP allows to check availability of stocked material while CTP also allows for taking manufacturing restrictions into account. Due to the design of modern APS the information can be gathered real-time within a few minutes or even seconds. Some vendors offer solutions even integrating suppliers into their CTP function.

The basic task for **Supplier Managed Inventory** tools in the Integrated Suppliers concept is to support the supplier in gaining and communicating all relevant data. The supplier should be enabled to control the stock levels of his customers and to calculate optimised replenishment dates and volumes.

Therefore these tools have to fulfil detailed requirements which can be divided into requirements of manufacturer and supplier software.

Specific requirements for manufacturer's information-system:

- Accurate and up to date data on the manufacturer's inventory levels is the basic information needed. Therefore an interface to the manufacturer's inventory management system is needed, which allows access to the current inventory levels (see above).
- The manufacturer's future material requirements provide additional benefits to the supplier. This information requires a link to the demand planning and production planning modules of the manufacturer which provide a forecast of the material requirements based on production plans and demand forecasts (see above).
- For the realisation of multiple supplier concepts the Supplier Managed Inventory module has to be able to consider necessary splits of the supplied material among the suppliers.

- As further requirements the selected data has to be processed first into an appropriate message format (see 6.3.2 Standardised Messages) before it is sent through a communication interface to the supplier.

Specific requirements for supplier's information-system:

- The Supplier Managed Inventory module used at the supplier needs to have an interface for receiving the incoming messages. After reception the messages have to be transferred into an appropriate structure for the further processing in the supplier's system.

- The received Manufacturer Inventory Reports and Material Requirements Forecasts are used for maintaining a database of the inventory levels of the manufacturer. This task either has to be fulfilled by the Supplier Managed Inventory module itself or is solved by a link to an inventory management system which maintains the mentioned database.

- The replenishment planning should also include the generation of replenishment proposals, the consideration of multiple-manufacturer locations and their specific delivery windows. Further requirements are the ability to group products needed by the same customer as well as automatic replenishment signals or alarms which support the supplier in the task of managing the inventory levels of the customer.

General requirements for a Supplier Managed Inventory module which apply both for the supplier and the manufacturer are user-configurability, simple adaptation to existing systems and a standardised process for setting up new suppliers / customers.

INTEGRATED SUPPLIERS CASE STUDIES

7.1 Case Study 1

The objective of the case was to find out which information the manufacturer should provide in the demand communication process and which benefits the supplier could gain out of this information.

Manufacturer
The manufacturer is a multinational group with sales of about 9 billion Euro providing mainly consumer goods. The case study covers four manufacturing sites producing confectionery and coffee. All are responsible for a specific product range divided into about 250 to 750 SKUs and which produce a volume between 35,000 and 45,000 tons per year.

The objective of the manufacturing sites inside the group is to deliver high quality products at low costs and to fulfil perfectly the needs of the market, represented by the distribution units of the company. Therefore, one critical success requirement is to reach high production volumes and to react quickly to any demand changes downstream. The core competencies can be described as high production know-how and the ability to control and manage the inbound and outbound processes. Accordingly, the ability to manage an efficient and lean flow of the supplies into the own production processes is crucial for success. Therefore logistical know-how and a tight integration of the suppliers are essential!

In recognition of this, the group's head office developed a replenishment concept that contains certain practices for the configuration of the supply process. This concept was implemented in the four sites, although with some variances, but all essentials of the concepts were implemented. So far, only two production sites have completely implemented the concepts with all packaging suppliers.
The four sites are all customers of the same key supplier for packaging, which represents the supply side in this case study.

Supplier
The supplier is an international enterprise in the packaging market. In the case study one manufacturing site of the group was visited. It has sales of 200 Mio. Euro and about 900 employees and is one of the largest sites inside the group

The site specialises in flexible consumer packaging, which is characterised by detailed consumer specifications, a large number of variants for each product type and continuous product changes. The complete product range of this site includes about 12,000 items.

The production of this packaging is – as is the entire packaging industry - characterised by high investments in fixed assets and relatively high start-up times. Therefore capacity utilisation is one of the core success factors for the supplier. This is very difficult when the requirements of the consumer good supply chain for the flexibility and service level are taken into account.

Relationship
The relationships between the different manufacturing sites have existed for ten years. In 1998 the manufacturer's internal replenishment concept was introduced. It is based on long term contracts for the key suppliers of the manufacturer. These contracts primarily fix the prices for the various supplied goods.

The replenishment process itself is set up as a Supplier Managed Inventory and focuses specifically on the high information level for the supplier in order to solve his extended responsibilities.

Therefore the manufacturing sites have to transfer their downstream future demands directly into the material requirements on the supply side. This information is communicated using an appropriate structure together with the actual material stock levels to the supplier. The supplier has to take the highest possible benefit for his

operations out of this information. Depending on the supplied products, the manufacturer "guarantees" the supplier that he will buy the forecasted material requirements for a fixed period, which is called the "production window".

Creation of the Material Requirements Forecast
All the manufacturing sites are connected to an internal demand communication and planning system. This is updated once per week by the distribution units with the latest sales forecasts for the next 5 months. The manufacturing sites process this information in their own production planning systems into their production plans. One output of the system is the forecast of the material requirements based on the production schedules.

The material requirements forecast is communicated weekly to the supplier, structured by the supplier's need. There is a daily forecast for the next three weeks and a weekly forecast for the rest of the period. The actual inventory levels at the manufacturer's sites are important additional information for the supplier. They are communicated together with the material requirements forecast on a weekly basis.

Based on this information and the agreements on future time periods for planning, the supplier is able to optimise the replenishment of the material in the relationship and in his own production planning.

Integration of the Material Requirements Forecast
The received information is the basis for the supplier's production and delivery planning. The Supplier Managed Inventory concept makes it necessary to make arrangements about the quantities to deliver and to produce. For this reason a production and a delivery window are set up. The delivery window allows the supplier to deliver the required materials for a certain amount of days to the warehouses close to the manufacturer's production sites (the exact amount depends on the warehouse structure in the special relationship). The production window gives an acceptance guarantee for next month's required material, which means that the supplier has a high security for the production of this material.

Both windows are based on the material requirements forecast. Therefore, all demand changes in time and / or quantity are automatically represented in the volumes derived from the planning windows.

