ISSN:0971-1260
Vol-22-Issue-37-December -2019

A Comprehensive Survey on the effect of Revenue Sharing Contract on Supply Chain Coordination

Anil Kumar[1], Anil Baliram Ghubade[2], Mahipal Singh[3], Minakshi Rathore[4], Nikita Jain[5], Hitesh Arora[6]

[1,2,3,6]*Assistant Professor, School of Mechanical Engineering, Lovely Professional University, Phagwara, Punjab-144411, India.*
[4]*Maulana Azad National Institute of Technology, Bhopal, Madhya Pradesh-462003, India*
[5]*Assistant Professor, School of Mechanical Engineering, Career Point University, Kota, Rajasthan-324005, India.*
Email: anil.20296@lpu.co.in[1], , anil.18325@lpu.co.in[2] , mahipal.17711@lpu.co.in[3], rathore.minakshi66@gmail.com[4], nikitaj822@gmail.com[5], hitesh.15774@lpu.co.in[6]
Corresponding Author[*]: anil.20296@lpu.co.in , Ph.No.:+91-9672978974.

Abstract

During a few last decades, it has been observed that the level of outsourcing among various industries has a significant increase. This increase is one of the keen interests of the researcher to do the sudden implementation of contracts in the supply chain. Due to competition, it is necessary to make a contract among involved parties, so that they can stay in the market along with good revenue. In this context, it has been tried to study the impact of revenue sharing contracts in a supply chain with a game theory approach.It has been analyzed that how coordination increases the productivity of the entire store network framework and to optimize the individual profit and for measuring efficiency.

Keywords: Revenue Sharing Contract, Supply Chain, Supply Chain players, Game Theory, Salvage Revenue.

1. Introduction

In a typical supply chain network as industries do not work in seclusion since everyone functions as a client when it conveys materials or products from providers and acts as a provider while materials or product passes to their own clients. A production network comprises the succession of occasions and associations which facilitate the movement of materials (tangible or intangible). A store network can be characterized as "a system of suppliers, manufacturers, distributors, retailers and customers where material flow downstream from suppliers to customers and information flows in both directions" (Leng Mingming and Parlar Mahmut, 2005). The objective of SCM is to increase confidence and relationship cum coordination among SCM partners, therefore enhancing inventory visibility as well as enhancing inventory velocity. They (involved parties) use some techniques to make a better supply chain, for reducing product. The cost as much as they can, so that customers can get attracted and they can get maximum profit.

Some researchers have tried to examine the main problem of allocating revenue savings within the SCM players of sharing the demand data in all the levels i.e. 2-level and 3-level supply chain or store network which comprises a maker, a merchant, and a retailer. To find an extraordinary allotment plot they (analysts) utilize musings from an agreeable game hypothesis which is known as cooperative game theory. In the same context firstly, they compute logically

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

the predictable cost associated with the manufacturer and later they use recreation (simulation) to get predictable costs for the remaining SCM players i.e. distributor and the retailer. Finally, they proposed a characteristic-function form of a three-person cooperative game, and start fundamental conditions for the dauntlessness of every one of five plausible alliances. To part the value investment funds or price savings between two individuals, or possibly among three SC individuals/players, researchers have used numerous distribution schemes (Leng and Parlar, 2009).

Hence coordination in the supply chain is necessary. For this different model of SC contracts have been developed. Supply Chain Collaboration represents the commitment between/among supply chain participants which include sharing of benefits, rewards and risks along with the sharing of information. Now there are some contracts have been developed like (Giannoccaro and Pontrandolfo, 2004):

- Quantity Discounts Model (Weng, 1995)
- Backup Agreements (Eppen and Iyer, 1997)
- Buy Back Or Return Policies (Emmons and Gilbert, 1998)
- Quantity Flexibility (QF) Contracts (Tsay, 1999)
- Allocation Rules (Cachon and Lariviere, 1999)
- Incentive Mechanisms (Lee and Whang, 1999)
- Revenue Sharing (RS) Contracts (Cachon and Lariviere, 2000)

As we have discussed above that there are so many contracts are available for supply chain coordination, but all are useful for a particular purpose only. So in this literature authors are not going in detail of all these contracts, we will focus our study only on *Revenue Sharing Contracts.* As we all know that every party (i.e. retailer, wholesaler and manufacturer) wants to maximize their own profit and nobody wants to collaborate because it decreases individual profit and efficiency of the supply chain, but simultaneously increases total supply chain profit. Hence Supply chain contracts are such mechanisms aimed at coordinating decentralized supply chain through the fulfillment of two objectives:

i. Increasing supply chain's profit comparable to that achieved through the centralized supply chain, and
ii. Risk-sharing between numerous coordinating partners (Giannoccaro and Pontrandolfo, 2004).

