AN OPERATIONS MODEL FOR AUTOMATED REPLENISHMENT IN THE PHARMACY INDUSTRY

Heidi Dreyer, Ola Strandhagen, Maria Kollberg and Anita Romsdal

Department of Production and Quality Engineering, Norwegian University of Science and Technology, NTNU
S.P. Andersens v. 5, 7491 Trondheim, Norway

ABSTRACT
Automated replenishments programs (ARP) is a recent supply chain innovation. The aim is to provide automated replenishment of products based on real time demand information to the production, warehouses and distribution processes in the supply chain. Due to their relative novelty, the knowledge of ARP is limited especially when it comes to how they are operated and controlled in a supply chain. Thus in this paper we have developed a framework of an operations model for ARP in a pharmaceutical supply chain consisting of manufacturing, wholesaling and retailing in the Norwegian pharmacy industry. The suggested operations model, developed through a literature and case study, as well as exploratory research, contains a transparent and electronic information lag with POS data, stock levels, forecasts, promotions, etc. It also shows a seamless flow of products and administrative control processes based on pull principles which balance supply chain capacity to final customer demand.

Keywords: Automated replenishment, operations model, supply chain control.

INTRODUCTION
During the last decade, the competitive environment of companies has toughened, leading to a shift in supply chain management towards collaborative concepts based on information sharing and transparency. The enhanced customer orientation and responsiveness requirements, together with the globalisation of business, are important characteristics which have transformed the competitive environment and thus forced companies to innovate their business models and concepts. There is a considerable interest for collaborative supply chain concepts due to the assumption of their positive effects on performance.

Collaboration concepts as Quick Response (QR), Efficient Consumer Response (ECR), Vendor Managed Inventory (VMI) and Collaborative Planning, Forecasting and Replenishment (CPFR) are examples that have been examined in recent research and applied in real life. The literature accounts for their progress, from relatively simple and limited concepts based on order and inventory information exchange, to today's complex and binding concepts. Recently, these concepts are more frequently based on the idea of continuous and automated replenishment of goods based on real time demand and enabled by the use of information and communication technology (ICT), instead of the traditional stock based practices.

Although there is a growing amount of research on collaborative approaches, there still seems to be limited knowledge and understanding of their practical and specific implications, and substance. From an operations management approach questions as how to design and operate such logistical systems between manufacturers, wholesalers and retailers altogether is still a poorly developed subject. Thus the research questions addressed in this paper is what are the important control aspects in automated replenishment concept in the supply chain, and how could they be transformed to an operations model for automated replenishment in the pharmacy industry. The aim of the paper is to develop a framework for an operations model for automated replenishment in a transparent and demand driven supply chain - including the processes of manufacturing, wholesaling and retailing. The operations model supports mapping and the identification of key characteristics of the supply chain, as well as in analysis and design of an automated replenishment system.

The research strategy followed is a combination of a literary review, an empirical and case study, and the development of an operations model for a supply chain in the pharmacy business. The theoretical concepts of automated replenishment and operations model are analysed and discussed in relation to operations management theory and an existing methodology for design of operation management systems. The empirical data is mainly collected from a single case study carried out in a supply chain in the pharmacy business. The supply chain consists of a manufacturer, wholesaler and retail-chain in the Norwegian pharmaceutical industry. The case study approach is preferred due to the need for a deep and extensive study of a real-life situation where the design of an automated replenishment system is in its early stages (Yin, 1994; Eisenhardt, 1989).

Data is collected through discussion with key production and logistics representatives in the companies about how the supply chain system is operated today. The information consists of data as process descriptions, quantitative parameters as cost, time, frequencies, and volumes, performance measures, ICT-system descriptions, etc. The data sets are analyzed through traditional quantitative and qualitative approaches as statistical processing and textual interpretations of field notes. Based on the theoretical framework and existing methodology, the data is utilised to develop an operations model for automated replenishment.

