MODELING THE INVENTORY COORDINATION DECISIONS IN A MULTI-STAGE SUPPLY CHAIN

MOHAMED ELHASSAN SELIAMAN

UNIVERSITI TEKNOLOGI MALAYSIA

MODELING THE INVENTORY COORDINATION DECISIONS IN A MULTI-STAGE SUPPLY CHAIN

MOHAMED ELHASSAN SELIAMAN

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Computer Science)

Faculty of Computer Science and Information System
Universiti Teknologi Malaysia

APRIL 2010

To my beloved mother and father
To my wife, and children.

ACKNOWLEDGEMENTS

All praise be to Allah Swt for his limitless help and guidance. Peace and blessings of Allah be upon his prophet Mohamed. I feel a deep sense of gratitude towards my supervisor, Associate Professor Dr. Ab Rahman bin Ahmad for his support and patience in coaching me in my research work. A special thanks to Professor Dr. Mohamad Ishak Desa for his valuable comments and feedback on this research. Acknowledgement is also due to Universiti Teknologi Malaysia(UTM) for the help and support.

I am indebted to my dearest family, especially my mother, my father, my wife, and my children Elaf , Ammar, Ahmad and Omar, for their constant love, purity of soul and inspiration to complete this thesis.

ABSTRACT

In the past, supply chain production-inventory decisions were not well-coordinated and information was not shared among the different relevant parties. However, recently, supply chain production and inventory coordination have been getting a lot of attention and because of that, numerous models on how to minimize the supply chain total cost and improve customer service have been developed. Currently, most of these developed models deal with two-stage chains. Although multi-stage supply chains were also considered, most of these developed models were based on certain restrictive assumptions. Therefore, there is a need to analyze models that are not restricted by the usual assumptions as this would allow for a more realistic analysis of the supply chain. The objective of this research is to identify the role of the supply chain decisions in the coordination and optimization of costs and accepted service levels. This was done by formulating mathematical optimization integrated models for the case of multi-stage non-serial supply chains. These models took into account three different inventory coordination mechanisms which were the equal cycle, the integer multipliers and powers of two multipliers. Then, the cost minimization procedures were applied in order to obtain feasible and satisfactory solutions to the problem. Numerical analysis indicated that the use of the integer multipliers coordination mechanism resulted in the lowest total costs. To entice this coordination, a benefit sharing scheme was proposed. In conclusion, the multi-stage supply chain cost efficiency can be improved drastically via centralized inventory coordination, mutual trust and proper coordination using a benefit sharing scheme.

ABSTRAK

Pada masa lalu, keputusan rantaian bekalan inventori-pengeluaran tidak diselaraskan dan maklumat tidak dikongsi di kalangan kumpulan berlainan yang berkaitan. Walau bagaimanapun, kini, penyelarasan rantaian bekalan pengeluaran dan inventori mendapat banyak perhatian, dan pelbagai model telah dibangunkan untuk mencapai kos rantaian bekalan yang minima dan mempertingkatkan perkhidmatan pelanggan. Kebanyakan model yang telah dibangunkan adalah berdasarkan rantaian dua-tahap. Di samping itu, rantaian bekalan pelbagai tahap juga dipertimbangkan dan kebanyakan model yang dibangunkan adalah berdasarkan andaian-andaian yang telah ditetapkan. Oleh itu,terdapat keperluan untuk membina model yang boleh menganalisa dan menerima andaian lain agar analisa yang lebih realistik bagi rantaian bekalan dapat dilakukan. Objektif penyelidikan ini adalah untuk melihat peranan keputusan rantaian bekalan untuk menyelaras dan mengoptimumkan kos dan tahap layanan yang boleh diterimapakai. Ini telah dilakukan dengan merumuskan model bersepadu pengoptimuman matematik untuk kes rantaian bekalan pelbagai tahap dan tak-bersiri. Model-model ini mengambil kira tiga mekanisma koordinasi inventori yang berbeza iaitu kitar sama, pendarab integer, dan kuasa dua pendarab. Kemudian tatacara meminimumkan kos digunakan untuk mendapatkan penyelesaian yang memadai dan memuaskan untuk mengatasi masalah tersebut. Analisa keputusan menunjukkan mekanisma koordinasi pendarab integer menunjukkan jumlah kos paling rendah. Untuk memacu kerjasama seterusnya, skema perkongsian keuntungan telah dicadangkan. Kesimpulannya, kecekapan kos rantaian-bekalan pelbagai tahap boleh dipertingkatkan dengan mendadak melalui koordinasi inventori berpusat, saling percaya dan koordinasi yang terurus menggunakan skema perkongsian keuntungan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIX

CHAPTER 1

INTRODUCTION

1.1 Problem Background

In the past, supply chain production-inventory decisions were not coordinated among the different parties in the supply chain. This lack of coordination leads to weakly connected processes and isolated decisions across the supply chain. Recently firms realized the need to improve their system performance and cost efficiency through closer collaboration among the chain partners and through high level of coordination of various decisions. This tendency towards full integration and close collaboration is also motivated by the significant advances in information and communication technologies, and the growing focus on supply chain management (SCM).

The term Supply chain management seems to have emerged in the late 1980s and since then many definitions of SCM have been proposed (Nahmias, 2001). In this introduction, we will present few of them. According to Stanford Supply chain forum, Supply chain management deals with the management of materials, information and financial flows in a network consisting of suppliers, manufacturers, distributors, and customers. Somichi-Levi et al.(2003) defines supply chain management as a set of approaches utilized to efficiently integrate suppliers, manufactures, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system-wide cost while satisfying service level requirements.

Ross (1998) defines supply chain management as a continuously evolving management philosophy that seeks to unify the collective productive competencies and resources of the business functions found both within the enterprise and outside the firm's allied business partners located along intersecting supply channels into a highly competitive, customer-enriching supply system focused on developing innovative solution and synchronizing the flow of marketplace products, services, and information to create unique individualized sources of customers, Nahmias (2001). Ellram (1991) defines Supply chain management as a coordinated approach for managing the flow of goods from suppliers to ultimate consumers.

Supply chain management is mainly aimed at enhancing the competitive performance of the entire supply chain via efficient integration of the different chain members. This integration includes functional integration, spatial integration, and intertemporal integration. Functional integration refers to integration of purchasing, manufacturing, transportation, warehousing and inventory management activities. Spatial integration refers to integration of these activities across geographically dispersed vendors, facilities and markets. Intertemporal integration refers to the integration of these activities over strategic, tactical, and operational planning horizons (Shapiro, 2001).

In summary, Supply Chain Management (SCM) can be defined as the management of flows of goods between the different stages in a supply chain in order to minimize system-wide cost and satisfy customer requirements.

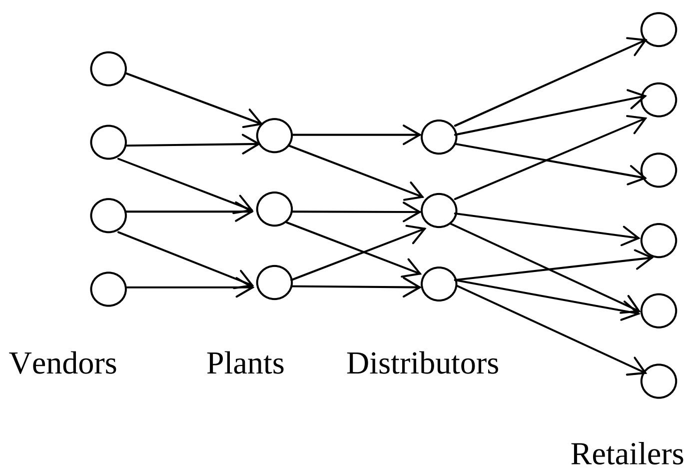

Figure 1.1: Four-stage supply chain network.