Hence collaboration is necessary so that all parties could get equal profit and they can get a good hold over the whole market. This collaboration among parties will decide all prices i.e. retailer price and the wholesale price which decide the profit margins, inventory etc for higher revenues (Chauhan and Proth, 2005).

Game theory can be used for finding a good solution via revenue-sharing contracts. That's why nowadays most persons are using it, to optimize the supply chain, understand and help parties to make the right decisions at the right time (Nagarjan and Sosic, 2006).

Hence two types of game-theoretic models have been given, first cooperative and second non-cooperative, which depends on how the involved parties are behaving. In non-cooperative games, two types of concepts are being used first Nash equilibrium and second is Stackelberg equilibrium (Leng and Parlar, 2005).

In a revenue-sharing contract, a retailer is offered goods by a supplier at a unit wholesale price which has been kept always less than the unit marginal price. Now it can be optimized

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

through the *Game Theory approach.* So we can see this revenue-sharing contract as a *Stackelberg game* and find Nash equilibrium.

For controlling the decision, the contract has to be determined by the players. These players have been defined as Stackelberg leader and Stackelberg follower. Stackelberg leader will be considered the player who plays first and the Stackelberg follower will the other one who optimally chooses the streamlined estimation of the choice variable based on the agreement.

Hence in the Stackelberg game, there are two types of games are available for any party first, the Stackelberg leader game, the second Stackelberg follower game. Let us assume that the manufacturer play game first acts as a Stackelberg leader in which the retailer (Stackelberg follower) decides the ordered quantity. The opposite will happen if the retailer plays first (called Stackelberg leader) and then the manufacturer (called Stackelberg follower) decides later on (Leng and Parlar, 2005).

On the other hand in Cooperative game theory, players straightly find from the possible outcomes; understand how another player can achieve, how they can get a better payoff on the basis of what coalitions will they form? Subsequently,the agreeable game hypothesis offers a few plans for this procedure. One such significant application is dealing with the players (Nagarjan and Sosic, 2006).

Generally, there are two types of controls that have been used in SCM, first is centralized control and second is decentralized control. In centralized control, the only single decision-maker exists in SC, who controls the whole network and who should have all the data or information about the whole supply chain which is appropriate to make a conclusion or decision. The centralized control guarantees the framework's effectiveness (channel coordination).

Hence, we have to consider other contracts also which can organize to organize the supply (production) network. In general, the accompanying highlights are significant in contracts (Erhun and Keskinocak, 2003):

- Cost-effectiveness: Accomplish benefits close to optimum.
- Equality and flexibility: The contract must have the scope for flexible separation of profits.
- Implementability: Contract must the ability to easily maintain and less-cost to administer.

However, the centralized optimization approach can be considered close to the real SC system, as most SC systems are decentralized. It has been also observed that central optimization models have some major dis-advantages:

(1) The liberation of supply chain players is ignored in the case of centralized SCM and competitive behavior among SC players will lower the efficiency of the supply chain.
(2) The information processing cost has also been observed on the higher side in the central optimization approach due to a single person who has the power to make the decision at the central level, has to collect all required information from all SC players and convey the same to members.
(3) The central optimization approach has a question on the capacity, if the problem is big and hard, though, it is not possible to get a model that can be calculated. (Wang et al, 2004).

A between hierarchical collaboration inventory network is made out of a few self-intrigued individuals/firms. To accomplish inventory network productivity, all players are happy to

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

coordinate, consequently, they need the agreeable system or agreement which must be deliberately arranged and planned. It has been indicated that the challenge between players brings down the framework proficiency, and as a rule, isn't ideal. At that point, the inquiry is how we can organize the store network individuals? An agreement based coordination instrument ought to be utilized to satisfy this work, and the agreement must consent to the accompanying guidelines:

(1) It ought to be guaranteed that the player's benefit isn't lower than the benefit level before store network collaboration and appropriately share the all-out agreeable income Participative requirement.
(2) Incentives ought to be decreased to go astray from the framework ideal arrangement Incentive perfect requirement (Wang et al, 2004).