AUTOMATED REPLENISHMENT IN AN OPERATIONS MANAGEMENT CONTEXT

Operation management is the management of all the resources and activities necessary to provide the market with tangible goods and services (Waller, 2003; Chase, 2004). This includes the systems and operations which creates and delivers the firm’s or the supply chain’s primary product of services. It also includes the activities of planning, organizing, and controlling as well as the system design, operation and improvements in order to maximize the relationship between demand and supply. Thus the need for harmonizing the systems and methods of planning and control decisions in the company and throughout the supply chain is emphasised (Slack et al., 2004). This means to adjust scheduling, material movements, stock levels, pricing and other sales strategies so as to bring all the operations in the chain into line with each other. This goes beyond the provision of information meaning that even when using the same information, differences in forecasting methods or purchasing practises can lead to fluctuations in orders between operations in the chain. It is the aspects related to operations, planning and control which are the interesting ones when discussing how to operate an automated replenishment system in the supply chain.

The aim of collaborative supply chain systems is the needs for coordinating the supply, production and delivery processes, at the same time as they balance production and supply with customers’ requirements and demand. Collaborative initiatives in the supply chain have a wide range of forms with one common goal: to gain real time information and to create a transparent, visible demand pattern that paces the entire supply chain (Holweg et al., 2005). ICT together with information and visibility is essential leading to higher predictability and insight into the demand situation which will prevent the “bullwhip” and artificial demand amplification (Busi and Dreyer, 2004; Mabert and Venkataramanan, 1998). Several studies identify the problems caused by a lack of information and to what extent competitive advantages can be gained from a seamless supply chain (Forrester, 1961; Lee et al., 1997; Chen et al., 2000).

The traditionally approach in supply chain management is to rely on forecasts to determine production plans, inventory allocation, and distribution and transport scheduling. However the necessity to deal with variable demand, out-of-stock situations and/or excessive inventory build-up has forced companies to sophisticate their forecasting techniques and to improve the quality of historical data in order to minimise demand uncertainty. Recent studies show a shift away from the traditional production, inventory and distribution practice towards a more marked responsive and pull oriented approach, and thereby to place less reliance upon historical data and forecasting and planning techniques. The supply chain concepts gathered under this “new” practice is referred to as automatic replenishment programs (ARPs) (Andraski, 1994; Daugherty et al., 1999; Ellinger et al., 1999; Myers et al., 2000; Sabath et al., 2001; Lohtia et al., 2004). ARPs are designed to streamline the flow of goods within the supply chain, while simultaneously allowing the seller to sustain effective customer service. The production capacity and inventories are made more efficient through precise planning and replenishment practises. Replenishment is triggered by actual sales figures throughout point-of-sale (POS) data and stock-level information which is typically collected at the retail level and transmitted backwards to the supplying actors via information and communication technology systems (ICT). Suppliers are thereby able to respond to demand on a just in time basis. Retailers implement ARPs to trigger replenishment from manufacturers (or middlemen). In addition to the outbound connection with retailers or wholesalers, manufacturers may use the systems to manage inbound inventory replenishment from their suppliers.

Even if ARPs to a large extend rely on real time demand information forecasting and planning, information is still an essential element in gaining reliable and valid replenishment data. Both forecast techniques, technology for information acquisition and exchange has been developed and adjusted according to the ARPs approaches. Information systems as Manugistics and i2 are examples of such technology (www.manugistics.com; www.i2.com). The concept of Collaborative Planning, Forecasting and Control (CPFR) is and example of a joint process between the supply chains actors were they collectively decides upon and develop improved forecasts and plans. Input from all actors as historical sales data, promotions and market plans, product development, production plans, etc. forms the basis which replenishment orders are made (Simchi-Levi et al., 2003). Thus the sophistication of forecasting techniques and technology together with joint effort to generate reliable data has strengthened the position of forecasts and plans as an important element in ARP.