The supply chain is often represented as a network like the one displayed in Figure 1.1. The nodes in the network represents the facilities, which are connected by the transportation links that allow the flow of materials, the flow of information and the flow of cash across the chain. Figure 1.1 depicts a supply chain that has four stages, which are vendors, plants distributors and retailers.

1.2 Supply chain modeling

There are variety of supply chain models developed for varying supply chain management and planning objectives. Shapiro (2001) classified mathematical models developed for implementation and application in supply chain management into two main types: descriptive models and optimization models.

Descriptive models are created by modeling practitioners to better understand functional relationship in the supply chain. They include demand forecasting models, cost relationship model, resource utilization relationship models, and supply chain system simulation model. Optimization models are either prescriptive models or normative models. Prescriptive models support the decision making process in identifying a set of decisions that can enhance the supply chain performance. Normative models help in identifying norms that the company should strive (Shapiro, 2001).

1.3 Production-Inventory coordination in the supply chain

Supply chain production-inventory distribution coordination is a centralized planning process that deals with production lot-sizing, production scheduling, shipment quantities, and inventory allocation. In the centralized production and replenishment decision policy, the global supply chain costs are optimized. While in the decentralized production and replenishment decision policy, each participant within the supply chain will consider optimizing its own costs independently.

In recent years numerous articles in supply chain modeling have addressed the issue of inventory-distribution coordination. Several researchers focused on the integrated vendor-buyer inventory and the joint economic lot sizing problem models (see reviews by Ben-Daya et al. 2008; and Khouja and Goyal 2008). Other researchers suggested that the inventory-distribution coordination can be achieved by synchronization of the cycle time across the chain stages. In many cases, pure just-in-time (JIT) schedules using a common synchronized common production-replenishment cycle are found not to be optimal. Therefore other developed supply chain models achieve coordination by following the integer multipliers mechanisms in which the cycle time at each stage is an integer multiple of the cycle time of the adjacent downstream stage (Khouja, 2003).

1.4 Benefits of Inventory Coordination

The benefits of inventory coordination and information sharing among the supply chain participants, have received significant attention in the literature. Research findings in this area revealed that information sharing and coordinated inventory replenishments can help reduce the inventory and order costs as well as transportation costs.

Lee et al. (1997) in their investigation on the bullwhip effect in supply chains reported that lack of information sharing can lead to excessive inventory, poor customer service, lost revenues, unplanned capacities, and ineffective logistics. They recommend avoiding managerial independence by integrating various supply chain functions. They also, recommend that firms need to device strategies that lead to smaller batches or frequent replenishments. Exchange of substantial quantities of information among the buyer, supplier, and carrier can increase the efficiency and effectiveness of the supply chain (Carter et al., 1995). Coordinated replenishment can significantly reduce inventory. Inventory reductions have a significant impact on supply chain activities. Lower inventory levels increase operating revenues and reduce the need for costly facilities (Esper and Williams, 2003).

Chen and Chen (2005) investigated the centralized, coordinated replenishment policy and the decentralized replenishment policy in a two-echelon, multi item supply chain. They determined the optimal common replenishment cycle for end items and the integer multiples of the common replenishment cycle for raw materials. They pointed out that a centralized, coordinated replenishment policy was always found to be superior to the decentralized replenishment policy in terms of cost reduction, especially when major setup costs were high.

1.5 Problem Statement

In the past, supply chain production-inventory decisions were not coordinated and information was not shared among the different parties in the supply chain. This lack of coordination leads to weakly connected activities and decisions across the supply chain. Today, timely sharing and coordination of information across the supply chains in addition to the emerging electronic commerce capabilities have changed the way supply chains operate. The global visibility of production-inventory profiles across the supply chain leads to coordinated decisions and in turn to reduced costs and improved customer service.

