

# Network Managed Supply

## Execution of Real Time Replenishment in Supply Networks

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### Abstract

As supply chains get less linear and more “networked”, concepts and tools have to be adjusted. In this paper a concept for how to manage and, primarily, execute supply chain networks (Network Managed Supply, NMS) will be described, as well as experiences from implementation of a “replenishment controlling system” between multiple companies with different ERP systems (exemplified by the software PipeChain®). A telecommunications OEM case, an example of a dynamic supply network (Zheng et al, 2001), will be given.

### Supply networks and Network Managed Supply

Dynamics in supply chains and distribution channels has been discussed since the late 50s (Forrester 1958), but is a problem still facing most industries. A lot of research, using the “Beer game” as model, has been made (e.g. Towill et al 1992, Sterman 1992, van Ackere et al 1993) and suggestions such as eliminating middlemen, making point-of-sales data available along the chain, reducing lead time or improving the planning have been made. In industry we can see companies trying all of those strategies, and key learning is that an effective supply chain is more about sharing information than optimisation.

Today the Internet gives a cheap platform that enables total connectivity with all partners in the supply chain. Furthermore, our partners can integrate their partners as well. So facing the real situation a company is not just part of one supply chain, but a network of suppliers and customers (figure 1). Lamming et al (2000) argue that the simplistic, linear and unidirectional models presented for supply chain management should be replaced by the supply network concept describing lateral links, reverse loops, two-way exchanges etc. encompassing the upstream and downstream activity with a focal firm as point of reference.

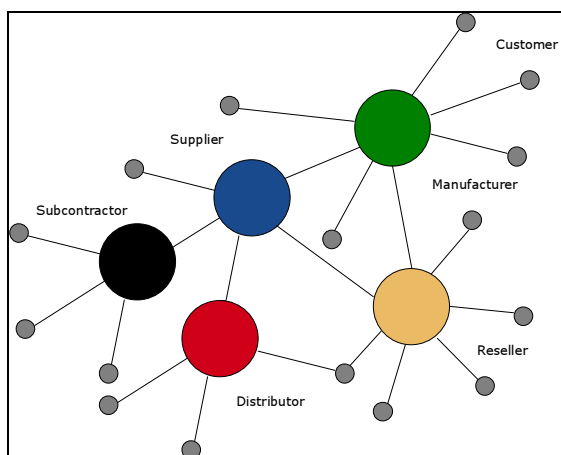


Figure 1. Supply chain network

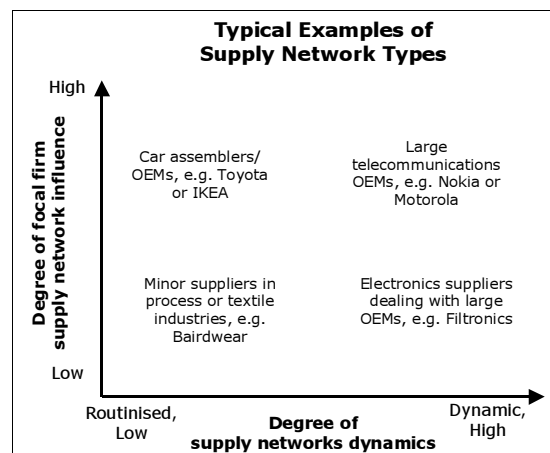


Figure 2. Supply network types.

Source: Zheng et al, 2001, p. 905

They refer to Harland (1996) when defining supply networks as “sets of inter-connected supply chains, embodying the flow of goods and services from original sources to end customers”. They first try to classify supply networks based on:

- a) degree of product complexity, and
- b) degree of innovative product.