Benefits
- Reduction of inventory levels up to 25% in the relationship
- Reduction of manufacturers administrative costs up to 20%
- Reduction of suppliers production costs up to 6%
- Stock-out situations are nearly eliminated

Lessons learned
The higher information level results in various benefits for both partners:

- Predictable customer needs allow a significant reduction of stock levels
- Production window gives the supplier the security for a minimum batch size.
- Far-reaching information about the customer's future material requirements enables the supplier to manage the small batches necessary close to demand time and large batches to improve the capacity utilisation. Moreover, it is more likely to reduce capacity peaks and troughs in advance.
- The two sites which have completely implemented the concepts now experience the full range of benefits.

7.2 Case Study 2

The objective of this case was to find out how the communication process in Integrated Suppliers could be organised by using the Internet as a communication medium.

Manufacturer
The manufacturer is a global and highly diversified corporation working mainly in the chemical sector. Overall, the corporation generates over 10 billion Euro sales with over 10,000 products, in more than 300 companies, in over 70 countries.

The case study was conducted in the headquarters of a national subsidiary in Southern Europe. The subsidiary is responsible for approximately 6% of the total sales of the group. Among other things, the national headquarters is responsible for the procurement and replenishment of five plants in the country. The main product lines manufactured in the plants are products for personal care and home care, like toothpaste or detergents. Additionally, the headquarters has an own IT-department that is responsible for all issues of electronic data processing in the subsidiary.

Supplier
The supplier is, with nearly 50 million Euro sales, a middle-sized company producing aluminium and laminated tubes. The production site for laminated tubes is over 2,000 kilometres away from the supplied plants in Southern Europe.

As typical in the packaging industry, tube production is characterised by high investments in fixed assets, relatively high costs for raw material and high requirements in quality and hygiene. Like most suppliers of packaging material in the industry, the supplier has to be able to react quickly to shifts in demand and products.

Relationship
January 1999 was the first contact. The manufacturer was looking for a new tube supplier because they were not quite satisfied with their former supplier of tubes. The reasons for this were minor reliability with deliveries and inability of the supplier to react to demand changes in the required time.

The first delivery of the new supplier was at the end of the first quarter and it was planned to supply the manufacturer – after a short period – with around 30 different tube-types, delivered on a weekly base in full truck loads to the plant. By the end of the period, the new customer would count for a significant part of the sales of the supplier.

The relationship is mainly based on personal contact between the employees of the parties involved. The only written document is a 3 year contract specifying total volumes and prices. This was necessary for the supplier, because he had to make high investments in fixed assets to supply the new customer.

From the very beginning of the supply process, communication of demand was exclusively based on the "extranet based supply web" of the manufacturer.

Development of the extranet
Facing the steadily increasing complexity of the own supply chain as well as the increasing competitive pressure, the manufacturer started in the mid '90s to develop and implement Integrated Supplier techniques like Supplier Managed Inventory or Self Billing. The major goals were to increase service levels, to shorten lead times and to reduce costs. At the beginning, the communication was based on fax, e-mail, paper or even phone calls. The first benefits of applying the Integrated Supplier techniques were achieved quickly. It was quite clear from the first day that both partners would benefit. However, there were still problems with the communication, such as data redundancies, time gaps and missing data.

A team of IT and purchasing personal decided that Internet communication could increase the efficiency and quality of the communication significantly. The use of the Internet was even considered for the co-operation and communication between small and medium-sized companies, because the application of traditional EDI-connections seemed sometimes inappropriate. Besides the Internet, the manufacturer plans also to use traditional EDI connections for communication with high volume suppliers.

Extranet based supply web
In 1997 the implementation of SAP R3 allowed the manufacturer to develop an extranet application for the communication of the necessary data to the suppliers. First of all, it was necessary to ensure the quality and timeliness of the data like inventory levels, forecasts or production schedules in the ERP system. The required data are copied in the Internet and every change in the ERP system is placed automatically into the Internet application. The supplier gets mainly four types of information:

- Actual inventory level
- Material requirements forecast
- Last delivery
- Past consumption

The supplier can choose, if the data should be listed on a daily, weekly or even monthly cut.

Supplier integrates the Internet
First, the partners agreed on future time periods, during which the supplier is allowed to purchase material, produce printed foils (the half product of laminated tubes), produce tubes and to deliver to the manufacturer accordingly to the forecasted quantities. All the information needed to plan quantities and schedules are sent to the supplier from the manufacturer's inventory level and production forecast via Internet. At the beginning of the relationship, the data were transferred manually into the supplier's ERP system. After a couple of months, the supplier decided to transfer them electronically on a regular basis. To do so, the IT department of the supplier wrote an application to transfer the information from the Internet automatically into the own ERP system. Three days were needed for the development of the software.

Benefits
The trading partners experience significant benefits from the application of the Integrated Supplier concept through the Internet use. Compared to "traditional" relationships with other comparable customers or suppliers, the benefits are:

- Up to 40% lower inventory levels
- Up to 10% reduction of administrative costs
- Up to 40% reduction in lead times
- Significant reduction of production costs
- Stock out situations nearly eliminated

Lessons learned
The use of the Internet for communication has some significant benefits compared to "traditional" means like fax, phone or email:

- Support of real time transactions
- Easy to implement and to use
- Relatively low restrictions on content and range of information
- Easily accessible: From nearly "every PC with a browser all over the world"
- The recipient of the information can decide when he wants to "pull" it

In particular the integration of small and medium sized companies will be supported by the use of the Internet for communication. Therefore it is obviously a good addition to the use of EDI.

7.3 Case Study 3

The objective of the case was to investigate how the flow of information and material in a Supplier Managed Inventory concept could be organised.

Manufacturer
The manufacturer is a global enterprise providing non-food consumer goods in the chemical sector. The case study examined a particular subsidiary which provides decorative coatings.

The plant examined produces a large variety of paint products. The majority of these are filled into printed cans. Compared to plain cans with paper or plastic wraps the printed cans convey a higher level of quality to the consumer. One batch of paint is filled into various types of cans. Depending on the latest information from the distribution centres, the decision about which cans to fill is made. The on-time delivery of the cans is a critical process in paint production, due to the limited storage time of the prepared paint.

Supplier
The supplier is an international enterprise in the metal packaging industry. The printed cans are provided through the business unit "Decorative Paints and Finishes". The production of these cans is split between different production sites of the group. These sites are responsible for the various steps in the production process (steel coils, printed steel plates, printed cans). The case study focuses on the last production step, the production of completed cans from pre-printed steel plates.

