

# **Consignment Inventory: Review and Critique of Literature**

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# ABSTRACT

Consignment inventory (CI) is a supply chain business partnership where the customer orders to the vendor, but delays paying for goods. In CI, like the traditional systems, each member has authority over the timing and quantity of replenishments; however, these systems differ in time of transferring ownership. Previous researches showed different approaches for delay in payment in customer managed inventory systems: (1) pay as sold, (2) pay as sold during a predefined period, (3) pay after a predefined period and (4) order to order consignment.

Each of the mentioned approaches can be considered as delay in payments in CI, though in most studies, it mainly included the first aforementioned category. In this type, CI was mostly taken to be synonymous with vendor managed inventory (VMI) or consignment vendor managed inventory (C&VMI). Besides, the area of trade credit, which is based on the second and third types of delay in payment, has received the attention of many researchers, although no work has considered trade credit as one of the states of CI.

In this paper, firstly we extracted CI from existing literature of VMI and C&VMI. Secondly, a classification of CI related studies was provided based on delay in payments.

KEYWORDS: Supply chain management; consignment inventory; delay in payment; trade credit.

# 1. INTRODUCTION

Conventionally, managers' decisions are limited only to a facility, and their main concern in decision making is also restricted to a company's benefit. However, in today's competitive environment, industries face major challenges in highly maintaining profitability and are rapidly moving away from the traditional decision making style, so-called manufacturing sale by[1]toward a coordinated one. The goal of this transition is to optimize total expected supply chain profit by changing focus from a single facility into the consideration of the entire system.

One of the supply chain coordination mechanisms that has received heavy attention in recent researches is VMI. The concept of VMI mainly focuses on sharing information among supply chain partners for improving the efficiency of supply chain management. VMI is a partnership to coordinate replenishment decisions in a supply chain while maintaining the independence of chain members. Under the VMI partnership, a vendor orders on behalf of the retailer so that the retailer can lessen the burden of inventory management and the vendor can benefit from flexible order replenishment and delivery (Detailed reviews in [3]and[3]).

CI is another coordination mechanism between vendor and customer where unlike VMI, the customer has authority over the timing and quantity of replenishments. In CI the customer does not expend his capital in inventory and delays paying for the goods. One of the major goals of this study is to review existing literature of delay in payment. For this purpose, CI is categorized into four types, (1) pay as sold (real time), (2) pay as sold during a predefined period, (3) ownership changes after a predefined period and (4) order to order consignment (when next consignment order is placed, previous is billed).

However, in CI related studies, the first type is mainly considered as the time of payment. Meanwhile, the second and third types are exactly considered in trade credit area, and no works have notified trade credit as one of the states of CI.

CI mostly benefits the customer when final demand is unknown, since it allows the customer to hedge against uncertainties in production and sales. There are also some benefits for the vendor in CI system; CI enables the vendor to create new sales channels when he offers new and unproven products that the customer hesitates to buy, or expensive items difficult for the customer to own. Furthermore, when there is a power differential between a weak vendor and a stronger customer, vendor can apply CI to meet customer's wishes.

Combination of the two mentioned mechanisms leads to the other supply chain practice called C&VMI which is considered as one of the states of VMI. Under C&VMI, the vendor takes full responsibilities for managing inventory of the retailer like VMI, and as in CI the retailer defers paying for goods. In the literature, CI is often taken to be synonymous with VMI or C&VMI. Hence the other goal of this paper is to extract CI from existing literature of VMI and C&VMI.

Previous approaches toward delay in payment literature have not considered the four aforementioned types of delay in payments as consignment inventory contract. The scientific contributions of the paper are: 1) integrating CI related studies based on the time of ownership transformation 2) delimiting CI from VMI and C&VMI studies.

The paper is organized as follows. Section 2 distinguishes CI from C&VMI. In section 3, we provide a classification of CI studies. Section 4 concludes the paper, and gives some further research directions.

## 2. DELIMITING CI FROM C&VMI

In most researches C&VMI is assumed as consignment inventory. There is, however, a major difference between C&VMI and CI; In C&VMI, the vendor has full responsibilities for managing inventory of the retailer and is responsible for the timing and quantity of orders, but in CI each member is in charge of his own replenishment costs.

[4]formulate nonlinear programming to obtain optimal solutions of replenishment cycles and safety stock level under C&VMI system.[5]examine decentralized C&VMI problem and specify a measurement scheme that helps to align the incentives of the multiple site managers so that the overall supply chain efficiency can be enhanced.[6] formulates the order quantity and reorder point problem as a principal-agent model and examines the impact of consignment stock on the supply chain performance.[7] explore the economics of C&VMI in the short and long terms. They formulate appropriate mathematical models for a buyer–supplier channel structure and examine the effects of a C&VMI strategy on the various cost components of both parties.