2. Material and Methods

2.1 Two-stage supply chain problem without revenue sharing contract:

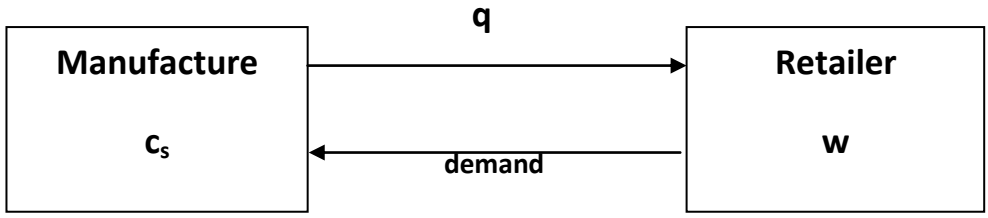


Figure 2.1: Two-Level Supply Chain Game

In the supply chain, we generally call parties who involve in it like manufacturer, distributor, and retailer. If there are two parties (i.e. manufacturer and retailer) that are involved, then we call it a two-stage supply chain and if three parties (i.e. manufacturer, distributor, and retailer) are there, then we call it three-stage supply chain.

2.2 Two-stage Supply Chain Management with facing problems:

It tends to be characterized as the administration of the development of merchandise and stream of data among producers and retailers to satisfy the client request. It covers the procedures of materials the board, coordinations, physical dispersion the executives, acquiring, and data the board. As such store network is the procedure to move material from the client request through the manufacturer, supply, generation, and dispersion of items to the client. In this way, SCM requires the responsibility of producer and retailer to work near facilitate request age, request taking and request satisfaction. For keeping up legitimate appropriation, each gathering needs to locate a correct requesting arrangement which is absolutely on differing requests and lead time of provider party moreover. The other point of a viable store network the board framework is to decrease stock by remembering a supposition that items are accessible when required. That implies the provider (producer) has enough amount to supply the retailer. Henceforth we can partition the Supply chain the executive's streams into three fundamental streams as for example Item stream, Information stream, Financial stream. In this way, sharing of data is important to all gatherings which guarantees them to access the item at a specific time with the diminishing

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

expense. This causes them to effortlessly deal with their assets so they can satisfy future interest moreover.

According to Qin, Zhaoqiong (2008), in the real process of the two-stage SCM retailer gets the demand from the customer, according to that demand retailer give the order to manufacturer and manufacturer has to supply that given order to the retailer. Here two cases can be taken, first when the manufacturer has enough supply to accomplish the retailer's order, second when the manufacturer doesn't have enough quantity to fulfill the retailer's order. If any player (i.e. either manufacturer or retailer) doesn't fulfill the demand of the lower party then he will be in loss and anyhow he has to fulfill that backorder. Hence they have to pay some backorder cost.

In any SCM demand can be deterministic or probabilistic. If demand is deterministic then the retailer does not change his order quantity according to time. But if demand is probabilistic then it leads to information sharing. As we know that every party wants to maximize his profit, so if they change their quantity according to demand and decides not to share that information to another party. Hence the phenomenon of bullwhip effect occurs.

If we assume that the manufacturer fulfills all orders which he gets from a retailer, then the manufacturer's cost will be $c_s * q$ and the retailer's cost will be $c_r * q$.

If they are unable to fulfill the demand they have to incur backorder cost (p). Hence αp cost will be added to the retailer and $(1-\alpha)p$ will be added to the manufacturer. Then the cost of both players will be given by the following expression:

The total cost of the manufacturer:

$$TC_m = c_s * q + (1-\alpha) * p \quad \text{..... (2.1)}$$

Similarly, the total cost of the retailer is:

$$TC_r = c_r * q + \alpha * p \quad \text{..... (2.2)}$$

The aim of both players is to minimize their costs.

For manufacturer

$$\min TC_m(\alpha, q) = c_m \int_0^q xf(x)dx + c_m q \int_q^\infty f(x)dx + (1-\alpha) \int_0^q p(q-x) \quad \text{..... (2.3)}$$

For retailer

$$\min TC_r(\alpha, q) = c_r \int_0^q xf(x)dx + c_m q \int_q^\infty f(x)dx + \alpha \int_0^q p(q-x) \quad \text{..... (2.4)}$$

In the above model we have not added any other factor/cost, but in fact, there are so many other factors/costs are also considered which are directly-indirectly involve in the system like lead times, inventory holding costs etc. we will add these factors later on.

2.3 Comparison of Revenue sharing contract with simple Supply Chain

A revenue-sharing contract defined with two parameters (ω, α); the first player (considering as supplier) receives from the retailer a unit wholesale price ω, which must be less from the unit cost c, in return for a percentage $(1-\alpha)$ of the retailer's income amount on the sold things.