Zheng et al (2001) continue later by proposing a taxonomy based on:

- a) *the degree of supply networks dynamics, and*
- b) *the degree of focal firm supply network influence (figure 2).*

As examples of companies being the focal actor in dynamic supply networks, with a high degree of focal firm influences, they mention large telecommunications OEMs such as Nokia and Motorola. One of the key problems stressed for dynamic supply networks is the need of buffer stocks due to uncertain demand conditions and high frequency of product launches. One issue is how to simplify and cope with dynamics when working in a dynamic supply network, something to operational to be addressed by Lamming, Zheng et al (2000, 2001). To be able to position the concept of NMS and define what it addresses (and not), and to compare it to some other concepts three dimensions are chosen:

- a) *the organisational scope of management* (internal logistics, supply chain or supply network),
- b) *the degree of operational activity* (execution, planning or more strategic choices), and
- c) *the decision making frequency*; whether the concepts (and support system) is based on real time information/decision making or periodical decisions made on “batch run” information (figure 3).

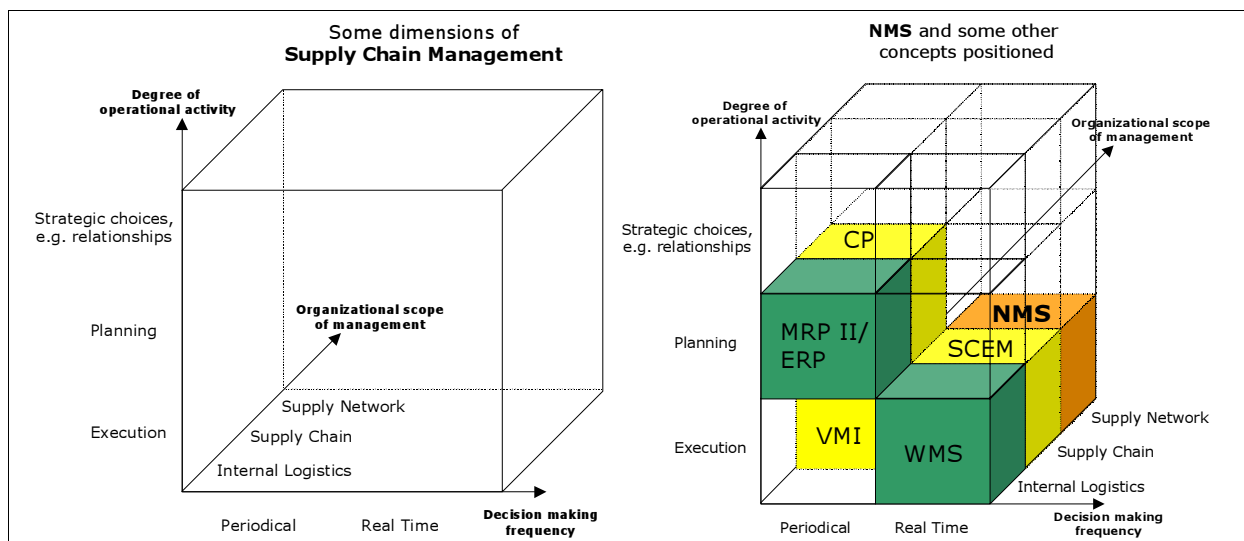


Figure 3. NMS as part of supply network management.

The concept of Network Managed Supply (NMS) is addressing real time execution in supply chain networks with the idea that end consumers’ real time demand should control the flow of goods in the network. This is close to Abou-Jaoude’s (2001) term Supply Network Execution, “controlling activities both within the node and across the entire supply network”. The scope of NMS is not the full management of supply networks as it e.g. not addresses medium and long term planning of resources and capacity. As focus is on execution, it has similarities to what AMR Research (2001) calls Supply Chain Event Management. But NMS has a more explicit focus on networks. VMI (which is a brick stone of NMS) is often referred to as a used

in a dyad, and has previously often not been based on real time data. When comparing NMS to MRP and Collaborative Planning, those are addressing medium term planning issues but not often using real time data nor concerned with execution. Further, when looking at Collaborative Planning solutions (Williams 1999, Ireland and Bruce 2000) most have until today been designed for optimisation of a linear supply chain and between two companies.