In recent years, supply chain production and inventory coordination received a lot of attention. Most of the developed models deal with two-stage chains. Even when multi-stage supply chains are considered, most of the developed models are based on restrictive assumptions such as the deterministic demand. Therefore, there is a need to analyze models that relax the usual assumptions to allow for a more realistic analysis of the supply chain. This research extends previous work in the inventory coordination in multi-stage supply chains, and to address the following research questions:

i. How can the supply chain network configured for better coordination?
ii. How to develop algebraic model to drive the optimal replenishment policy for the multi-stage supply chain?

iii. What is the effect of stochastic demand on modeling inventory coordination in multi-stage supply chains ?

iv. How can the benefits resulting from inventory coordination be shared among the supply chain partners?

1.6 Objectives of the Study

The proposed research aims at answering questions about how supply chain decisions can be coordinated and optimized to maintain low costs and accepted service levels. The ultimate objective for this research is to develop mathematical optimization models that can be utilized to efficiently coordinate and integrate the production-inventory decisions among the supply chain partners. These partners are suppliers, manufactures, distributors/warehouses, and stores/retailers. However, such collaboration among the supply chain partners requires mutual trust and coordination benefit sharing scheme. Therefore, this research also aims to develop a benefit sharing scheme to entice the production-inventory coordination across the entire supply chain.

To achieve this objective a multi-stage, non-serial supply chain model will be formulated first, and then cost minimization procedures will be proposed to obtain feasible and satisfactory solutions to the problem. Subsidiary objectives to achieve this main objective include:

1. To develop quantitative stochastic models for the multi-stage supply chains. These models will take in to account different inventory coordination mechanism.
2. To develop a mathematical model that can be used to support supply chain strategic policy making such as network reconfiguration.
3. To develop a benefits sharing scheme.

1.7 The Scope of the Study

In this research work we consider the case of a multi-stage supply chain where a firm can supply many customers. This supply chain system consists of suppliers, manufactures, distributors and retailers. The production rates for the suppliers and manufactures are assumed finite. In addition the demand for each firm is assumed to be stochastic. The problem is to coordinate production and inventory decisions across the supply chain so that the total cost of the system is minimized. The model is developed under the following assumptions:

(a) A single product is produced and distributed through a four stage, multi customer, non-serial , supply chain
(b) Production rates are deterministic and uniform
(c) Demand rates are stochastic
(d) Unsatisfied demands at the end retailers are backordered
(e) Ordering /setup costs are the same for firms at the same stage
(f) Holding costs cost are the same for firms at the same stage
(g) Shortage costs are the same for firms at the same stage
(h) A lot produced at stage is sent in equal shipments to the downstream stage.

1.8 Significance of the Study

As mentioned earlier numerous articles in supply chain modeling have been written in response to the global competition. However, most of the developed supply chain inventory models deal with two-stage supply chains. Even when multi-stage supply chains are considered, most of the developed models are based on restrictive assumptions such as of the deterministic demand. But Supply chains are stochastic in nature. Therefore, there is a need to analyze models that relax the usual assumptions to allow for a more realistic analysis of the supply chain inventory coordination.

1.9 Organization of the Thesis

This thesis on multi-stage supply chain inventory coordination is presented in seven chapters. The organization of the report is as follows: chapter 1 is dedicated to give brief introduction the supply chain inventory coordination, statement of the problem, objective of the study, scope of the study, and organization of the thesis.

Chapter 2 provides a review of the research on supply chain inventory modeling. This review included contributions related to two stage supply chains as well as multi-stage supply chain models.

Chapter 3 presents the mathematical description of the problem and the methodology that the researcher used in this research work. It also describes the different inventory coordination mechanisms.

In chapter 4, extensions of the deterministic multi-stage supply chain models are presented. A mathematical model that can help in the integrated design of strategic supply chain networks and the determination of tactical production-inventory decisions is also presented in this chapter.

Chapter 5 describes a stochastic four-stage supply chain model and presents a solution procedure.

Chapter 6 presents the validation of the developed models.

Chapter 7 summarizes this research, outlines the major contributions, and presents its conclusion remarks and recommendations for future research.