[8] study a C&VMI system under deterministic but price-sensitive demand. They use wholesaler- owned inventory with delayed payment and analyse the impacts of coordinating pricing and replenishment when decisions are made jointly. [9]consider a retailer selling newspaper, and a publisher under C&VMI when reported demand cannot be verified. They analyse the impacts of VMI and revenue sharing on coordination of the retailer's sales reports (to the publisher). An analytical model is offered by [10] with reference to the industrial case of a single-vendor and multiple-buyer. They analyse the advantages and disadvantages of C&VMI and compare it numerically with [11]'s solution.[12] study a C&VMI agreement where the supplier controls inventory replenishment, and the retailer determines the product price and characterizes the solution to both centralized and decentralized systems.

[13] develop a supply chain model under consignment contract where the manufacturer determines the retail price and delivery of the quantity, and the retailer pays for the product and shares a percentage from the selling price to the manufacturer after it is sold to her customer. They apply stackelberg game to specify the percentage allocation of sales revenue between the retailer (leader) and the manufacturer (follower).[14] propose an analytical model able to consider the effects of obsolescence in a single-vendor, single-buyer supply chain managed with a C&VMI policy. They compare the results with a non-obsolescence optimal solution available in the literature and demonstrate that the effects of obsolescence can consistently influence the global optimum condition.[15]provide an extension to the above-mentioned study and introduce stock-out risk arising from demand variability, obsolescence of materials and finite warehouse capacity at a buyer's plant in industrial environments.[16]also extend [14] by developing an analytical model where a vendor supplies the same product to multiple buyers.[17] study the effect of learning and forgetting on a vendor's production process in a two-level supply chain under C&VMI policy. [18]consider a two echelon supply chain where a manufacturer produces a single deteriorating product and supplies it to the buyer based on C&VMI policy. They minimize the manufacturer's total cost in an integrated model to determine production batch and the replenishment lot sizes.

## 3. CLASSIFICATION OF CONSIGNMENT INVENTORY STUDIES

This section itemizes CI studies based on the types of consignment that are in common practice identified by Piasecki [19].

#### 3.1. PAY AS SOLD

In this type of arrangement, which has extensively been ignored, the ownership and payment are being exchanged at the moment when the goods are consumed by the customer. Figure1 illustrates the time of transferring the ownership in this type of consignment contract. [20] analyze this type of CI in a supply chain under deterministic demand and provide general conditions under which CI benefits the vendor, the customer, and the two parties together. They also consider C&VMI and extend their analysis to find the optimal policies and potential savings under that agreement. [21] obtain replenishment intervals and retail prices in a two echelon supply chain under CI contract where multiple retailers with deterministic demand pay to upstream (a warehouse) after selling the products. A game-theoretic model is built in [22] to investigate and compare the impacts of CI and C&VMI policies on a single-vendor single-buyer supply chain. They conclude that the supply chain loses less profit in C&VMI, where the vendor determines the inventory level, than in CI, where the buyer is responsible for his time and quantity of orders. [23] concentrate on two special types of payment arrangement in CI named consignment price contract and consignment contract with revenue share. They investigate the influence of competition among retailers under these two different payment schemes. They apply a supplier-Stackelberg game to analyze the channel decisions and performance.



Figure 1 Pay as sold scheme

## **3.2. PAY AS SOLD DURING A PREDEFINED PERIOD**

In this type, during a predefined period, the customer should pay for goods when they leave his warehouse for sale or manufacturing. If the goods stored at the customer's site are not consumed within the predefined period, the customer has to face a choice to either take the ownership of the goods and make the payment or let the vendor take the goods back.

[24] presents the discounted cash-flows (DCF) approach for the analysis of the optimal inventory policy in the presence of the trade credit. He considers that during the credit period, the firm makes payment to the supplier immediately after the use, and on the last day of this period pays the remaining balance. [25] extend [24]to develop an inventory model for obtaining the optimal order quantity of deteriorating items. [26] generalize [25] by applying credit terms for large order quantities. [27]incorporate all concepts of DCF approach, trade credit and the quantity ordered and develop a new model to generalize [24].[28]propose a simple algorithm to improve the optimal solutions obtained by [25].

#### **3.3. OWNERSHIP CHANGES AFTER A PREDEFINED PERIOD**

In this contract, which is mostly called trade credit in the literature, the supplier allows a certain fixed credit period to settle the account for stimulating retailer's demand. During this credit period, the retailer can start to accumulate revenues from the sales and earn interest on that revenue, but beyond this period the supplier charges interest. During the past few years, many researches have been done dealing with various inventory models under trade credit.