The typical specifics of the packaging industry, such as high investments in fixed assets, the impact of the batch size on the efficiency of the production, as well as the necessity for fast reaction on demand signals, are also characteristic of can production.

Relationship
The relationship has a long history: for 50 years the cans for the paint production have been supplied from the same supplier site. The distance between both plants is about 30 km. At the moment this site supplies 70% of the required printed cans.

At the beginning of the relationship, there was a traditional supply process. Orders were exchanged on the basis of yearly or half yearly contracts. The orders were usually fulfilled from stock. This configuration resulted in high inventories of cans on the supplier's side and long lead times for cans made to order.

To improve this situation an ECR project was set-up in 1997 focussing on improving the material and the information flow. The core concepts applied were "information sharing", "supplier managed inventory" and "consignment stock".

Information sharing concept
The information basis for the new process was long-term material requirements forecast based on the downstream demand signals, a short-term material requirements forecast based on the production plan, and a manufacturer's inventory report.

The long-term forecast is used by the supplier to plan his own production. Instead of defined security stocks, a maximum usage figure is used that represents the upper limit of the future demand. The supplier has to be able to fulfil this demand. The short-term forecast, in combination with the manufacturer inventory report, is used for the delivery planning in the supplier managed inventory concept.

Supplier Managed Inventory concept
The agreement is that according to the production plan of the manufacturer the number of cans required for the next 24 hours should be delivered to the manufacturer plant. The supplier calculates the necessary delivery quantity for every item as shown below:

Required cans for next 24 hours
- Manufacturer stock level
- Stocks in transit
+ Safety stocks

Quantity to deliver

The calculated quantity can still be adapted to an efficient delivery size.

Consignment stock
The delivered cans are stored as consignment stock at the manufacturer's warehouse until further processing. The delivery data is entered manually into the manufacturer's system in advance of the delivery and is checked when the delivery arrives. The consumption of the stored cans through the manufacturer is recorded in the manufacturer's system and is visible for the can supplier in the manufacturer's inventory report. This consumption is the basis for the invoicing, which is done monthly by the supplier.

Benefits
Through the implementation of Supplier Managed Inventory the partners experienced the following benefits:

- Up to 40% reduction of stocks

- A significant reduction of administrative effort on both sides
- Up to 25% reduction of lead times
- Out of stock situations nearly eliminated

Lessons learned
The Supplier Managed Inventory concept together with the consignment stock concept showed several benefits for the relationship:

- Visibility, responsibility and ownership of all inventories inside the relationship as a basis for a real reduction of stock levels instead of a simple shifting of stocks from the manufacturer to the supplier.
- Ability to take efficient delivery sizes and consolidation of different items per delivery into account.
- An important step in implementing Supplier Managed Inventory concepts is to overcome possible initial resistance against the shifted responsibilities for the inventories and their replenishment.

7.4 Case Study 4

This case study concerned a manufacturer of corrugated products with one paper supplier. The objective was to find out if the challenges and issues in Integrated Suppliers were the same further upstream the supply chain.

Manufacturer
The manufacturer is one of the global players in the packaging industry. Also the manufacturer covers nearly all paper products made of wood; the production of corrugated board is the main business sector with more than one third of total sales. The company operates nearly 40 plants in Europe.

The case study was conducted in one national subsidiary of the group. The national subsidiary is responsible for five corrugated plants. At more than 50%, the bulk of the production from these plants is packaging for specific products of the consumer goods industry like food or drinks. As typical for this industry, the printing of the cases or trays are for specific variants of a product and can only be used for "one" product or even one promotional action. Accordingly, most of the customers operate "just in time" which requires a very short delivery lead time for the corrugated products.

In order to handle the demand fluctuations and the service requirements, the policy of the manufacturer is to order from the suppliers and to offer to the customers an "OTIF" (on time in full) service. Nearly every product is made-to-order and shipped almost immediately in full truck loads to the customers. The profitability and competitiveness of the business depends highly on keeping stock levels to a minimum while, at the same time, ensuring that the right materials are available at the right time.

Supplier
On the supply side, the case was conducted with one paper mill and the main products are fluting and liner for corrugated paper. The mill produces around 150,000 tons of paper yearly and has more than 100 employees.

Paper production is comparable with the production of other semi-fabricates, such as steel production, often using a continuous flow of production. The mill is "one big machine", producing paper 51.5 weeks a year, 7 days a week and 24 hours a day. The competitive pressure is high in the industry and it is relatively easy to change the supplier of paper because the product is highly standardised. The competitive pressure on the paper mill is even higher because many customers have their "own" paper mills within the company. The supplier of the case is still not integrated.

The utilisation of capacity is a key success factor due to the high fixed asset investments and pressure on prices. Additionally, the supplier has recognised that a promise of high service levels to the customers will be a competitive advantage, such as 24-hour delivery lead times, although long "change over" times between the different types of paper mean a four day average production time.

Relationship
The business relationship of the partners was founded almost three decades ago. Today, the partners are both key-partners for their businesses with each having a significant part of the others sales or supply costs. Almost 150 different paper types are supplied in the relationship, ordered and delivered on nearly a daily basis in full truck loads with around 5 different items per delivery.

Due to the rapid turnaround of demand and orders in the supply chain, success can only be achieved if the partners work closely and most efficiently together. The manufacturer started a new way of co-operation with the paper mill five years ago by sharing information and using EDI for communication.

Sharing information
In order to realise a 24 hour lead time and to lower the stock levels or even the danger of out-of-stock situations, one of the major challenges in the partnership was to provide the supplier with more reliable data about future material requirements. Therefore, each week the manufacturer provides the supplier with a 14 day forecast of the material requirements. The call-offs of paper are still organised in a "traditional" order and order confirmation system and not, as in other cases, based on a Supplier Managed Inventory concept.

However, when determining the delivery size, the supplier is allowed to fill the delivery to the optimal truck load with frequently used materials. The delivery details are sent in advance to the manufacturer. This information is used by the manufacturer to create a "Stock in Transit" record. Using the information the receiving can be prepared, like the printing of labels. After receiving this, the manufacturer sends the Receiving Advice to the supplier.

Based on the Receiving Advice the supplier invoices the manufacturer. The verification of the invoice can be done automatically because of a fixed cost table for material based on the weight.

Using EDI for communication
Due to the weaknesses of using traditional communication methods such as high manual effort or the likelihood of mistakes, the manufacturer decided to automate the communication by building up EDI connections to the key suppliers.