The NMS concept is founded on the following principles:

- **Real time demand driven supply chain network**
- **Vendor Managed Inventory (VMI)** - the supplier is responsible for that the customer has the right amount of goods in stock. The customer doesn't have to place orders, goods should be replenished when needed.
- A **strong partnership** between the customer and the supplier.
- **Transparent and easily transferable information** in the network.
- A **plain product strategy**, that states what products should be produced against stock or order, where the products should be stored etc.
- In each node of the network decisions are made, based on the **real-time** situation, and these are for that moment the best achievable. It is impossible to have 100% confidence in the future performance of a network system, but we can run the system, in real-time, with real goods and, analogous to an ecosystem, cope with the outcomes (compare Tulip 2001).

Thus, focus is on optimising the flow through the nodes in the network, instead of optimising a complex chain.

### PipeChain's Logic of Water Distribution

Often supply chains are illustrated with the "Beer game" (e.g. Sterman 1992 or Senge 1990) and it has inspired the logic behind PipeChain. However, water distribution has been found better to illustrate real time demand driven supply networks and the principles behind NMS. Water is accumulated, and then distributed automatically through the pipe system (figure 4).

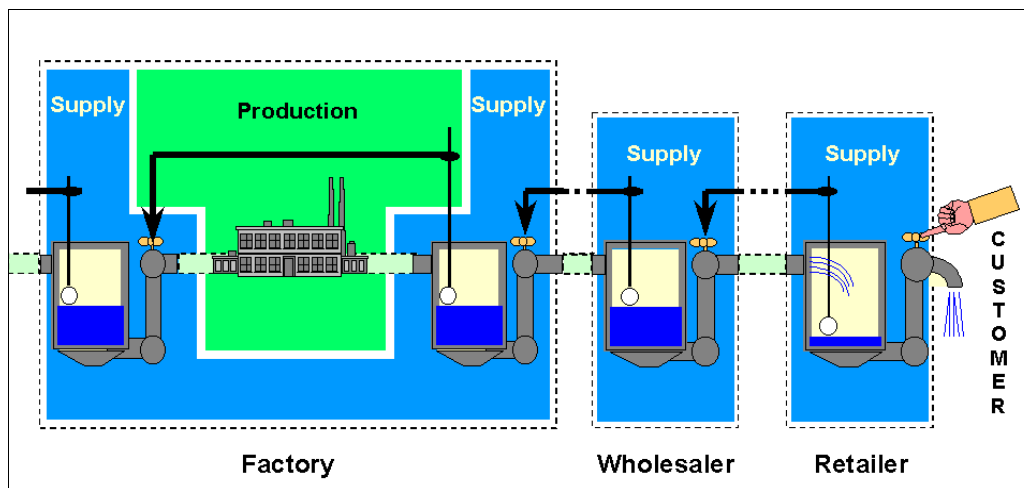


Figure 4. The material flow is analogous to supply of water.

PipeChain, a software tool supporting NMS, is constructed to produce a material flow analogous to that of water supply – products can be compared to water and stocks to water tanks. When a customer consumes water (products), the level falls in the tank. As each tank is connected to others, the one with an outflow is automatically replenished. Deliveries are entirely linked to and triggered by consumption so only when a customer consumes (“turns on the tap”) deliveries are made forward in the system. Hence the whole network adapts to the

consumption. The “tanks” compensate for the demand fluctuations. They are designed and positioned according to the size and characteristics of the fluctuations. Adapting VMI, suppliers have complete responsibility for product availability. Design and planning of pipes and tanks is hence crucial to the result. Replenishment is driven by each link sending its stock status and current sales to the preceding supplier. The supplier itself then decides when it is time to replenish. Data needed to control the flow (such as balance, actual sales, duration, advised deliveries) is exchanged over the Internet and via interfaces with local ERP systems. No competitor information shared. Everyone can see the fill rate of his or her products all the way downstream to the end customer. While much of the concept is similar to more dyadic relations, this is a “network characteristics”.

The issue to send information between different ERP systems, or sometimes between different version of the same, is often difficult to solve. PipeChain is designed to be the backbone in global supply chain networks, and hence it not only exchanges information but also has the necessary logic to control and execute even complex networks of companies with different ERP systems.