[29]and [30]consider the lot-sizing problem faced by a buyer under trade credit financing undertow situations: firstly, the credit period is greater than or equal to the cycle time and secondly, it is smaller than the cycle time. They show that when demand is fixed, the buyer's lot size is invariant to the length of the credit period.[31]suggest using a discounted price for the product. With this price, they have been able to derive a lot-size formula which depends on the credit period even for the case of equal interest rates.[32] shows that the best order quantity is an increasing function of the permitted delay in payment and discusses an alternative approach to the trade credit problem suggested by [31].

[33] considers the pricing and the lot-sizing problem under conditions of price sensitive demand and permissible delay in payment. He shows that when the end demand is price sensitive, the lot size for the buyer is not invariant to the length of the credit period.[34]develops a theorem to determine the economic order quantity by showing the convexity of the total annual variable cost function. In his article, a simple procedure is presented to simplify the solution procedure described in [30].[35]study the problem of order-size-dependent delay in payments and formulate two types of mathematical models from which algorithms are derived based on properties of an optimal solution. [36]show the unit price and the length of the credit period offered by the seller to the buyer influence the final demand. The authors formulate a model to determine the best policies of seller and buyer under non-cooperative and cooperative relationships. [37] generalize Goyal's EOQ model to an EPQ model in which the selling price is the same as the purchase cost. [38]extend Goyal's model by considering that the supplier would offer a credit period to the retailer, and the retailer would offer the similar trade credit to his/her customer. He models the retailer's inventory system as a cost minimization problem to determine the retailer's optimal ordering policies. [39]investigate the effect of fixed permissible delay in payments on ordering policies for an (s, S) inventory model where stock is reviewed periodically. The performance of the model is validated using a custom-built simulation program. [40]develop [30]'s model by considering order-size-dependent delay in payments and demonstrate that the optimal cycle time is not longer than that of [30]'s model. [41] propose a centralized model in a two-echelon supply chain where the permissible delay in payments is considered as a decision variable. They indicate that the retailer orders in larger quantities than its economic order quantity, with savings to either both members, or to one in the supply chain. [42]modifies[38] to incorporate a retailer's storage space limitation into the model.

[43] establish an EOQ model for a retailer when the supplier offers a progressive interest charge. They establish the necessary and sufficient conditions for the unique optimal replenishment interval, and obtain the explicit closed-form optimal solution. [44] further incorporates both [37]and [38], and develops the retailer's inventory system as a cost minimization problem to determine the retailer's optimal replenishment decisions within the EPQ framework. [45] establish an EOQ model with two-level trade credit where the trade credit period offered by the supplier is not necessarily longer than the trade credit period offered by the retailer.

[46]study the concept of credit-linked demand and develop an inventory model under two levels of trade credit policy in which the supplier would offer a fixed credit period to the retailer and also the retailer would suggest credit period to its customers. [47] develop a simple theoretical model with a stochastic demand framework that captures the trade-off between inventories and trade credit. [48]incorporate shortages a new inventory model to generalize [30]'s model and show that the total annual variable cost function possesses some kinds of convexities. [49]modifies[44]by relaxing the assumption that the trade credit period offered by the supplier is longer than the trade credit period offered by the retailer. [50]modify[38]'s model by developing optimal wholesaler's replenishment decisions under two levels of trade credit policy depending on the order quantity.[51] propose a two-level trade credit model in an EPQ framework. In two-level trade credit not only the supplier offers a credit period to the vendor but also the vendor proposes a delay period to his customers. They determine the optimal replenishment decisions with the existence of defective items.

[52] obtains optimal cycle time in an inventory model under trade credit which embodies logistic risk considerations from both risk-neutral and risk-averse perspective. [53] establishes a two-level trade credit policy where the retailer's credit period can be smaller or greater than the customers' credit period, unlike the previous studies where the retailer's credit period was generally longer. He also assumes that demand is dependent on retail price and customers' credit time. [54] incorporate the studies conducted by [68] and [70] to investigate the replenishment cycle time and the order lot-size. They analyze the model to identify whether it is economical for the retailers to rent an additional warehouse to benefit from trade credit contract. [55] develop an EOQ model under trade credit financing by introducing a linear time-increasing demand function which warrants the growth stage of a product life cycle. [56] propose a two-level trade credit inventory model in which the retailer receives batches containing defective items. Moreover, the customers' demand rate is assumed to be linked to the length of the credit

period offered by the retailer. [57] consider optimization model in a two-echelon supply chain with credit period and weight freight cost discount. They study the effects of credit period, multi-item replenishment and pricing from both individual and channel perspectives. [58] formulate an EOQ inventory model under partial trade credit, where a fraction of the costs must be paid at the beginning of the period, and partial shortage, including both backorders and lost sales to find the optimal replenishment decisions and shortage level.