The partners started to use EDI and EANCOM® messages for the communication of the delivery process, the Despatch Advice and the Receiving Advice. As soon as the communication of these two messages works without any mistakes, the implementation of further messages is planned. Ultimately, nearly all transactions should be supported by standardised messages, which can then be transferred automatically in the ERP systems of the both partners for further processing.

Benefits
The benefits of applying some key concepts of Integrating Suppliers are high for both partners. Because the number of material numbers increased significantly while implementing the "new way of doing business", it is hard for the partners to determine the benefits directly related to the concepts.

- Over 25% reduction of stock levels
- Up to 40% reduction of lead times
- Service level measured in "OTIF" deliveries increased significantly

Lessons learned
The basic challenges and restrictions of working together and the need to react quick and efficient on demand changes in the supply chain are the same further upstream. The case shows that implementing the key concepts of Integrated Suppliers has some significant profit impact and benefits for both partners. Although there are, so far, only a few experiences working with EDI in the relationship, the partners expect a significant reduction of administrative work, while speeding up the communication processes as well as the quality of the data.

7.5 Case Studies "Out of the Box"

Searching for good or the best practices solely within a particular industry may lead to some kind of "inbreeding", i.e. a self-fulfilling loop of repeating and reinforcing the same ideas continuously. Looking out of the "narrow box" of one industry and thus broadening one's own horizon is a way to overcome this danger. The group therefore decided to go - on a small scale - for a trial of a so called out-of-the-box-benchmarking. Two objects were chosen and visited for the "out of the box" case study: first, a manufacturer of the pharmaceutical industry and second, a manufacturer of the Hi-Tec industry, selected as representative of the assembling industry.

Pharmaceutical case – comparing apples and pears
In the case of the pharmaceutical industry, the typical problem of comparing apples with pears soon arose. Although similar in the manufacturing process, when focussing on sourcing, key characteristics of the pharmaceutical industry seem quite different to the fast moving consumer goods industry.

For most of the products, ingredients as well as packaging material and thus also the specific suppliers themselves have to be approved by the authorities. Due to the time consuming approval process, materials and suppliers are usually selected once and early during product development. They are typically not changed during the whole product life-cycle. In addition prices are usually regulated and fixed during the whole product life-cycle.

For that reason the major key success factor of the pharmaceutical industry is still seen in Research and Development. Success is primarily based on developing new products on a target costing base, which means developing products to a price assumed acceptable to the market.

Finding the right supplier globally is more important than managing the supplier base continuously. Because of regulation, and thus a fixed market share, which provides fairly constant demand - at least in the short term and mid term, production volumes are fairly stable. Additionally, most ingredients supplied - except for basic chemicals - are of low volume. The key to sourcing materials therefore is to secure the supply, and not so much the adaptation to demand fluctuations. In such an environment stocks have a different meaning as can be seen by the average number of orders per supplied material per year which was only two in the case study.

Despite these industry characteristics concepts such as Supplier Managed Inventory are also applied to some degree in the pharmaceutical industry (especially for bulky primary material). Elements of other concepts such as Efficient Product Change Management of packaging material and tracking and tracing as part of Reliable and Efficient Supply were also found in the pharmaceutical industry. However, only little differences to the descriptions and configurations described in the other cases and key concepts could be found, so further detail in this report seems unhelpful. Adding to this are difficulties to assess the impact of these concepts on the company's success due to the specific situation.

But one key learning may be summarised: the basic problems, as well as the principal solutions, seem to remain the same in the pharmaceutical industry as in the fast moving consumer goods industry, although their relevance in the context of the whole industry may differ.

Assembling industry case – streamlining the demand-to-payment process
Widening the horizon even further, a manufacturer of the assembling industry was selected as the second case study. The manufacturer site visited is a global actor in the market for high quality medical equipment. About 35 % of finished products are shipped to Europe, 35 % to America and 15 % each to Asia and the rest of the world. Sales total to about 500 million Euro per year. The manufacturing site has about 400 people and about 1,200 people employed world-wide. The production can be characterised by a small series production. Two types of products - one a lower priced type and one a high-end product type - are made-to-order on two product lines. Through different combination of components a high degree of variety and options are available to the customer for each type.

The manufacturer recently restructured its operations in a major way and has been awarded with the title "Factory of the Year" as well as gaining the "European Logistics Award for Logistics Excellence" and the "Global Award of Excellence in Operations" for these efforts. The objective of the restructuring was to streamline the whole supply chain from order management, material logistics, production, despatch to installation at the customer site in order to improve lead times, increase profitability and to fulfil customer demand better.

Material logistics in this case refers to the integration of the suppliers which has been just one, although important, element of the overall restructuring efforts. These logistic processes have been classified by benchmarking studies as "best practice". Due to the focus of this report we concentrate on the material logistics system called Kanban-Logistics.

Kanban-Logistics – From supplier involvement to supplier integration

The core element of the material and logistics processes is a concept called "Kanban-Logistics". The term Kanban is well known from the automotive industry and its prime example is the "Toyota-Production System". It describes a simple and effective method of triggering supply by a replenishment signal in shape of a card (Japanese word: "Kanban"). In this case the term Kanban-Logistics covers much more than just this narrow concept. It describes the specific idea of integrating suppliers to the manufacturer and covers information flows as well as the physical and financial flows. The basic elements are characterised as follows:

- Long term contracts for the key suppliers of the manufacturer. These contracts primarily fix the prices for the various supplied goods. They are negotiated for each supplier individually and take the specific requirements of the supplied material, e.g. optimal transport quantity, into account.

- High complexity in material logistics was reduced by the regular formation of material sets and the outsourcing of C-parts so that article numbers were reduced from 2,100 to 900. Material sets are built by single suppliers consolidating and bundling the materials of other suppliers. Suppliers remaining in direct contact to the manufacturer thus are promoted to key suppliers - the so called "A-suppliers". The complexity in sourcing is considerably reduced.

- Within the manufacturers production site a dedicated area is defined for each key supplier, visualised by coloured adhesive tape on the floor. The areas for each supplier are further marked by a metal sign hanging from the ceiling showing the name of the supplier, the name and the article number of the material, which relates to the specific area. The dedicated areas define the maximum quantity of the specific material allowed to be stored as this kind of inventory. No further inventory for material exists. At the start of the relationship, the dedicated area is once filled with material. Starting from this point in time, the supplier is responsible for refilling this buffer stock, in the sense of a replenishment philosophy.