### Towards NMS at Ericsson

Ericsson Radio Systems, world-leading manufacturer of radio base stations for mobile telecommunication, has started to execute its upstream supply chain network according to NMS. Until 1996 the overall performance at the production plant was poor. Implementing a new supply chain strategy (1998) was one part of the corporate supply chain improvement program TTC Global. One major scope was to change how to plan and control production into a JIT/MRP II environment (compare Sandras, 2000). In a traditional work order environment (MRP II) a detailed production plan is centrally developed, and the production is centrally controlled through the release of work orders and purchase orders. Ericsson now develops only a macro production plan centrally, while the execution of customer orders is decentralised (figure 5). Within the production, scheduling is made according to the theory of constraints principles (Goldratt, 1990). Each resource constraint can individually be adjusted, both for time and amount.

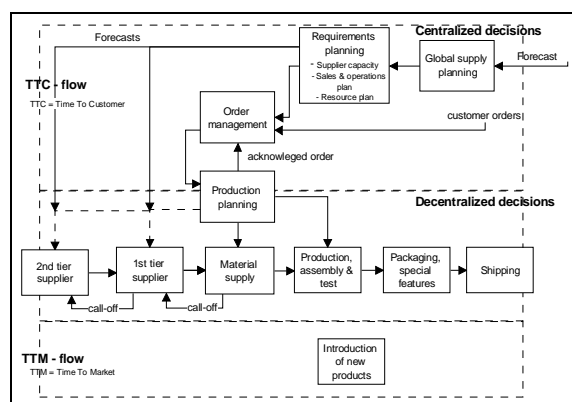


Figure 5. Overview of Ericsson's program TTC Global. Source: adaptation of Rudberg (2000), p. 22.

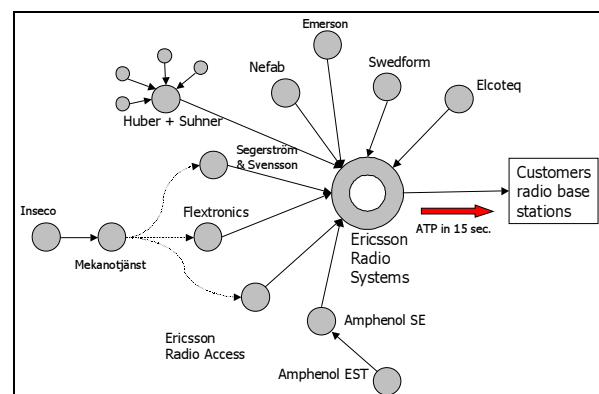


Figure 6. A supply chain network using NMS

Today Ericsson is using PipeChain for a supply network consisting of some 12 subcontractors and a number of their own plants (figure 6). Every change of status for a production assignment (work order) is instantly updated, monitored and displayed in the PipeChain generated production schedule. Interaction with the applications at customers' and suppliers' sites ensures collaboration throughout the network. The software tool enables automated real-time available-to-promise (ATP) and capable-to-promise (CTP) information.

## Effects and Experiences

The effect of both the overall changed strategy and the use of PipeChain as replenishment tool has been positive (figure 7). Order-to-delivery lead time has decreased from 15 to first 5 and later 1 day, on-time deliveries has increased from 20% to first 98% and later 99,8%, yearly inventory turnover rate increased from 5 to first 35 and later 80, and finally has total overhead cost been reduced. Note that the effects in 2000 are achieved by automating the NMS principles (adopted “manually” in 1998) with the software tool. The purchasing department at Ericsson Radio Systems was the one that was quickest to realise the direct benefit of PipeChain. Here routine work on the daily ordering of certain goods disappeared almost immediately. Instead, the subcontractors themselves, and their suppliers, can check how much is needed and deliver accordingly.