In ARPs the traditional ordering and purchasing process and operation are radically changed. Order processing becomes redundant because this information is automatically registered and transmitted from POS and stock systems, and replenishment is based on this automation as well as the reorder-point-level principles embedded in the system. This also means that the traditional synchronisation between order placement and physical shipment no longer exists due to the fact that POS data and stock level information are transmitted even if this not implies a physical shipment. Shipments will only take place when the system register that the reorder point is reached.

Response based supply chain strategies as ARPs are found to consistently outperform anticipatory systems in terms of improved performance. Myers et al., (2000) suggest that the changes in operations systems due to ARPs are associated with several improvements. Reduction in production run length, shipments size, and reliance on forecasting allows firms to manufacture and deliver in shorter time-spans. Reduction in order cycle length and smaller size shipments reduces inventories. Efficiency comes out of the ability to deliver exact the quantity needed and configured to meet customer requirements. Additionally efficiency results from better communication linkages between buyers and sellers which reduce waste of both tangibles and time. Reliability is an effect of more predictable order cycles which enable selling forms to deliver goods on time and to deal with fewer out-of-stock items. These changes are captured in the cost reduction and service enhancements of the replenishment systems. According to Ellinger et al., (1999) firms will be more involved in automatic replenishment (as evidenced by a greater proportion of their total sales being ARP related) benefit in terms of operational enhancements, greater profitability, and better relationships with ARP customers. However Ellinger (op cit.) conclude that ARP is resource intensive and implies both more work and complexity as more trading partners take part in ARPs.

Based on the operations model concept important ARPs aspects can be summarized as follows:

- ARP combines pull and push principles – replenishment is triggered by real time demand information supported by information from advanced planning and forecasting techniques and reorder-point-level principles
- Real time demand and stock level information distributed in the supply chain through transparent information systems
- Production, inventory and shipment capacity is adjusted according to end customer demand
- Considerable changes in the order and purchase process – traditional procurement activities becomes redundant and automatic is embedded in the replenishment process

A FRAMEWORK FOR SUPPLY CHAIN OPERATIONS MODEL

An efficient and systematic approach to deal with the operations, planning and control aspects – especially due to the seamlessness and complexity of ARPs, is to build a holistic and integrated operations model concept based on principles from enterprise modelling (Vernadat, 1996). An operations model can be seen as an overall and systematic framework for all relevant aspect related to operations and controlling of the flow of materials and information in a company or supply chain (Alfnes, 2005). The operations model is a description and a visualization of how the system is operated which enables managers to manage, design and analyse operations without a high level of detail. Alfnes (op cit.) proposes six views which should be modelled and illustrated in Figure 1.

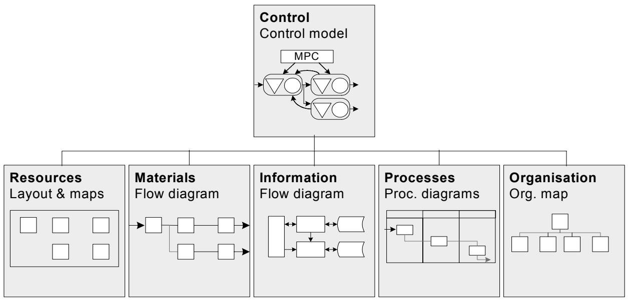

Figure 1 - The operations model-set (Alfnes, 2005)

Figure 1 shows the different views in an operations model-set and examples of models that can represent each view. Furthermore, it illustrates that the core concepts from each view should be synthesized in an overall control model. A control model is a representation of how operations are organised and controlled in manufacturing and is normally developed by the following building blocks (Quistgaard et. al, 1989; Andersen et al., 1998; Alfnes and Strandhagen, 2000):

- customer order decoupling point (specifying which parts of the value chain that is controlled by customer orders)
- control principles and methods (specifying for the chain and for each operations area)
- main operations processes (operations and buffers)
- operations areas (specifying which operations that is one area of responsibility)
- material flow (specifying main routes through the operations processes)
- information flow (specifying the flow of information related to value chain)

The control model is the key model in the comprehensive operations model. One of the application areas of the control model is to decompose the decisions-making process into operations areas, and thereby specify how different parts of the operations process are supported by different control principles and methods. A simplified example of a control model for a manufacturing enterprise is shown in Figure 2. This model is based on a set of predefined templates and modelling principles.