1.10 Summary

With the growing focus on supply chain management (SCM), firms realized the need to improve their cost efficiency through closer collaboration among the chain partners and through high level of coordination of various decisions. This efficient supply chain coordination requires that the flow of products and information among the supply chain members is managed in cooperative manner.

This research study is dealing with the problem of coordinating production and inventory decisions across the multi-stage supply chain so that the total cost of the system is minimized. For this purpose, we develop mathematical models to deal with different inventory coordination mechanisms between the chain members.

REFERENCES

Ab Rahman, A., and Seliaman, M. E. (2007). Reconfiguring the Supply Chain Network for Better Coordination. In the Proceedings of the International Conference of Mathematical Sciences. Bangi-Putrajaya, Malaysia.

Al-Fawzan,, M., A.(1997). Mathematical Models for quality in Multi-Stage Production Systems. Ph.D. dissertation. King Fahd University of Peteroleum and Minerals.

Al-Sultan, K.S. and Al-Fawzan, M.A. (1997). A tabu search Hooke and Jeeves algorithm for unconstrained optimization. *European Journal of Operational Research.* 103 :198–208.

Axsater, S. (2000). Inventory Control. Kluwer Academic Publishers Boston/Dordech/ London.

Banerjee, A. (1986). A Joint Economic-Lot-Size Model for Purchaser and Vendor. *Decision Sciences*. 17: 292-311.

Banerjee, A., Jonathan, B., and Banerjee, S. (2003). Simulation Study of Lateral Shipments in Single Supplier, Multiple Buyers Supply Chain Networks. *International Journal of Production Economics,* Amsterdam: 81/82 : 103.

Barnes-Schuster, D., Bassok, Y., and Anupindi, R. (2006). Optimizing Delivery Lead time /Inventory Placement in a Two-Stage Production/Distribution System. *European Journal of Operational Research*. 174:1664-1684.

Ben-Daya, M., Darwish, M., and Ertogral, K. (2008). The joint economic lot sizing problem: Review and extensions. *European Journal of Operational Research*. 185 : 726–742.

Ben-daya, M., Al-Nassar, A., (2008). Integrated multi-stage multi-customer supply chain. *Production Planning and Control the Management of Operations*. 19 (2):97–104.

Cárdenas-Barrón, L. E. (2006). Optimizing Inventory Decisions in a Multi-stage Multi-Customer Supply Chain: A Note. *Transportation Research Part E: Logistics and Transportation Review*. 43 (5):647–654..

Carter, J., R, Ferrin, B. G, Carter, C. R. (1995). The effect of less-than-truckload rates on the purchase order lot size decision. *Transportation Journal*. Lock Haven. 34(3) pg. 35-45.

Chelouah R. and Siarry, P. (2000). Tabu Search applied to global optimization *European Journal of Operational Research*. 123:256-270.

Chelouah R. and Siarry, P. (2005). A hybrid method combining continuous tabu search and Nelder–Mead simplex algorithms for the global optimization of multiminima functions. *European Journal of Operational Research*. 161: 636–654.

Chen ,J., and Chen, T. (2005). The Multi-Item Replenishment Problem in a Two-Echelon Supply Chain: The Effect of Centralization versus Decentralization. *Computers & Operations Research*. 32: 3191–3207

Chen, T., and Chen, J. (2005). Optimizing supply chain collaboration based on joint replenishment and channel coordination. *Transportation Research Part E: Logistics and Transportation Review*. 41(4): 261-285

Chiu, S.W. (2008). Production lot size problem with failure in repair and backlogging derived without derivatives. *European Journal of Operational Research*. 188(2),pp 610-615.

Chung, C. J. and Wee, H. M. (2007). Optimizing the Economic Lot Size of a Three-Stage Supply Chain with Backordering Derived without Derivatives. *European Journal of Operational Research*. 183:933-943

Ding , D. and Chen, J. (2008)Coordinating a three level supply chain with flexible return policies. *Omega*. 36: 865–876.