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

The retailer retains a part α of his revenue generated. Using salary sharing understanding, the decentralized stock system can be encouraged, where the assumption w<c ensures channel coordination while α decides the allocation of all-out benefits between the provider and the retailer. According to Cachon and Lariviere (2005), "under a revenue-sharing contract, a retailer pays a supplier a wholesale price for each unit purchased, plus a percentage of the revenue the retailer generates." We can take the example of Blockbuster Incorporation, in which the videocassette retailer faces a difficult limit issue. In this model pinnacle fame of a rental title lasts just half a month, however, the expense of tape was more compared with the cost of a rental. With given understanding, the retailer buys each tape from his provider for about $65 and gathers about $3 per rental. Thus, a tape acquires a benefit simply after 22 rentals.

3. Model Formulation

3.1 Formulation of a game of two-stage supply chain without RS contract

We expect that the interest level which is gotten by the retailer is arbitrarily circulated which pursues a nonstop likelihood appropriation work f(x) on an interim [a,b](a<0) with a comparing aggregate dispersion work F(x). For any revenue-sharing contract model, we took

1) $f(x) = the\ random\ demand\ distribution$
2) $p = the\ unit\ retail\ price$
3) $c = the\ unit\ production\ cost$;
4) $s = the\ unit\ product\ salvage\ value$
5) $\alpha = the\ transfer\ cost\ rate$
6) $q = quantity\ ordered$
7) $x = demand$

As we all know that in any supply chain every player wants to make his profit maximum. Hence the decisions generally conflict. To minimize these conflicts and maximize the profit, the contract is necessary. As we discussed that supply chain management is separated into two sorts, first centralized and second decentralized.

In centralized decision SCM, only one single decision-maker is there, who takes all decisions and control the whole SCM through his decisions. He is the only responsible to take all risks. In another case (decentralized SCM), the decision is together decided by all parties. But generally, it seems that profit is always more in a centralized SCM case comparatively decentralized SCM case.

Hence the expected channel profit $B(q)$ for centralized SCM, which can be expressed as (for whole supply chain):

$$B(q) = p\int_0^q xf(x)dx + pq\int_q^\infty f(x)dx + s\int_0^q (q-x)f(x)dx - cq \quad \text{..... (3.1)}$$

Here the exchange with income sharing component is not considered. It very well may be derived with the help of optimality conditions that the ideal amount q* to be conveyed must fulfill,

$$F(q_0^*) = \frac{(p-c)}{(p-s)}$$

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

…….. (3.2)

Proof: We can easily find out the optimal quantity q^*, by differentiating the profit equation, like:

$$B(q) = p\int_0^q xf(x)dx + pq\int_q^\infty f(x)dx + s\int_0^q (q-x)f(x)dx - cq$$

…….. (3.3)

$$\frac{\partial}{\partial q}[B(q)] = 0$$

$$\frac{\partial}{\partial q}\left[p\int_0^q xf(x)dx + pq\int_q^\infty f(x)dx + s\int_0^q (q-x)f(x)dx - cq\right] = 0$$

$$\frac{\partial}{\partial q}\left[p\int_0^q xf(x)dx\right] = p[q\,f(q)] = pqf(q)$$

$$\frac{\partial}{\partial q}\left[pq\int_q^\infty f(x)dx\right] = p.1.\int_q^\infty f(x)dx + pq\,[-f(q)] = r_1p[1-F(q)] - r_1pqf(q)$$

$$\frac{\partial}{\partial q}\left[s\int_0^q (q-x)f(x)dx\right] = \frac{\partial}{\partial q}\left[sq\int_0^q f(x)dx - s\int_0^q xf(x)dx\right]$$

$$= sqf(q) + s\int_0^q f(x)dx - sqf(q)$$

$$= sqF(q)$$

$$\frac{\partial}{\partial q}[cq] = c$$

By combining all the above equations, we get

$$p[1-F(q^*)] + s\,F(q^*) - \alpha c = 0$$

$$p - \alpha c - (p-s)F(q^*) = 0$$

$$F(q_0^*) = \frac{(p-c)}{(p-s)}$$

…….. (3.4)

3.2 Formulation of a game of two-stage supply chain with RS contract

Zhaoqiong Qin (2008) describes this revenue-sharing contract into two types which we will take later on. In which the retailer caters to the market demand, $D(p)$that is uncertain and characterized by the cumulative distribution function:

$F(d,p) = \Pr(D(p) \le d)$.