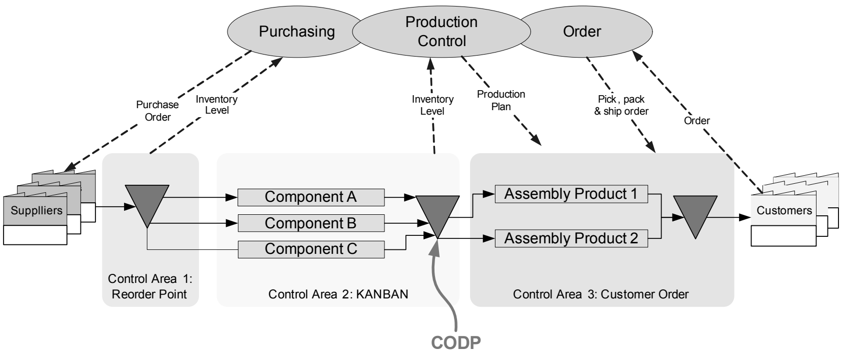

Figure 2 Control Model for Manufacturing Enterprise

This simplified example shows the main manufacturing processes, including assembly, the buffers/stores, the control areas and information flows and administrative processes as well as how suppliers and customers are connected. The focus in this model is on control of the internal processes of the enterprise. To expand from an enterprise to a supply chain view the operations model set has to include aspects given in Table 1 – The expanded supply chain view

.

Table 1 – The expanded supply chain view

Resoruces	Processes	Material	Information	Organisation	Control
Suppliers Transporters Wholesalers Customers	Forecasts Ordrer Call offs Procurements Wholesalers control	Demand pattern between actors Distribution principles	Informations flow between actors ICT systems of actors	Roles of different actors Contract principles	CODP placing (several in VC) Control principles Control areas combining actors KPI measure in customer-supplier relations

DATA SET (documentation)

The table builds on the same logic as the enterprise model, but the scope is considerable broadened. It includes all actors, physical and administrative processes, the flow of goods and information and ICT, organisational conditions, and the control principles for the whole supply chain system.

In order to develop a suitable operations model, process reengineering is necessary. This requires an in-depth understanding of the supply chain current manufacturing and logistics processes. The enterprise reengineering process can be organised in six steps; project initiation, mapping, analysis, design, implementation and project management (Strandhagen and Dreyer, 2006). The purpose is to create an operations model that describes the AS-IS and TO-BE situations. The process purpose and preliminary problem hypothesis are defined in the initial stage. These guide the choice of methods for the mapping and analysis stages. Mapping consists of creating a description of the AS-IS Operations Model and identifying potential improvement areas. Subsequently a selection of general and specific analyses is performed on chosen aspects of the enterprise's operations. This should identify the key characteristics of the supply chain, and based on the findings, the TO-BE Operations Model and solution elements are designed, and implemented in the enterprise.

AN ARP BASED OPERATIONS MODEL FOR AUTOMED

The framework presented in the previous chapter forms the fundament for suggesting an operations model for automated replenishment in the pharmacy business. Before the operations model is developed the pharmacy case is presented.

The AUTOMED supply chain

AUTOMED (automated replenishment of pharmaceuticals) is a project taking place in the Norwegian pharmacy industry with the aim to develop automated replenishment of pharmaceuticals from producer to pharmacy. The project partners are a group of logistics researchers, a manufacturer, wholesaler and a pharmacy retailer chain which is fully owned by the wholesaler. In Norway the pharmacy industry is dominated by intense competition due to the new pharmacy law enforced in 2001 that was more liberal and led to increased integration both vertically and horizontally. The wholesalers primarily deliver goods to their own pharmacies (retail chain) in spite of the multiple channel system allowing each wholesaler to deliver pharmaceuticals to all pharmacies in the market. Three main wholesalers with associated pharmacy chains dominate the market.