Dumrongsiri , A., Fana, M., Jaina, A. and Moinzadeha, A. (2006). A supply chain model with direct and retail channels. *European Journal of Operational Research*. 187(3): 691-718.

El Saadanya, A. M., Jaber, M. Y. (2008). Coordinating a two-level supply chain with production interruptions to restore process quality. *Computers & Industrial Engineering*. 54(1),pp. 95-109.

Ellram, L.M. (1991).Supply Chain Management: The Industrial Organization Perspective. *International Journal of Physical Distribution and Logistics Management*. 21(1): 13-22.

Ertogral, K., Darwish, M., Ben-Daya, M. (2007). Production and Shipment Lot Sizing in a Vendor-Buyer Supply Chain with Transportation Cost. *European Journal of Operational Research*. 176:1592-1606.

Esper, T.,L. and Williams L., R.(2003). The value of Collaborative Transportation Management (CTM): Its relationship to CPFR and information technology. *Transportation Journa*l. Lock Haven. 42(4): 55

Farahania, R. Z. and Elahipanaha, M. (2008). Genetic algorithm to optimize the total cost and service level for just-in-time distribution in a supply chain. *International Journal of Production Economics*. 111(2),pp. 229-243.

Glover, F. (1989).Tabu search. Part I. *ORSA Journal on Computing* .1 (3): 190-206.

Glover, F., and Laguna, M. (1997). Tabu Search. Kluwer Academic Publishers.

Goyal, S.K. (1995). A One-Vendor Multi-Buyer Integrated Inventory Model: A Comment. *European Journal of Operational Research*. 82: 209-210.

Goyal, S.K. and Gupta Y.P. (1989). Integrated inventory models: The buyer-vendor Coordination. *European Journal of Operational Research*. 41: 261-269.

Goyal, S.K. and Nebebe, F. (2000). Determination of Economic Production-Shipment Policy for a Single-Vendor Single-Buyer System. *European Journal of Operational Research*. 121: 175-178.

Goyal, S.K. and Szendrovits A.Z.,(1986). A Constant Lot Size Model with Equal and Unequal Sized Batch Shipments between Production Stages. *Engineering Costs and Production Economics*. 10: 203-210.

Goyal, S.K., (1976). An Integrated Inventory Model for a Single Supplier-Single Customer Problem. *International Journal of Production Research*.: 107-111

Ha, D. and Kim, S. (1997). Implementation of JIT Purchasing: An Integrated Approach. *Production Planning & Control* .8:152-157.

Han , C. (2005). Stochastic modeling of a two-echelon multiple sourcing supply chain system with genetic algorithm. *Journal of Manufacturing Technology Management.* 16(1): 87-108.

Hedar, A. and Fukushima, M. (2006). Tabu Search directed by direct search methods for nonlinear global optimization. *European Journal of Operational Research*. 170: 329–349.

Hill, R.M. (1997). The-single vendor single-buyer integrated production-inventory model with a generalized policy. *European Journal of Operational Research*.7: 493-499.

Hill, R.M. (1999). The optimal production and shipment policy for the single-vendor single-buyer integrated production-inventory problem. *International Journal of Production Research*. 37: 2463-2475

Hooke, R. and Jeeves, T. A. (1961). Direct Search Solution of Numerical and Statistical Problems. *Journal of the Association for Computing Machinery*. 212-229.

Hoque, M. A. (2008). Synchronization in the single-manufacturer multi-buyer integrated inventory supply chain. *European Journal of Operational Research*. 188: 811–825.

Houqe, M.A. and Goyal, S.K. (2000). An optimal policy for a single-vendor single-buyer integrated production-inventory system with capacity constraint of the transport equipment. *International; Journal of Production Economics* 65. pp 305-315.

Hua, Z. and Li, S. (2008). Impacts of demand uncertainty on retailer's dominance and manufacturer-retailer supply chain cooperation. *Omega* 36 : 697–714.