- To support this task the manufacturer provides a yearly production plan, primarily used to adjust capacities, and a non-binding forecast for the next three months which is renewed every two weeks. The Manufacturer and supplier share the same information. Suppliers that deliver customer order specific components (e.g. computer systems) are even connected online to the manufacturer's production control system.

- Stock movements are currently communicated in a simple fax form which the supplier attaches to each component stored in the Kanban stock. It contains basic information such as the name of the supplier, his fax number, the name and the article number of the material. When material is picked from the Kanban stock by manufacturing personnel the worker removes the fax form and sends it via the fax machine to the supplier. Thus, stock movements are immediately communicated to the suppliers.

- With deliveries, almost 90 % of the total procurement is shipped-to-line, i.e. the supplier or his logistics provider are supposed to enter the manufacturing site and to transport the shipped material right up to the dedicated area. The manufacturer employs no personnel for transporting supplied material to the Kanban stock. Visualisation, called the "blue line", helps suppliers to find their way from delivery ramp to the Kanban-stock easily.

- For its own distribution of finished products the manufacturer closely works together with a third party logistics provider as a strategic partner. On the supply side the same logistics service provider now is also a partner of most of the suppliers, fulfilling more than 80 % of deliveries on the supply side. By using the on site knowledge of the logistics provider, stability of the process is further reinforced. In addition the logistics service provider is able to bundle and optimise shipments and backhauling to some extent.

- Stock in the Kanban inventory is consignment stock. No quality control exists for incoming material. Quality is an agreed responsibility of the suppliers. Due to the high quality production defective parts are detected when the product is assembled. If this occurs, the defective parts are sorted out to an area along the production line called "red zone" and replaced by another part from the Kanban inventory. At the Kanban inventory a visualised message for the supplier is provided that a defective part in the "red zone" waits to be taken back to the supplier.

- Payment is not triggered by an invoice and it is also not triggered when picking the material from the Kanban stock. Instead, the manufacturer determines "retrograde" the used material for finished products by using the bill-of-material. Material withdrawal is then booked in the computer systems and payment is released. Administrative handling of defective parts is reduced to a minimum. Physical handling is reduced to the diverting of defective parts to the "red zones" and creating a message for the supplier in the Kanban stock.

- By monthly assessing the supplier's performance with simple measures (such as deliveries in full, deliveries without errors) the manufacturer was able to improve its supply logistics and quality constantly. The main objective is to improve the process permanently and thus realising price reductions.

Benefits
The effects of the total reorganisation had a significant impact which can also be stressed by some basic business measures:

- Increase in delivery reliability by 65%
- Increase in deliverability by 66%
- Reduction of delivery time by 86%
- Reduction of stocks by 60%
- Despite increasing production volume, reduction of required floor space by 50%
- Decrease in processing time by 67%

Lessons learned
The high information level results in various benefits for both partners:

- Although there is a high fluctuation in order-entry, the simplicity and robustness of the system allows for flexible adaptation to meet demand.
- Consignment stock and "retrograde payment" allow for a straightforward handling of defective components. One necessary condition is a relationship based on trust and fairness.
- Shipping-to-line has to be supported by clear and consequent visualisation. ("Follow the blue line"). Only by agreeing on clearly defined rules and sticking to the rules can the system be maintained. Fair and transparent evaluation of the suppliers by a few measures on a monthly basis supports the continuous improvement
- Open communication and a relationship based on mutual trust between manufacturer and supplier were essential for the integration effort. The manufacturer provides the strategic partners with all the information it has at its disposal. Where desirable, suppliers may even be online with the manufacturer's order and control systems.
- By switching to Kanban-logistics and shipping-to-line in the suppliers' responsibility, packaging material for supplied goods was reduced by 38 tons of wooden materials and three tons of padding materials per year. This meant a cost reduction of about 130,000 Euro annually. The quality did not suffer by handing over responsibilities to suppliers. But the opportunity to concentrate on core activities had a positive impact on the total supply chain.
- What was once the warehouse is today a complex of offices for product development and global support.

Restructuring measures overall did not cause layoffs but gained productivity and savings were "compensated" through increased market share.

8 MEASURING PERFORMANCE OF INTEGRATED SUPPLIERS

"You can't manage what you can't measure!"

Measuring the actual performance of the supply strategy, the execution of the strategy and the potential profit impact of improvements are essential for managing the supply chain. To achieve this, three core elements should be applied:

- Scorecard for Integrated Suppliers
  The scorecard helps to identify the current status of implementation of the key concepts within the company or partnership. Thereby, the scorecard helps to identify gaps between the achieved level and the best possible level of performance. These gaps indicate the need for improvement.

- Key Performance Indicators
  With the Key Performance Indicators it is possible to measure the overall performance of the relationship in terms of inventory, service level and lead time.

- Assessing the profit impact of improvements
  Before starting any project to improve the supplier integration, it is necessary to evaluate the profit impact on the bottom line.

8.1 Scorecard for Integrated Suppliers

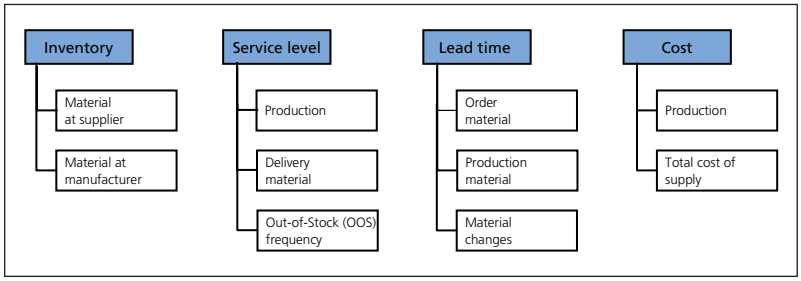
The scorecard for Integrated Suppliers is structured according to the six key concepts of Integrated Suppliers and covers both sides, the manufacturer and the supplier. The scorecard can and should be used for self assessment and for the joint evaluation with the trading partners. Once the trading partners have agreed in cross functional teams on scores concerning the key concepts, they have achieved clarity on the need for action. Moreover, the scorecard should be used continuously in order to monitor the performance on a regular basis and to establish a culture of continuous improvement within the company and between the trading partners.

The scorecard for Integrated Suppliers can be found in the appendix of this report.