The pharmacy law aims to assure a safe delivery of pharmaceuticals to final consumers and a proper consumption in Norway. It also regulates pharmaceutical sales-prices and the wholesalers are obliged to deliver within 24 hours to any pharmacy in Norway. The number of pharmacies in Norway is about 550. The pharmaceuticals industry is global with several multinational companies and the main pharmacy chains in Norway are owned by three major European wholesalers.

The manufacturing company in the project covers internally developed products in terms of tablets, mixtures, sprays, creams and some final products. Purchasing and production are based on forecasting and planning, while finished products are stored in finished goods stock. The manufacturer distributes the products through a third party distributor responsible for a second finished goods stock as well as the distribution to wholesalers.

Purchasing at the wholesaler is based on forecasts and information regarding inventory levels. The wholesaler provides products to the pharmacies based on historical sales data and information of daily sales in pharmacy. The products are distributed from a main inventory directly to customers or via a regional stock for the northern parts of Norway. The administrative processes include pharmacy replenishment, wholesaler forecasting and planning (including market activities), wholesaler replenishment/purchasing, producer order management, and producer (production) planning and forecasting. The physical processes include delivery and transportation to pharmacies and regional inventory, main and regional inventory control, delivery and transportation to wholesaler, production and raw material handling. Each pharmacy outlet is responsible for sale, customer assistance, etc.

The AS-IS operations model in AUTOMED

From a supply chain perspective the overall throughput time in the AUTOMED supply chain typically covers 9 months; more than 7 months for manufacturing processes and 2 months at the wholesaler and their pharmacies. The products are divided into RX (pharmaceuticals that require a prescription), OTC (pharmaceuticals sold over-the-counter) and commodities. The manufacturer manages about 750 stock keeping units (SKUs), the wholesaler about 11000 SKUs and each pharmacy about 3000 SKUs.

The supply chain is primarily controlled based on forecasted estimates of market demand expectations in wholesaler and pharmacies. Estimates are based on historical sales corrected with expectations of future sales development. Replenishment of inventory is based on inventory levels and is initiated based on the need to refill up to a certain level.

Series/batch sizes in the production is non flexible since each batch size needs to pass a validation process for acceptance from government, that requires a lot of time and resource. Production plans are developed based on traditional MRP principles of forecasting and inventory level. Production and packing is conducted to stock (make-to-stock).

Information of inventory levels at the pharmacies is also used to correct the forecasting and planning information at the wholesaler. The replenishment plans are corrected with inventory levels on a daily basis at the wholesaler. This information is however not further transmitted through the supply chain to be used for control by the manufacturer.

Based on this information an AS-IS operations model for AUTOMED has been developed and is illustrated in Figure 3.