Some researchers have also adopted trade credit for deteriorating items. Deteriorating items are the goods such as gasoline, fruits, fresh fishes, etc. which decay during their storage period.[59] consider the inventory model with an exponential deterioration rate under the condition of permissible delay in payments. [60]consider the lot-sizing problem for a deteriorating item under conditions of fixed demand and allowable delay in payment. [61] extend [30]'s model to the case of deterioration. [62] and[63] further generalize the model with allowing for shortages. [64] consider a model in which the deterioration rate is constant, and the customer has a fixed period to settle the account with the supplier. [65]develop a model to determine an optimal ordering policy for deteriorating items under inflation, permissible delay in payment and permissible shortage. They show that the optimal order quantity and maximum allowable shortage vary with the difference between inflation and time discount. [66]investigate the model of [59] with the assumption of inflation and initial-stock-dependent consumption rate.[67]establish an EOQ model for constantly deteriorating items when the supplier provides a cash discount and a permissible delay to the customer. They compare the optimal order quantity under supplier credits to the classical economic order quantity.[68] determine EOQ in a two storage facility, one owned warehouse and one rented, under the order-size-dependent trade credit for deteriorating items.

[69]extend [62] model by fuzzifying the carrying cost rate, interest paid rate and interest earned rate simultaneously, based on the interval-valued fuzzy numbers and triangular fuzzy number to fit the real world.[70] assume two different warehouses, one rented and the other owned. The rented warehouse is applied when inventory exceeds the owned warehouse. They determine the optimal cycle time for deteriorating item under trade credit approach.[71] also refer to [38]'s model by developing a two-warehouse inventory model for deteriorating items under permissible delay in payments. [72]extend [67] by considering a deteriorating item that follows an exponential distribution. With convexity of the total variable cost, they find the optimal ordering policy and compare the results with that of [67].[73] develops an EPQ model for exponentially deteriorating items under the two-level trade credit policy and generalizes[38]. [74]establish an EOQ model for deteriorating items in a twolevel trade credit. They assume that the demand rate of the items is dependent on the retailer's current-stock level.

[75]present a deterministic EOQ model for deteriorating items with time varying demand. They assume the retailer receives the supplier trade credit and provides a shorter trade credit to the customer.[76] introduces a general finite horizon trade credit inventory model for deteriorating items under inflation and time value of money. The given time horizon consists of different cycles each of which has its own demand rate and its own trade credit period which is usually offered from the supplier to the retailer.

Considering two warehouses, [77] investigate the effect of delay in payment in an inventory system that the full trade credit is order dependent and ordering below a specific amount will only provide partial permissible delay in payment. It is assumed that the items deteriorate exponentially and the demand is sensitive to the stock and selling price. They proposed a hybrid algorithm of particle swarm optimization and genetic algorithm to find the proposed model's solution

## 3.4. ORDER TO ORDER CONSIGNMENT

In this type of arrangement, the exchange of ownership occurs when the next consignment order is placed and the customer is billed by the amount of goods in the previous consignment. [78]consider the continuous review inventory model where the retailer can pay for the goods at the time of receipt or delay the payment till the next replenishment order. Generally, order to order consignment has not been specifically discussed in the literature, but there are some works in CI that consider the credit ([29];[30];[33][59]60, period less/greater than equal the cycle time or to 61];[67];[69];[71],[72],[73],[74],[75][76]mentioned in sections 3.2 and 3.3).

## 4. DISCUSSION

To facilitate our discussion, Table 1 is provided to sum up the reviewed papers based on types of delay in payment and adoption of deteriorating items.

Year	Authors	VAI	C&VMI		0	Л		Deterioration			
		V IVII		1	2	3	4	adopted			
1973	Haley and Higgins [29]					√					
1985	Goyal [30]					$\checkmark$					
1987	Chand and Ward [31]					√					
1989	Chung [24]				√						
1989	Rachamadugu [32]					√					
1994	Jaggi and Aggarwal [25]				✓			Yes			
1995	Hung et al.[4]		$\checkmark$								
1995	Aggarwal and Jaggi [59]					✓		Yes			
1997	Shinn [33]					~					
1997	Hwang and Shinn [60]					✓		Yes			