Hwarang, H., Chong, C, Xie, N. and Burgess, T.(2005). Modeling Compless supply chain: Understanding the Effect of Simplified assumptions. *International Journal of Production research*. 43(13) 2829-2872

Jaber, M. and Rosen, M. A. (2007). The economic order quantity repair and waste disposal mode. *European Journal of Operational Research.*188(1), pp. 109-120.

Karabatı, S., and Sayına, S. (2008). Single-supplier/multiple-buyer supply chain coordination: Incorporating buyers' expectations under vertical information sharing. *European Journal of Operational Research*. 187(3)pp. 746-764.

Khouja, M. and Goyal, S.(2008). A review of the joint replenishment problem literature: 1989-2005. *European Journal of Operational Research*. 186:1-16

Khouja., M. (2003) Optimizing Inventory Decisions in a Multi-Stage Multi-Customer Supply Chain. *Transportation Research. Part E, Logistics & Transportation Review*. Exeter. 193-208.

Kim, S., W. and Park, S. (2008). Development of a Three-Echelon SC Model to Optimize Coordination Costs. *European Journal of Operational Research*.184:1044-1061.

Kit-Nam Francis Leung (2008).Using the complete squares method to analyze a lot size model when the quantity backordered and the quantity received are both uncertain. *European Journal of Operational Research*. 187(1)pp:

Lee ,H.L., Padmanabhan, V. Whang, S. (1997). The Bullwhip Effect in Supply Chains. *Sloan Management Review*. 93-102.

Lee, H. T., Wu, J.C.(2006) A study on inventory replenishment policies in a two-echelon supply chain system. *Computers & Industrial Engineering* 51 : 257–263.

Lee, Young Hae , Cho, Min Kwan; Kim, Yun Bae. (2002). A Discrete-Continuous Combined Modeling Approach for Supply Chain Simulation. *Simulation*. 78(5): 321-329.

Li, J., and Liu, L. (2006). Supply chain coordination with quantity discount policy. *Int. J. Production Economics*.101:89–98.

Long, Z., Shiji , S., and Cheng , W. (2005). Supply Chain Coordination of Loss-Averse Newsvendor with Contract. *Tsinghua Science &Technology*. 10(2): 133-140.

Lu, L.(1995). A One-Vendor Multi-buyer Integrated Inventory Model. *European Journal of Operational Research*. 81: 312-323.

Man-Yi, T., and Xiao-Wo, T. (2006). The Further Study of Safety Stock under Uncertain Environment . *Fuzzy Optimization and Decision Makin*g. 5(2): 193-202.

Nagarajan, M. and Sošić, G. (2008).Game-theoretic analysis of cooperation among supply chain agents: Review and extensions. *European Journal of Operational Research*. 187(3), pp. 719-745.

Nahmias, S. (2001). *Production and Operations Analysis*. Fourth Edition McGraw-Hill/Irwin

Ouenniche, J. and Boctor, F. F. (2001). The multi-product, economic lot-sizingproblem in flow shops:the powers-of-two heuristic. *Computers & Operations Research*. 28:1165-1182.

Pujaria, N. A., Trevor, S. and Faizul Huq. (2008). A continuous approximation procedure for determining inventory distribution schemas within supply chains. *European Journal of Operational Research*. 186(1),pp. 405-422 .

Rajesh., P., Viswanathan., S.(2003). A Model for Evaluating Supplier-Owned Inventory Strategy. *International Journal of Production Economics,* Amsterdam. 81/82: 565

Rau, H. and OuYang, B. C. (2008).An optimal batch size for integrated production–inventory policy in a supply chain. *European Journal of Operational Research.* 185(2),pp 619-634.

Ross, D.(1998). Competing Through Supply Chain Management: Creating Market-Winning Strategies Through Supply Chain Partnerships. New York: Chapman & Hill.

Santos, T., Ahmed, S., Goetschalckx, M., and Shsairo, A. (2005) . A Stochastic Programming Approach for Supply Chain Network Design under Uncertainty. *European Journal of Operational Research*. 167:96-115.