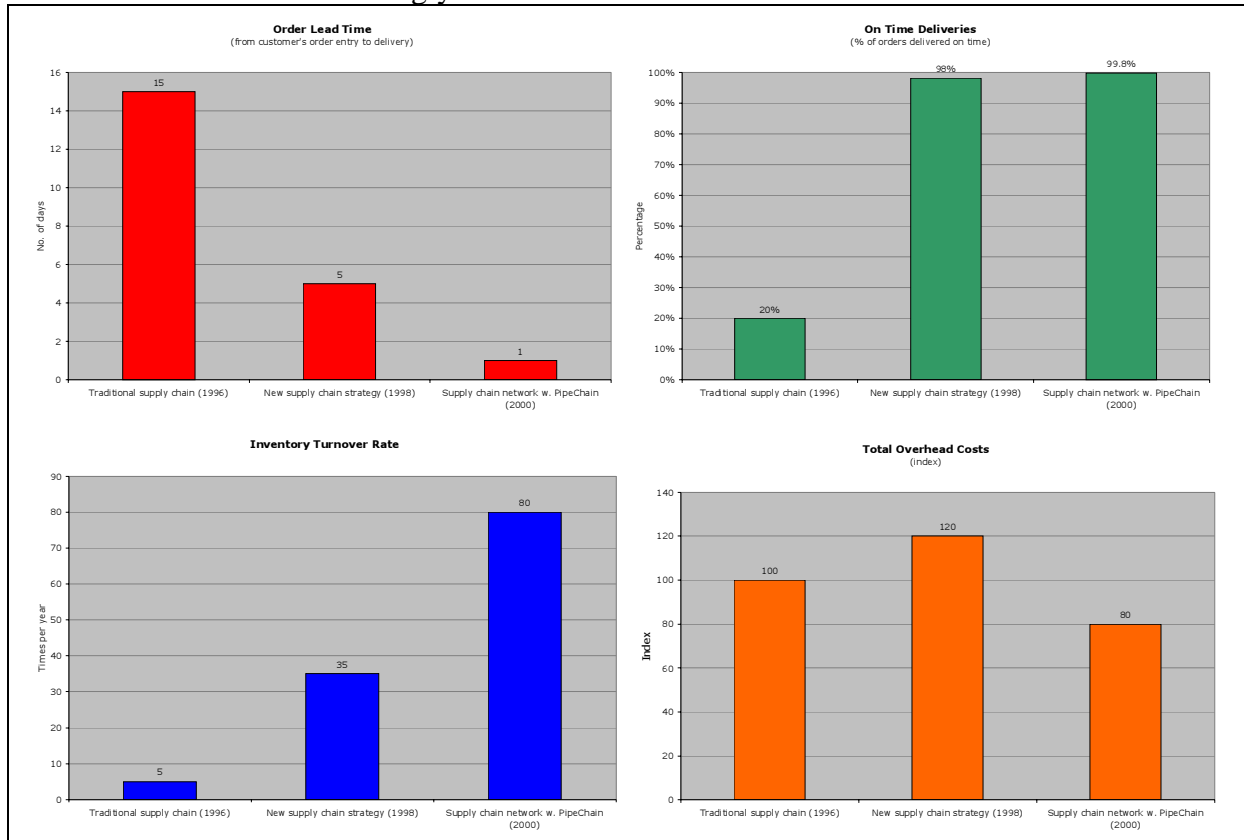


Figure 7. Impact of the changed supply chain strategy and implementation of PipeChain

Some positive and negative experiences from implementing NMS and PipeChain have been:

- + main effects (figure 7) can be identified shortly after an implementation (months)
- + the investment pays off shortly (months)
- although the concept is easy to understand, accepting the change of working procedures and shift of responsibility takes time
- + the customers and suppliers in the network have gained a greater knowledge and understanding of each others’ working processes and businesses
- + the software tool is fast to implement (weeks-month)
- + the users of the software tool rely on the system and find it logical and process oriented
- + the work load for the people working with operative logistics has been less fluctuating
- even though a standard interface is used to integrate the ERP systems it must be adapted to the process. This should not be underestimated, but creates work and takes time
- the software tool doesn’t fit certain businesses (e.g. random suppliers and seldom supply)

## Conclusions

In many industries supply chains are getting more complex forming supply networks. One way to handle execution in those is with NMS, creating transparency and visibility throughout the network and making decisions based on real time data. Positive effects such as improved service levels, reduction of administration costs and inventory levels have been identified. But in order to reach positive results, issues like acceptance of a new concept, commitment from involved actors in the network, handling organisational and process change must be dealt with along the way.

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