Table 1 Classification of the reviewed literature

Voor	A set la sur	VMI	CRVMI	CI				Deterioration
rear	Authors	VIVII	Cavim	1	2	3	4	adopted
1997	Jamal et al. [62]					✓		Yes
1998	Chung [34]					√		
1998	Chu et al. [61]					√		Yes
1999	Lee and Whang[5]		✓					
2000	Jamal et al. [64]					~		Yes
2000	Sarker et al. [65]					✓		Yes
2000	Liao et al. [66]					✓		Yes
2001	Corbett [6]		✓					
2001	Chang and Dye [63]					✓		Yes
2002	Dongand and Xu [7]		✓					
2002	Boyaci and Gallego [8]		✓					
2003	Gerchak and Khmelnitsky [9]	~	✓					
2003	Valentini and Zavanella[10]		✓					
2003	Bernstein and Federgruen[12]		✓					
2003	Shinn and Hwang [35]					~		
2003	Abad and Jaggi [36]					~		
2003	Chung and Huang [37]					~		
2003	Huang [38]					~		
2004	Wang et al.[13]		✓					
2004	Maddah et al.[39]					✓		
2004	Chang and Teng[67]					✓	✓	Yes
2005	Persona et al.[14]		√					Yes
2005	Chung et al. [40]					✓		
2006	Chung and Liao [26]				✓			Yes
2006	Huang [42]					✓		
2006	Chung and Huang [70]					✓		
2006	Chen and Ouyang [69]					✓	✓	Yes
2007	Goyal et al. [43]					✓		
2007	Huang [44]					✓		
2007	Teng and Goyal [45]					✓		
2007	Chung and Huang [71]					✓	✓	Yes
2008	Gümüs et al. [20]		✓	✓				
2008	Jaggi et al. [46]					✓		
2008	Huang and Liao [72]					✓	✓	Yes
2008	Liao [73]					√	✓	Yes
2009	Sharifyazdi [21]			✓				
2009	Chung and Liao [27]				✓			
2009	Bougheas et al. [47]					√		
2009	Chung and Huang [48]					✓		
2009	Teng and Chang [49]					✓		
2010	Battini et al.[15]		✓					Yes
2010	Battini et al.[16]		✓					Yes
2010	Ru andWang[22]		✓	✓				
2010	Kreng and Tan [50]					✓		
2010	Min et al. [74]					$\checkmark$	✓	Yes
2011	Adida andRatisoontorn [23]			✓				
2011	Chung and Lin [28]				✓			Yes
2011	Dye and Ouyang [75]					✓	✓	Yes
2011	Balkhi [76]					✓	✓	Yes
2011	Kreng and Tan [51]					✓	✓	
2011	Tsao[52]					✓	✓	
2011	Ho[53]					✓	✓	
2012	Zanoni et al.[17]		✓					
2012	Wang et al.[18]		✓					Yes
2012	Liao et al. [54]					✓	✓	Yes
2012	Teng et al. [55]					✓	✓	
2012	Lin et al. [56]					✓	✓	
2012	Tsao and Sheen [57]					✓		
2013	Guchhait et al. [77]					✓		Yes
2013	Taleizadeh et al. [58]					✓		
2003	Salameh et al. [78]						✓	

# 5. CONCLUSION

The aim of this paper is to integrate CI related studies based on the four mentioned approaches of delay in payments.

As discussed above, CI is mainly regarded as VMI or C&VMI. Section 2 delimits CI related studies from existing VMI and C&VMI literature. Moreover, we perform an analysis on four types of delay in payments in CI contract in section 3.According to this classification, trade credit (mentioned in subsections3.2 and 3.3) which has been tackled by many researchers should be considered as one of CI type systems. Finally, Section 4 summarizes the reviewed papers in a table. Our

study shows that few works have been done in CI when the arrangements are pay as sold, pay as sold during a predefined period and order to order consignment.