Sarmah, S.P., Acharya, D., and Goyal, S.K.(2006). Buyer vendor coordination models in supply chain management. *European Journal of Operational Research*.175: 1–15.

Scott, J. M., P Mauricio, R., Jennifer, A. F, and Randall, G. K. (2003). Integrating the Warehousing and Transportation Functions of the Supply Chain. *Transportation Research. Part E, Logistics & Transportation Review,* Exeter. 39(2): 141.

Seliaman, M. E., and Ab Rahman, A. (2008a). Optimizing inventory decisions in a multi-stage supply chain under stochastic demands. *Applied Mathematics and Computation* Elsevier Inc. 206(2): pp.538-542

Seliaman, M. E., and Ab Rahman, A.(2008b). Proposed Scheme for Sharing the Benefits of the Supply Chain Coordination. In the Proceedings of ICMSAO' 09 , JANUARY 20-22 2009 , SHARJAH,

Seliaman, M. E., and Ab Rahman, A. (2008c) A Generalized Algebraic Model for Optimizing Inventory Decisions in a Multi-Stage Complex Supply Chain.. *Transportation Research Part E*. Elsevier Inc. 45:pp.409-418.

Seliaman, M. E., and Ab Rahman,(2007). Simulation Analysis of a Perishable Supply Chain. In the proceedings of The Fourth Saudi Technical Conference and Exhibition, 02-06 December 2006, Riyadh, Kingdom of Saudi Arabia.

Seliaman, M. E., and Ab Rahman,(2008d) A.Modeling the Coordinated Supply Chain Network. Accepted for publication in Journal of Quality Measurement and Analysis (JQMA).

Shapiro, J. F. (2001). *Modeling the Supply Chain*. First Edition, DUXBURY, Thomson Learning.

Simch-Levi, D. Kaminsky, P. and Simch-Levi, E (2003) *Designing &Managing the Supply Chain: Concepts , Strategies, and Case Studies*. Second Edition, McGraw-Hill.

Smitha, S., Petty, D., Trustrum, D., Labib, A. and Khan, A.(2008). A supply network-modeling system for a small- to medium-sized manufacturing company. *Robotics and Computer-Integrated Manufacturing*. In Press. Corrected Proof.

Steven, G.C. (1989). Integrating the Supply Chain. *International Journal of Physical Distribution and Logistics Management*. 8(8): 3-8.

Tee, Y. and Rossetti,M. (2002). A Robustness Study of a Multi-echelon Inventory Model vi Simulation. *International Journal of Production Economics*. 80: 265-277

Tempelmeier, H. (2006). On the Stochastic Uncapacitated Dynamic Single-Item Lotsizing Problem with Service Level Constraints. *European Journal of Operational Research*.

Tsiakis, P., and Papageorgiou, L. G. (2008). Optimal production allocation and distribution supply chain networks. *International Journal of Production Economics*. 111(2) 468-483.

Viswanathan, S.(1998). Optimal Strategy for the Integrated Vendor-Buyer Inventory Model. *European Journal of Operational Research*. 105: 38-42.

Waller, M., Johnson, M. ., Davis, T. (1999). Vendor-managed inventory in the retail supply chain. *Journal of Business Logistics*. Oak Brook: 20(1) 183-2 04.

Wee, H. M., and Chung, C. J. (2007). Note on the economic lot size of the integrated vendor–buyer inventory system derived without derivatives. *European Journal of Operational Research*.177 (2), pp: 1289-1293.

Weng, Z. K., and McClurg, T. (2003). Coordinating Ordering Decisions for Short Life cycle Products with Uncertain in Delivery Time and Demand. *European Journal of Operational Research*. 151:12-24.

Yao , M., and Chiou, C. (2004). On a replenishment coordination model in an integrated supply chain with one vendor and multiple buyers. *European Journal of Operational Research*. 159(2): 406-419.

Yao, M. and Elmaghraby, S. E.(2001). The Economic Lot Scheduling Problem under Power-Of-Two Policy. *Computers and Mathematics with Applications*. 41: 1379-1393.