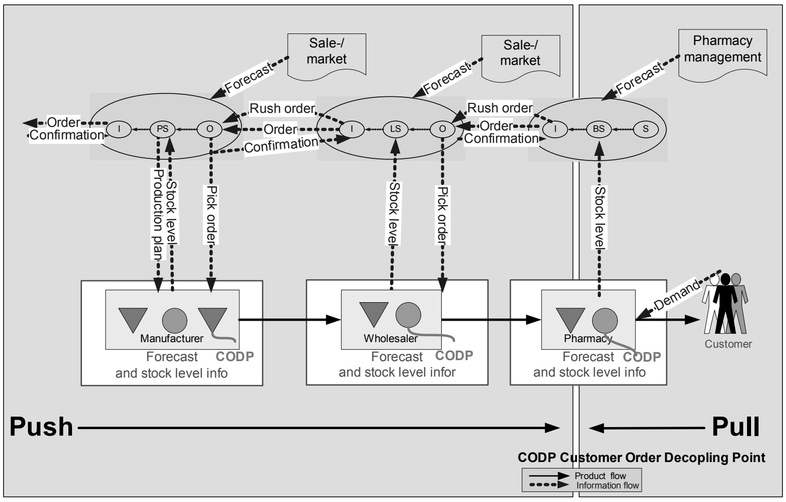

Figure 3: AS-IS operations model for AUTOMED

First of all Figure 3 shows a system based on the classic procedures for supply and shipments according to orders and procurement requisitions. Secondly, the illustration shows that the product flow throughout the supply chain is controlled according to rules and principles for stock level reordering, and that forecast is widely used in order to secure that customers demand is met, and that either demand or stock level information is communicated or exchanged. Thirdly the figure shows that the administrative planning and control processes are separated in traditional functions as ordering, purchasing and planning, and that the integration level between the processes are low, both inside each company and between the companies. Thus the operations model for the AUTOMED supply chain could be characterised as a traditional push based system which generates an accumulated high level of inventory, long throughput time, fluctuating service level, and a fairly non-flexible production system.

The TO-BE ARP based operations model in AUTOMED

Based on the weakness and lack of performance in the AS-IS operations model and the potential improvement applying the ARP-concept, a new operations model for AUTOMED has been developed.

The new operations model has three main changes. The first is based on the thinking that an ARP based operations model should have a holistic and balanced view of the production, distribution and demand system which again will lead to a more efficient, responsive, leaner, and timeliness supply chain, according to authors like Daugherty et al., 1999; Ellinger et al., 1999; Myers et al., 2000; Sabath et al., 2001. ARPs is said to be pull based meaning that real time demand and customer orders controls the movement of products. However the understanding and practise of the pull and push principles varies and pull principles is often explained in terms of making or delivering products to order as opposed to making them to stock or forecast (Hopp and Spearman, 2004). Aiming to clarify our understanding of the pull principle and how it is used in this situation, since it is an important element in ARPs, we assert that a pull system is one that explicitly limits the amount of work in process that can be in the system and then reacts on the need for replenishment signal. Coordinating supply and demand across the various companies and processes in the supply chain has significant importance in order to secure reliable deliveries of globally produced high value and essential products. Decreased inventory levels, improved utilisation of production capacity, less stock out situations, etc. are some of the effects of an ARP based supply chain.

Secondly, in order to realise the replenishment logic and to extend the effects of replenishment based supply chain, principles, algorithms, and ICT technology allowing automated replenishment processes must be embedded in the system. Thirdly, due to the nature of ARPs processes, organisational structures need to be reengineered in the supply chain. The ARP based operations model for AUTOMED is illustrated in Figure 4.

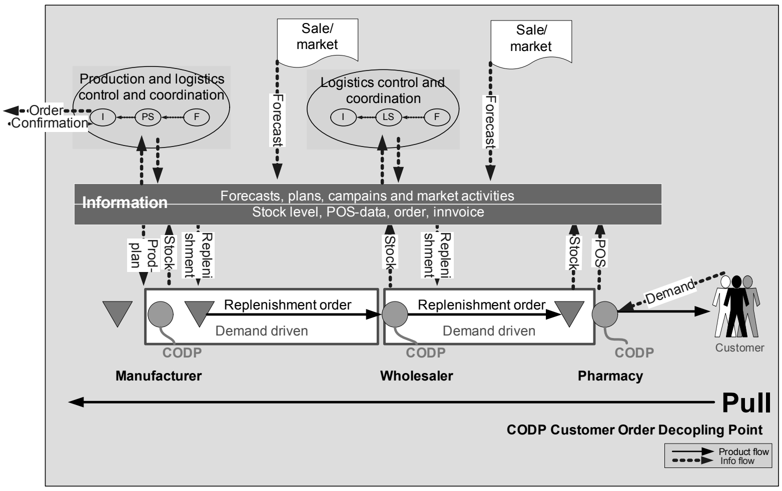

Figure 4: TO-BE ARP based operations model pharmacy industry

Figure 4 shows the reengineered operations model where a pull and automated replenishment driven concept is applied. POS data and stock level information controls the fulfilment of production and shipments in the supply chain. The pharmacies receive shipments from the wholesaler which are automatically calculated. The information is available for the manufacturer which uses it as input for production planning, supply ordering and shipments to the wholesaler. This is illustrated in the rectangular transparent information layer which includes the collection, aggregation, visualisation and sharing of information. The layer is composed of different information categories; operations information as POS data, stock level, etc., and planning and control information as forecasts, campaigns, etc.