## **6. REFERENCES**

- Khosravi, A., A. Jahanbani and H. Shokohi, 2012. Electronic Commerce Position in Islamic Economy. Journal of Basic and Applied Scientific research, 2(12): 13122-13125.
- [2] M. Gümüs, 2006. Three essays on vendor managed inventory in supply chains, Ph.D. dissertation, The University of Waterloo, Ontario, Canada.
- [3] C. Ryu,2006 .An Investigation of Impacts of Advanced Coordination Mechanisms on Supply Chain Performance: Consignment, VMI I, VMI II, and CPFR, PhD dissertation, The State University of New York,.
- [4] Hung,J. S., Y. P. Fun and C.C. Li, 1995. Inventory management in the consignment system. *Production and Inventory Management Journal*, 36 (4): 1-5.
- [5] Lee,H. and S. Whang, 1999. Decentralized multi-echelon supply chains: Incentives and information. *Management Science*, 45 (5): 633-637.
- [6] Corbett, C. J., 2001. Stochastic inventory systems in a supply chain with asymmetric information: Cycle stocks, safety stocks, and consignment stock. *OperationsResearch*, 49 (4): 487-500.
- [7] Dong, Y. and K. Xu, 2002. A supply chain model of vendor managed inventory. Transportation Research, 38 (2): 75-95.
- [8] Boyaci, T. and G. Gallego, 2002. Coordinating pricing and inventory replenishment policies for one wholesaler and one or more geographically dispersed retailers. *International Journal of Production Economics*, 77 (2): 95-111.
- [9] Gerchak, Y. and E. Khmelnitsky, 2003. A consignment system where suppliers cannot verify retailer's sales reports. *International Journal of Production Economics*, 83(1): 37-43.
- [10] Valentini, G. and L. Zavanella, 2003. The consignment stock of inventories: industrial case and performance analysis. *International Journal of Production Economics*, 81–82 (1): 215-224.
- [11] Hill, R.M., 1997. The single-vendor single-buyer integrated production-inventory model with a generalized policy. *European Journal of Operational Research*, 97 (3): 493-499.
- [12] Bernstein, F. and A. Federgruen, 2003. Pricing and replenishment strategies in a distribution system with competing retailers. *Operation Research*, 51 (3): 409-426.
- [13] Wang, Y., L. Jiang and Z.J. Shen, 2004. Channel performance under consignment contract with revenue sharing. *Management Science*, 50: 34–47.
- [14] Persona, A., A. Grassi and M. Catena, 2005. Consignment stock of inventories in the presence of obsolescence. International Journal of Production Research, 43 (23): 4969-4988.
- [15] Battini, D., A. Gunasekaran, M. Faccio, A. Persona and F. Sgarbossa, 2010. Consignmentstock inventory model in an integrated supply chain. *International Journal of Production Research*, 48 (2): 477-500.
- [16] Battini, D., A. Grassi, A. Persona and F. Sgarbossa, 2010. Consignment stock inventorypolicy: Methodological framework and model. *International Journal of ProductionResearch*, 48 (7): 2055-2079.
- [17] Zanoni, S., M.Y. Jaber and L.E. Zavanella, 2012. Vendor managed inventory (VMI) with consignment considering learning and forgetting effects. *International Journal of Production Economics*, 140 (2): 721-730.
- [18] Wang,S.P., W. Lee, and C.Y. Chang, 2012. Modelling the consignmentinventory for a deteriorating item while the buyer has warehouse capacity constraint.*InternationalJournal of Production Economics*, 138 (2): 284-292.
- [19] Piasecki, D., 2004. Consignment inventory: What is it and when does it make sense to use it? Inventory Operations Consulting LLC, [online]. Available: http://www.inventoryops.com.
- [20] Gümüs, M., E.M. Jewkes and J. H. Bookbinder, 2008 .Impact of consignment inventory and vendor-managed inventory for a two party supply chain.*International Journal of Production Economics*, 113 (2): 502-517.
- [21] Sharifyazdi, M., A. Jafari, Z. Molamohamadi, M. Rezaeiahari and R. Arshizadeh, 2009. Particle swarm optimization approach in a consignment inventory system. In the Proceedings of *American Institute of Physics Conference*, 1168: 240-243.
- [22] Ru,J. andY. Wang,2010. Consignment contracting: Who should control inventory in the supply chain?. *European Journal* of Operational Research, 201 (3):760-769.
- [23] Adida, E. and N. Ratisoontorn, 2011. Consignment contracts with retail competition. *European Journal of Operational Research*, 215 (1):136-148.
- [24] Chung, K.H., 1989. Inventory control and trade credit revisited. Journal of Operational Research Society, 40 (5): 495-498.
- [25] Jaggi,C.K. and S.P. Aggarwal, 1994. Credit financing in economic ordering policies of deteriorating items. *International Journal of Production Economics*, 34(2): 151-155.