8.2 Key Performance Indicators for Integrated Suppliers

The main purpose of using the Key Performance Indicators (KPI) is to measure the overall performance of the relationship between supplier and manufacturer. The KPIs are directly related to the Integrated Suppliers' scorecard. Therefore, they reflect the progress a company or partnership is making in the implementation. Although the KPIs can not be linked directly to single key concepts, they can be used to verify the scores. For example, if a company scores high in Supplier Managed Inventory then one would expect to see a low level of inventory in the warehouse at the manufacturer.

Another purpose of the KPIs is to share them regularly with the key trading partners. Moreover, they should be used for intra- and inter-company wide benchmarking. Therefore, it is critical that the trading partners agree and fully understand the composition and calculation of each single KPI. People will not trust nor use them for measuring and learning, if they do not have a full understanding of their meaning.



The necessity of sharing the KPIs with the trading partners and using them for benchmarking are the main reasons why cost measures are not chosen as KPIs but as internal business measure, although costs are a very important performance measure. Therefore cost data should be monitored closely by the companies but they are not considered as KPIs for communication or external benchmarking.

The lead time is an important measure for the performance of the relationship and therefore considered as a KPI. The order lead time indicates the total lead time from issuing an order to the receipt of the ordered items and the production lead time from issuing a production order to the receipt of the items. Therefore, the production lead time is a sound indicator of the degree for the flexibility of the supplier. However, in many relationships, especially when the implementation level of the key concepts is advanced, working with orders will be obsolete. Consequently, it will be impossible and unnecessary to measure the lead time from issuing an order to the receipt of the ordered items. Therefore, the production lead time becomes more relevant.

The same problem occurs with the measurement of the service level by using perfect orders as KPI. As mentioned, orders are likely to be obsolete in advanced Integrated Supplier relationships. Accordingly, the "Out-of-Stock frequency" will become a more important performance indicator.

The suggested KPIs are a sound and commonly agreeable base for measuring performance. But they are not exhaustive. Depending on the specific relationship other measures or degrees of details should be considered. The ranking or the importance of the single KPI also depends on the company and the relationship. For example, if the demand changes occur very often and are hard to predict, low levels of inventories are most likely to be critical for the success. In other relationships where capacity utilisation is most important a high service level might be the key factor for success. However, the list is intended to provide a quick and reasonable view of the actual performance and to be a starting point for further developments. But the specific weighting of the KPI remains a decision of the management.

8.3 Assessing the Profit Impact of Improvements

One of the most important steps in measuring the performance within a company or relationship is to determine the true cost of the processes. In recognition of this, the "Profit Impact of ECR Task Force" (PIETF) has developed and tested an ABC-cost quantifier methodology, a six step approach for assessing the profit impact and a computer based tool, the activity wizard, to support the mapping of the activities. These tools are used to determine the existing costs of the processes as well as to assess the potential profit impact of improvements. A detailed description of the methodology and tools is issued in the ECR-Europe guidebook "Assessing the Profit Impact of ECR".

Area	Key Performance Indicator	Applied by*	Measure	Definition
Inventory	Material at supplier	S	Days	value of material - inventory on hand / value of average daily sales of material
	Material at manufacturer	Both	Days	value of material - inventory on hand / value of average daily use of material
Service Level	Production	S	% Perfect Orders	# of production orders completed on time, in full, no error / total # of production orders
	Delivery material	Both	% Perfect Orders	# of order - lines for material delivered on time, in full, no error / total # of order - lines for material
	Out-of-Stock (OOS) frequency – material at manufacturer	Both	% OOS	# of times mterial - stocks are not available to be picked / total # of material - picks
Lead time	Order material	Both	Days	average # of days from date of order issue for material to date of order receipt
	Production material	S	Days	average # of days from date of order issue for production for material to date of receipt
	Material changes	Both	Days	average # of days from date of order issue for material changes to date of receipt of the changed material
Internal Business Measures				
Cost	Cost of production	S	% of sales	total cost for production of material / total value of sales of these materials
	Total cost of supply	M	% of sales	total cost of supply (price, process costs, administrative costs / total value of sales of these materials

* S = Supplier, M = Manufacturer

Based on the result of the PIETF work software companies are enabled and encouraged to develop computer tools which support companies effectively to link the costs to activities and to quantify costs and profit when applying the different ECR improvement concepts.

The core element of the ABC-cost quantifier is an activity list for the description of the existing and new processes. One task of this working group was to prove if the activity list can also be used upstream the supply chain, between manufacturers and their suppliers. If not or if some activities were missing, they were to be added to the list.

In order to do so, the working group extended the activity list with the missing activities upstream. Next, the list was used in the case studies for the mapping of the current processes. The list and the related methodology has been proven to be an effective tool for mapping current practices and to assess the profit impact of improvements. The adjusted activity list can be found in the appendix of this report.

APPENDICES

Glossary

Activity Based Costing (ABC)
All major activities are identified and the costs of performing each one are calculated, including costs that cross functional boundaries. The resulting costs are then charged to the product, product line, customer or supplier that caused the activity to be performed.

Activity Driver
Activity drivers describe how cost objects consume activities (e.g. for moving a pallet within a warehouse the activity driver is the "# of pallets").

Advanced Planning Systems (APS)
Advanced Planning and Scheduling Systems (APS) are real time systems for production planning and scheduling. APS-Systems synchronise material and capacity planning simultaneously and against restricted available capacity.

Available-To-Promise (ATP)
Available-To-Promise is a Supply Chain Management concept whose objective is to provide the customer with reliable information about product availability and delivery time at the time of customers request.

Cross Docking
Method in which goods received in a distribution centre are not stored but directly allocated to the customers and prepared for shipment.

EAN•UCC Global Trade Item Number
A numbering standard managed by EAN•UCC for the unique identification of trade items.

EAN International
EAN International manages a world-wide system that allows the identification and the communication of data on products, services, utilities, transport units and locations. It develops and maintains coding standards for all users. Its aim is to develop a global, multi-sectorial standards system thus providing a common language for national and international trade.

EAN•UCC Global Location Number
A standard number managed by EAN•UCC and used to identify any physical, functional, or logical location.

EAN•UCC Logistics Label
EAN standard for labelling of pallets with unique serial number – the serial shipping container code – and other standardised information using EAN-128 bar codes.

EANCOM®
A subset of the UN/EDIFACT standards produced by EAN International as standardised messages for trade and distribution.

EDI for Finance, Administration, Commerce and Transport (EDIFACT)
A set of internationally agreed standards, directories and guidelines for the electronic interchange of structured data managed by the United Nations.

Efficient Consumer Response (ECR)
Co-operation between partners in the supply chain in order to serve the consumer faster, better and at lower cost.