The planning and control processes in each company are coordinated and integrated into one process. Between the companies the planning and control activities are joined together in the information layer and carried out thought information exchange and regular control meetings.

An essential element in this ARP based operations model is ICT-solution for information exchange and sharing, as well as for data collection and registration, calculations of replenishment shipments and, automatic processing of information.

CONCLUSIONS

The research issues discussed in this paper is the control aspects of ARPs in the supply chain, and the systematisation of the control elements in an operations model framework for ARP in the pharmacy industry. Traditional supply chain models has a strong focus on integration of processes, technology, etc., however without changing either the way the flow of products and information is controlled, nor the way modern ICT, operations management and control philosophies can contribute to automate the supply and replenishment processes. Automation as a concept is far more developed inside physical company processes as production and warehouse management than it is for administrative and supply chain wide processes.

Due to the replenishment and automation concepts in ARPs this makes it interesting as a new and revitalised supply chain model. What separates ARPs from the traditional supply chain models is that replenishment is triggered by real time demand information supported by information from advanced planning and forecasting techniques and reorder-point-level principles. Build-in mechanisms for new control principles, algorithms, and ICT technology should therefore be developed in ARPs. This information is distributed among the supply chain partners through transparent information systems, and it allows that production, inventory and shipment capacity is adjusted according to end customer demand. The order and purchase process is changed in a way that makes traditional procurement processes redundant. Thus the operations model framework developed for the pharmacy business is a customer driven; pull based and automated replenishment system.

Through the development of an ARP based operations model for the pharmacy business, this paper expands knowledge by explaining how the system should be designed and operated. The paper will contribute to making the concept of automated replenishment, its applicability and important implementation aspects more widespread, thus potentially increasing the application of ARS. This research is limited to the pharmacy business and to pharmaceutical products which are characterised by limited shelf life, imposed and emergency deliveries, etc. Thus further research is suggested on experiences from other industries, and the transferability of this particular operations model to other sectors. Also further developments of the framework to a methodology are needed.

REFERENCES

Adraski, J.C. (1994), “Foundations for Successful Continuous Replenishment Programs,” *The International Journal of Logistics Management,* Vol.5, Issue.1, pp. 1-8.

Alfnes, E. (2005), *Enterprise reengineering: A strategic framework and methodology,* Faculty of Engineering Science and Technology, Department of Production and Quality Engineering. Trondheim, Norwegian University of Science and Technology, NTNU. Doctoral thesis, 2005:153.

Alfnes, E., Strandhagen, J. O. (2000), "Enterprise Design for Mass Customization – The Control Model Methodology," *International Journal of Logistics,* Vol.3, No.2, July.

Andersen, B., Strandhagen, J. O., Haavardtun, L. J. (1998), *Material- og produksjonsstyring*, Cappelen Akademisk Forlag, Oslo.

Busi, M, Dreyer, H.C. (2004), "Collaboration or business as usual? Suggested matrix to categorize and develop collaboration," *Proceedings of the 16th Annual Conference for Nordic Researchers in Logistics.*

Chase, R.B., Jacobs, F.R., Aquilano, N.J (2004), *Operations management for competitive advantage,* Tenth edition, McGraw-Hill.

Chen, F. Drezner, Z., Ryan, J., Simichi-Levi, D. (2000), "Quantifying the Bullwhip Effect in a Simple Supply Chain: The Impact of Forecasting, Lead Times, and Information," *Management Science,* Vol.46, No.3, pp. 436-443.