- [26] Chung, K.J. and J.J.Liao., 2006. The optimal ordering policy in a DCF analysis for deteriorating items when trade credit depends on the order quantity. *International Journal of Production Economics*, 100 (1): 116-130.
- [27] Chung, K.J. and J.J.Liao., 2009. The optimal ordering policy of the EOQ model under trade credit depending on the ordering quantity from the DCF approach. *European Journal of Operational Research*, 196 (2): 563-568.
- [28] Chung, K.J. and S. D. Lin, 2011. The inventory model for trade credit in economic ordering policies of deteriorating items in a supply chain system. *Applied Mathematical Modelling*, 35 (6): 3111-3115.
- [29] Haley, C.W. and R.C., Higgins, 1973. Inventory policy and trade financing. Management Science, 20 (4): 464-471.
- [30] Goyal, S. K., 1985. Economic ordering quantity under conditions of permissible delay in payments. *Journal of the Operational Research Society*, 36: 335-343.
- [31] Chand, S. and J. Ward, 1987. A note on economic order quantity under conditions of permissible delay in payments. *Journal of the Operational Research Society*, 38 (1): 83-84.
- [32] Rachamadugu, R., 1989. Effect of Delayed Payments (Trade Credit) on Order Quantities. Journal of Operation Research Society, 40 (9): 805-813.
- [33] Shinn, S.W., 1997. Determining optimal retail price and lot size under day-terms supplier credit. *Computer and Industrial Engineering*, 33 (3-4): 717-720.
- [34] Chung, K.J, 1998. A theorem on the determination of economic order quantity under conditions of permissible delay in payments. *Computers and Operations Research*, 25 (1): 49-52.
- [35] Shinn, W.S. and H. Hwang, 2003. Optimal pricing and ordering policies for retailers under order size dependent delay in payments. *Computers and Operations Research*, 30 (1): 35-50.
- [36] Abad, P.L. and C.K. Jaggi, 2003. A joint approach for setting unit price and the length of the credit period for a seller when end demand is price sensitive. *International Journal of Production Economics*, 83 (2): 115-122.
- [37] Chung, K. J. and Y. F. Huang, 2003. The optimal cycle time for EPQ inventory model under permissible delay in payments. *International Journal of Production Economics*, 84 (3):307-318.
- [38] Huang, Y. F., 2003. Optimal retailer's ordering policies in the EOQ model under trade credit financing. *Journal of the Operational Research Society*, 54 (9): 1011-1015.
- [39] Maddah,B.S., M.Y. Jaber and N.E. Abboud, 2004. Periodic review (s, S) inventory model with permissible delay in payments. *Journal of the Operational Research Society*, 55 (2): 147-159.
- [40] Chung, K.J, S.K. Goyal and Y.F. Huang, 2005. The optimal inventory policies under permissible delay in payments depending on the ordering quantity. *International Journal of Production Economics*, 95 (2), 203-213.
- [41] Jaber and I.H. Osman, 2006. Coordinating a two-level supply chain with delay in payments and profit sharing. *Computers & Industrial Engineering*, 50 (4): 385-400.
- [42] Y. F. Huang, 2006. An inventory model under two levels of trade credit and limited storage space derived without derivatives. *Applied Mathematical Modelling*, 30 (5): 418-436.
- [43] Goyal,S.K., J.T. Teng and C.T. Chang, 2007. Optimal ordering policies when the supplier provides a progressive interest scheme. *European Journal of Operational Research*, 179 (2): 404-413.
- [44] Huang, Y. F., 2007. Optimal retailer's replenishment decisions in the EPQ model under two levels of trade credit policy. *European Journal of Operational Research*, 176 (3): 1577-1591.
- [45] Teng, J. T. and S. K. Goyal, 2007. Optimal ordering policies for a retailer in a supply chain with up-stream and downstream trade credits. *Journal of the Operational Research Society*, 58 (9): 1252-1255.
- [46] Jaggi, C.K., S.K. Goyal and S.K. Goel, 2008. Retailer's optimal replenishment decisions with credit-linked demand under permissible delay in payments. *European Journal of Operational Research*, 190 (1): 130-135.
- [47] Bougheas, S., S. Mateut and P. Mizen, 2009. Corporate trade credit and inventories: New evidence of a trade-off from accounts payable and receivable. *Journal of Banking & Finance*, 33 (2): 300-307.
- [48] Chung, K.J. and C.K. Huang, 2009. An ordering policy with allowable shortage and permissible delay in payments. *Applied Mathematical Modelling*, 33 (5): 2518-2525.
- [49] Teng, J. T. and C. T. Chang, 2009. Optimal manufacturer's replenishment policies in the EPQ model under two levels of trade credit policy. *European Journal of Operational Research*, 195 (2): 358-363.
- [50] Kreng, V.B. and S.J. Tan, 2010. The optimal replenishment decisions under two levels of trade credit policy depending on the order quantity. *Expert Systems with Applications*, 37 (7): 5514-5522.
- [51] Kreng, V.B., and S.J. Tan, 2011. Optimal replenishment decision in an EPQ model with defective items under supply chain trade credit policy. *Expert Systems with Applications*, 38 (8): 9888-9899.
- [52] Tsao, Y.C., 2011. Replenishment policies considering trade credit and logistics risk. *Scientialranica*, 18 (3):753-758.
- [53] Ho, C.H., 2011. The optimal integrated inventory policy with price-and-credit-linked demand under two-level trade credit. Computers & Industrial Engineering, 60 (1): 117-126.