Electronic Data Interchange (EDI)
The computer-to-computer transfer of structured data, by agreed message standards, from one computer to another by electronic means and with a minimum of human intervention.

Enterprise Resource Planning (ERP)

Packaged software systems using database technology and single interface to control all the information related to a company's business including customer, product, employee, and financial data.

Extranet

Extranet applications are applications that use the World Wide Web for a limited group of users, usually for the exchange of information that is private and not to be accessed by everyone. Extranets use the public Internet as its transmission system, but limit the access by passwords or channelling techniques.

EAN•UCC Serial shipping container code (SSCC)

A unique 18 digit serial number, used to identify any transport unit (typically pallets) containing standard or non-standard combinations of product and managed by EAN•UCC. It can be bar coded using UCC/EAN-128, and is widely used together with an EDI advance shipping notice.

Stock Keeping Unit (SKU)

An SKU is any trading unit (e.g. case, tray, promotional shipper, pallet), that can be ordered by customers and handled in the supply chain. It is labelled with a uniquely identifiable trade number. It may internally consist of consumer units (product package size as sold to consumers) or other trading units.

UCC/EAN-128 Symbology (also known as EAN-128)

Bar code symbology used with application identifier standards for primary and secondary product information. Used to identify traded units with their article number, and to identify transport units, e.g. pallets, with the serial shipping container code (SSCC)

Uniform Code Council (UCC)

The body that administers the Universal Product Code (UPC) system in North America. Sister organisation of EAN International.

Value Added Networks (VAN)

Value added networks are third-party communication networks for the communication of trading messages. Besides simple transmission they provide additional services, such as message storage and forwarding, error detection and correction, protocol conversion or acknowledgements of reception.

Scorecard for Integrated Suppliers

		Scorecard Integrated Suppliers		
		Integrated Suppliers is a concept for improving the part of the supply chain between manufacturers and their tiers of suppliers of ingredients, raw materials and packaging. By sharing information both parties are able to exercise judgement on costs, quantities and timing of deliveries and production in order to streamline the product flow and to move to a collaborative relationship.		
		Demand Communication and Management	**Efficient Product Change Management**	**Synchronised Production**
Score	**General Meaning**	The manufacturer identifies future demand based on actual sales and reliable demand forecasts. Future material requirements and inventory levels are regularly communicated to suppliers.	All product changes are managed in a standardised, integrated and time oriented process. All responsibilities within the product change process are well defined with suppliers involved at an early stage.	The ability to integrate manufacturer demand signals into the planning and production process of the supplier.
0	Nothing planned	Supplier has no visibility of future customer or consumer demand or even inventory levels. Planning is based on historical data and orders.	No definite product change process in place. Late involvement of the supplier in the change of products.	No forward recognition of actual manufacturer demand. No recognition of need to synchronise production with this demand signal. Production schedules are based on traditional economic batch size logic.
1	Plans agreed but have not yet started implementation	Manufacturer plans to communicate his forecasts on future demand in the form of future material requirements to key suppliers. Visibility of inventory levels is not yet achieved. Trading partners have agreed on the needed content of the exchanged information.	Key trading partners have recognised the need for a definite product change process and have agreed on the implementation.	Marketing and sales forecasts are used as input to adjust production schedules and execution. Suppliers receive a long term material requirements forecast for production planning.
2	Pilot tests being conducted	Manufacturer starts to communicate future demand as a material requirements forecast for single items per location. Actual information on inventory levels is available. Key trading partners measure and discuss the performance of the pilot forecasts and potential improvements.	The requirements of all involved partners on the product change process are collected and transparent. Some efforts are made to implement a standardised, lean and time oriented process.	Production planning has started to use manufacturer material requirements forecasts for single items, on a weekly base.
3	Roll-out of implementation started	Material requirements forecast and inventory levels are shared with all key trading partners in weekly time brackets by items, by location. Performance and quality of the demand forecast and the derived material requirements forecast is measured and improved regularly.	Pilots have been rolled out with key trading partners. The performance is measured and discussed with all involved parties. Suppliers are early involved and responsibilities are defined in the product change process.	Manufacturer material requirements forecasts are used for production planning for most items, on a daily base. Methods for improving the synchronisation are considered.
4	Fully implemented	Demand communication and management is fully implemented with all key trading partners. Forecast and inventory reports are capable of daily planning by item, by location.	A highly efficient and time oriented product change process is implemented with all key trading partners. Trouble shooting caused by product changes is nearly eliminated.	Material requirements forecasts are fully implemented into the production planning and execution process for all items. Projects on improving the synchronisation are set up regularly.

continued

		Scorecard Integrated Suppliers		
		Supplier Managed Inventory (SMI)	Reliable and Efficient Supply	Self Billing
Score	General Meaning	Suppliers take responsibility for the replenishment of their products to the manufacturer. Replenishment of products is driven by the real usage rate. Responsibility for the management and ownership of the inventory may be determined between the trading partners.	Methods and tools are in place to monitor and improve the reliability and efficiency of the supply. Supply of items is made in the right quantity, in time and without quality failures.	Settlement of payments where no invoice is issued by the selling party of the goods but the receiving party pays automatically.
0	Nothing planned	No visibility of product usage, replenishment is simply driven by orders.	No methods or tools in place. Supply of items is often made with failures.	Suppliers invoice the manufacturer based on orders or deliveries.
1	Plans agreed but have not yet started implementation	Plans are developed and agreed between the trading partners to develop and implement SMI.	Measures identified and targets are set to improve the supply of items.	Trading partners developed and agreed on plans how to design the Self Billing process. Specific accounting requirements are identified and necessary changes planned.
2	Pilot tests being conducted	SMI pilot tests have been rolled out with the key trading partners. Suppliers manage the inventory levels of pilot materials on manufacturers side.	Performance of the supply is monitored regularly and systematically. Methods and tools are identified to improve the reliability and efficiency of the supply.	Pilot tests of self billing are rolled out with the key trading partners on selected deliveries. Performance and reliability is monitored and discussed with the key trading partners.
3	Roll-out of implementation started	The SMI system is being rolled out with the key trading partners covering the main replenishment volumes. First benefits of SMI are experienced by the trading partners.	Trading partners work close together to improve the supply performance. Different methods and tools are implemented to improve the performance.	Self Billing is implemented with the majority of key trading partners. Disputes on invoices are nearly eliminated.
4	Fully implemented	Supplier Managed Inventory systems are fully implemented with the top 80% of trading partners. Suppliers have full visibility of the inventories and usage rates and the replenishment of the products and materials is fully driven by the real usage rate.	Achieved supply standards are among the top results between the trading partners. Supply of items is made well above industry averages in terms of reliability and efficiency.	Self Billing is fully implemented with all key trading partners. The Self Billing process works perfectly and the trading partners experience the benefits.