Daugherty, P. J., Myers, M. B. and Autry, C. W. (1999), "Automatic replenishment programs: An empirical examination," *Journal of Business Logistics,* Vol.20, No.2, pp. 63-82.

Eisenhardt, K. M. (1989), "Building Theories from Case Study Research," *Academy of Management Review,* Vol.14, No.4, pp. 532-550.

Ellinger, E. A., Taylor, C. J. and Daugherty, J. P. (1999), "Automatic replenishment programs and level of involvement: Performance implications," *The International Journal of Logistics Management,* Vol.10, No.1, pp. 25.

Forrester, J. W. (1961), *Industrial Dynamics,* MIT Press, Cambridge, MA.

Holweg, M., Disney, S, Holmström, J, Småros, J. (2005), "Supply Chain Collaboration: Making Sense of the Strategy Continuum," *European Management Journal,* Vol.23, No.2, pp. 170-181.

Hopp, W.J. and Spearman, M.L. (2004), "To Pull or Not to Pull: What is the Question?," *Manufacturing & Service Operations Management,* Vol.6, No.2, pp. 133-148.

www.i2.com

Jagdev, H. S. and Thoben, K.-D. (2001), "Anatomy of enterprise collaborations," *Production Planning & Control,* Vol.12, No.5, pp. 437-451.

Lee, H. L., Padmanabhan, V., Whang, S. (1997), "Information Distortion in a Supply Chain: The Bullwhip Effect," *Management Science,* Vol.43, No.4, pp. 546-558.

Lohtia, R., Xie, T. and Subramaniam, R. (2004), "Efficient consumer response in Japan Industry concerns, current status, benefits, and barriers to implementation," *Journal of Business Research*, Vol.57, pp. 306-311.

Mabert, V. A, Venkataramanan, M. A. (1998), "Special Research Focus on Supply Chain Linkages: Challenges for Design and Management in the 21st Century," *Decision Sciences,* Summer.29, No.3, pp. 537-552.

www.Manugistics.com

Myers, M.B., Daugherty, P.J. and Autry, C.W. (2000), "The effectiveness of Automatic Inventory Replenishment in Supply Chain Operations: Antecedents and Outcomes," *Journal of Retailing*, Vol.76, No.4, pp-455-481.

Quistgaard, T., Grøtte, P. B., Hauknes, B. A., Engh, Ø., Persson, G. (1998), *Håndbok for flytorientert MPS*. Tapir Forlag et. al.

Sabath, R. E., Autry, C. W. and Daugherty, J. P. (2001). "Automatic replenishment programs: The impact of organizational structure," *Journal of Business Logistics,* Vol.22, No.1, pp. 91.

Silberberger, H. (2003), *Business. Erfolgreiche Internetstrategien durch Collaborative Business*. Spinger, Berlin 2003.

Simchi-Levi, D., Kaminsky, P., Simchi-Levi, E. (2003), *Designing and managing the supply chain: concepts, strategies & case studies*. McGraw-Hill.

Slack, N., Chambers, S. and Johnston, R. (2004), *Operations Mangement,* Pearson Education Limited,

Strandhagen, J.O. and Dreyer, H.C. (2006), "An operations model to support manufacturing logistics processes in the supply chain," *To be published in the conference proceeding of the PROLAMAT conference in Shanghai*, June 2006.

Voluntary Industry Commerce Standards (2004). "Collaborative planning, forecasting and replenishment (CPFR): An overview." from http://www.vics.org/committees/cpfr/CPFR_Overview_US-A4.pdf.

Vernadat, F.B. (1996) Enterprise Modelling and Integration: principles and applications. Chap. & Hall.

Waller, D. L. (2003), *Operations Management - a supply chain approach,* International Thomson Business Press.

Yin, R. K. (1994), *Case Study Research: Design and Methods,* Thousand Oaks, CA, Sage Publications, Inc.