- [54] Liao, J.J., K.N. Huang and K.J. Chung, 2012. Lot-sizing decisions for deteriorating items with two warehouses under an order-size-dependent trade credit. *International Journal of Production Economics*, 137 (1): 102-115.
- [55] Teng, J.T., J. Min and Q. Pan, 2012. Economic order quantity model with trade credit financing for non-decreasing demand. Omega, 40 (3): 328-335.
- [56] Lin, Y. J., L.Y. Ouyang and Y.F. Dang, 2012. A joint optimal ordering and delivery policy for an integrated supplierretailer inventory model with trade credit and defective items. *Applied Mathematics and Computation*, 218 (14): 7498-7514.
- [57] Tsao, Y. C. and G. J. Sheen, 2012. A multi-item supply chain with credit periods and weight freight cost discounts. International Journal of Production Economics, 135 (1): 106-115.
- [58] Taleizadeh, A. A., D.W., Pentico, M. S., Jabalameliand M. Aryanezhad, 2013. An EOQ model with partial delayed payment and partial backordering. *Omega*, 41(2): 354–368.
- [59] Aggarwal,S.P. and C.K. Jaggi, 1995. Ordering policies of deteriorating items under permissible delay in payments. *Journal of the Operational Research Society*, 46 (5): 658-662.
- [60] Hwang, H. and S.W. Shinn, 1997. Retailer's pricing and lot sizing policy for exponentially deteriorating products under the condition of permissible delay in payments. *Computer and Operations Research*, 24 (6): 539-547.
- [61] Chu, P., K.H. Chung and S.P. Lan, 1998. Economic order quantity of deteriorating items under permissible delay in payments. *Computer and Operations Research*, 25 (10): 817-824.
- [62] Jamal,A.M.M., B.R. Sarkar and S. Wang, 1997. An ordering policy for deteriorating items with allowable shortage and permissible delay in payments. *Journal of Operational Research Society*, 48 (8): 826-833.
- [63] Chang,H. J. And C.Y. Dye, 2001. An inventory model for deteriorating items withpartial backlogging and permissible delay in payments. *International Journal of Systems Science*, 32 (3):345-352.
- [64] Jamal.A.M.M., B. Sarkar and S. Wang, 2000. Optimal payment time for a retailer under permitted delay of payment to the wholesaler. *International Journal of Production Economics*, 66 (1): 59–66.
- [65] Sarker, B.R., A.M.M. Jamal and S.Wang, 2000. Supply chain models for perishable products under inflation and permissible delay in payment. *Computers and Operations Research*, 27 (1), 59-75.
- [66] Liao, H.C., C.H. Tsai and C.T. Su, 2000. An inventory model with deteriorating items under inflation when a delay in payment is permissible. *International Journal of Production Economics*, 63 (2): 207-214
- [67] Chang, C.T. and J.T. Teng, 2004. Retailer's optimal ordering policy under supplier credits. *Mathematical Methods of Operations Research*, 60 (3):471-483.
- [68] Chung, K.J. and J.J. Liao, 2004. Lot-sizing decisions under trade credit depending on the ordering quantity. Computers and Operations Research, 31 (6): 909–928.
- [69] Chen,L.H. and L.Y. Ouyang, 2006.Fuzzy inventory model for deteriorating items with permissible delay in payment. *AppliedMathematics and Computing*, 182 (1): 711-726.
- [70] Chung, K.J., T.S. Huang, 2006. The optimal cycle time for deteriorating items with limited storage capacity under permissible delay in payments. Asia-Pacific of Operational Research, 23 (3): 347–370.
- [71] Chung, K. J. and T. S. Huang, 2007. The optimal retailer's ordering policies for deteriorating items with limited storage capacity under trade credit financing. *International Journal of Production Economics*, 106 (1): 127-145.
- [72] Huang, K.N. and J.J. Liao, 2008. A simple method to locate the optimal solution for exponentially deteriorating items under trade credit financing. *Computers and Mathematics with Applications*, 56 (4): 965-977.
- [73] Liao, J.J., 2008. An EOQ model with noninstantaneous receipt and exponentially deteriorating items under two-level trade credit. *International Journal of Production Economics*, 113 (2): 852-861.
- [74] Min, J., Y.W. Zhou and J. Zhao, 2010. An inventory model for deteriorating items under stock-dependent demand and twolevel trade credit. *Applied Mathematical Modelling*, 34 (11): 3273-3285.
- [75] Dye,C.Y. and L.Y. Ouyang, 2011. A particle swarm optimization for solving joint pricing and lot-sizing problem with fluctuating demand and trade credit financing. *Computers & Industrial Engineering*, 60 (1): 127-137.
- [76] Balkhi,Z.T., 2011. Optimal economic ordering policy with deteriorating items under different supplier trade credits for finite horizon case. *International Journal of Production Economics*, 133 (1): 216-223.
- [77] Guchhait, P.,M. K., Maiti and M., Maiti, 2013. Two storage inventory model of a deteriorating item with variable demand under partial credit period. *Applied Soft Computing*, 13(1): 428–448.
- [78] Salameh, M.K., N.E. Abboud, A.N. El-Kassar and R.E. Ghattas, 2003. Continuous review inventory model with delay in payments. *International Journal of Production Economics*, 85 (1): 91-95.