Adjusted PIETF Activity List

Major Activity (Replenishment)	Activity	S[1]	M[2]	Activity driver unit-related	Activity driver not unit-related
Procure materials or finished goods	Negotiate basic supplier agreement	x	x		# of suppliers
	Manage supplier relations	x	x		# of suppliers
	Forecast demand	x	x	# of SKU's	
	Communicate demand	x	x	# of SKU's	
	Transfer demand into material requirements	x	x	# of SKU's	
	Communicate material requirements	x	x	# of SKU's	
	Forecast stock requirements	x	x	# of SKU's	
	Communicate stock requirements	x	x		# of suppliers
	Manage reclamation and aged products	x	x	# of returned products	
	Determine delivery size	x	x	# of orderlines	
	Place replenishment orders and specify order delivery	x	x	# of orderlines	
	Place raw materials orders and specify order delivery	x	x	# of orderlines	
Receive and store products or materials	Plan and monitor product delivery	x	x	# of orderlines	
	Receive and unload products or raw materials	x	x	# of load units	
	Checking incoming goods	x	x	# of load units	
	Administration of incoming goods	x	x	# of orderlines	
	Downsizing for storing	x	x	# of units packed	
	Repack or packout for storing	x	x	# of units packed	
	Putaway products or materials in warehouse	x	x	# of load units	
	Storage of products or materials in warehouse	x	x	# of slot days	
	Inventory cost of products or materials in warehouse	x	x	Multidimensional	
	Move products across dock	x	x	# of load units	
Produce or refine products	Define product change	x	x	# of SKU's changed	
	Communicate product change	x	x	# of SKU's changed	
	Plan product change	x	x	# of SKU's changed	
	Make tool change	x	x	# of SKU's changed	
	Run test of product change	x	x	# of SKU's changed	
	Check test of product change	x	x	# of SKU's changed	
	Approve product change	x	x	# of SKU's changed	
	Formulate products	x	x		
	Plan, schedule and control production	x	x	# of production runs	
	Plan and issue orders for production	x	x	# of production runs	
	Set-up production	x	x	# of production runs	
	Produce product	x	x		
	Package product	x	x		
	Prepare special packings e.g. duo packs	x	x	# of units special packed	
	Manipulate or label products e.g. promotions	x	x	# of units manipulated or labeled	
	Test or inspect products	x	x	# of SKU's	
	Label cases or pallets	x	x	# of units packed	
	Store products from production	x	x	# of loads or dm3 in stock	
	Refine or assemble finished product	x	x	# of units assembled	

[1] Supplier; [2] Manufacturer

continued

Major Activity (Replenishment)	Activity	S[1]	M[2]	Activity driver unit-related	Activity driver not unit-related
Store products	Maintain inventory policies and levels	x	x		
	Manage inventory levels incl. stock reconciliations	x	x	# of SKU's	
	Communicate inventory level downstream	x	x	# of SKU's	
	Backroom product handling			# of cases	
	Storage of products in backroom			# of dm3 in stock	
	Inventory cost of products in backroom			Multidimensional	
	Open case			# of cases to be opened	
	Price product			# of Units priced	
	Price shelf ends			# of SKU's	
	Putaway products in backroom			# of units	
	Storage of products on store shelf			# of dm3 taken of shelf space taken	
	Inventory cost of products on store shelf			Multidimensional	
	Refill store shelf			# of cases	
	Cleanup packing materials			# of cases to be cleaned up	
	Condition shelves			# of events	
	Retail store ordering				# orderlines store
Manage customer orders	Receive customer orders	x	x	# of orderlines customer	
	Consolidate and send delayed customer orders	x	x	# of orderlines customer	
	Consolidate demand	x	x	# of orderlines customer via salesmen	
	Override orders for known variations	x	x	# of orderlines customer overridden	
	Manage customer orders, queries or reclamations	x	x		# of complaints
Pick orders and deliver products	Prepare picking papers or data	x	x	# of orderlines customer	
	Pick orders / call-offs / delivery sizes and move to loading area	x	x	# of units moved	
	Refill picking location from buffer	x	x	# of units moved	
	Plan delivery routes and stops	x	x		# of orders
	Prepare shipping documents	x	x	# of orderlines customer	
	Communicate delivery plan to customer	x	x		# of deliveries
	Prepare load for despatch	x	x	# of loads	
	Load vehicle	x	x	# of loads	
	Move product between warehouse locations	x	x	Multidimensional	
	Transport to customer	x	x	Multidimensional	
Handle returnables	Receive empties	x	x	# of units of empties	
	Clean or repair empties	x	x	# of units of empties	
	Sort empties	x	x	# of units of empties	
	Putaway empties	x	x	# of units of empties	
	Storage of empties	x	x	# of dm3 of empties in stock	
	Inventory cost of empties	x	x	Multidimensional	
	Prepare empties for despatch	x	x	# of units of empties	
	Load empties vehicle	x	x	# of loads of empties	
	Transport empties	x	x	Multidimensional	
	Administrate empties	x	x	# of returned load units	
	Scrap returned products	x	x	# of scrapped units	
	Handle recyclables	x	x	# of units	
Manage invoices	Assemble payables information	x	x	# of invoice lines	
	Check against order and delivery documents	x	x	# of invoice lines	
	Resolve disputes with suppliers	x	x	# of invoice lines	
	Issue payments for products or services	x	x		# of invoices
	Assemble receivables information	x	x	# of invoice lines	
	Issue invoices to customers	x	x		# of invoices
	Resolve disputes with customers	x	x		# of disputes
Maintain masterfile data	Maintain product bills of material	x	x	# of changes	
	Maintain product processing records	x	x	# of changes	
	Maintain product cost data	x	x	# of changes	
	Maintain product price records	x	x	# of changes	
	Maintain product inventory records	x	x	# of changes	
	Maintain scan data or EAN codes	x	x	# of changes	
	Maintain product testing records	x	x	# of changes	
	Maintain product logistics records	x	x	# of changes	
	Maintain customer records	x	x	# of changes	

[1] *Supplier;* [2] *Manufacturer*

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