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

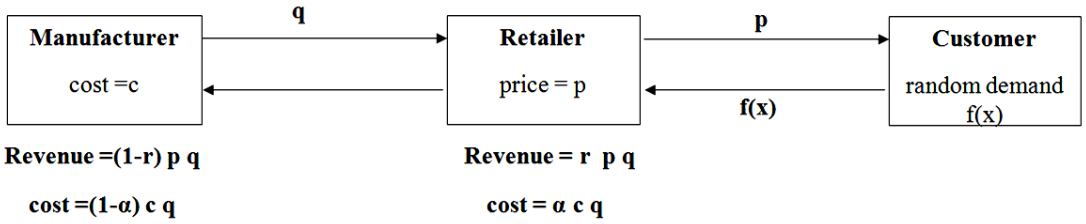


Figure 3.1: Two Echelon supply chain game with revenue sharing

We have also used the Stackelberg game to formulate the problem as Zhaoqiong Qin (2008) proposed in which the first player will be considered as the game's head and the second player will be considered as the game's supporter. For sharing the revenue, he assumes that the rate of revenue-sharing $r$is constant i.e. it should be predefined. At the point when the provider is the Stackelberg game's pioneer (the provider's Stackelberg game), he chooses the exchange cost rate and afterward the retailer chooses the amount to be requested from the provider; whereas when the retailer is the Stackelberg game's pioneer (the retailer's Stackelberg game), he chooses the exchange cost rate and afterward the provider chooses the amount to be given to the retailer. Zhaoqiong Qin (2008) took the following two cases in that revenue sharing contract:

1. Salvage revenue is not shared between the supplier and the retailer (SRNS)
2. Salvage revenue is shared between the supplier and the retailer (SRS).

3.2.1 When the salvage revenue is not shared (Zhaoqiong Qin (2008))

As we assume that supplier play first and then after seeing the supplier's strategy/action, the retailer chooses his best action to maximize his profit. Here we are taking this game as a Stackelberg leader-follower game; in this situation, the supplier will be known as Stackelberg leader and retailer will to be known as Stackelberg follower. Every player will change his strategy/action and find his best option to get maximum profit until they get their optimal profit.

Hence in this RS contract, Stackelberg leader (who is supplier) starts the game and chooses the α (transfer cost) and Stackelberg follower (who is a retailer) decides the q (quantity requested). In this case retailer orders, the quantities according to customers' demand and supplier arrange that order according to the retailer's order. Then the manufacturer decides transfer cost and at last, the retailer delivers quantities to customers. After delivering the retailer keeps some ratio of that revenue and returns remaining to the supplier as per RS contract. Both supplier and retailer are sharing the revenue so the retailer's normal benefit will be given by the accompanying articulation:

$$\theta_R(\alpha, q) = rp\int_0^q xf(x)dx + rpq\int_q^\infty f(x)dx + s\int_0^q (q-x)f(x)dx - \alpha c \quad \text{..... (3.5)}$$

For getting the maximum profit following equation should also be satisfied with optimal profit:

$$p\left(1 - F(q_S^*)\right) + (s - rp)q_S^* f(q_S^*) + sF(q_S^*) - c = 0 \quad \text{..... (3.6)}$$

3.2.2 When the salvage revenue is also shared (Zhaoqiong Qin (2008))

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

Supplier is Stackelberg leader and retailer is a follower

In this case, we assume that supplier play first and then after seeing the supplier's strategy/action, the retailer chooses his best action to maximize his profit. Here we are taking this game as a Stackelberg leader-follower game; hence in this situation supplier will be known as Stackelberg leader and retailer will to be known as Stackelberg follower. Every player will change his strategy/action and find his best option to get maximum profit until they get a Nash equilibrium.

Hence in this RS contract, the supplier (who is a Stackelberg leader) starts the game and chooses the α (transfer cost) and retailer (who is Stackelberg follower) decides the q (quantity ordered). In this case, suppliers and retailers are sharing revenue which includes salvage revenue also. So the retailer's expected profit will be given by the accompanying articulation:

$$L_R(\alpha, q) = rp\int_0^q xf(x)dx + rpq\int_q^\infty f(x)dx + rs\int_0^q (q-x)f(x)dx - \alpha cq$$

…….. (3.7)

Suppose supplier chooses $\alpha = \alpha_R^0(q)$ in which supplier considers the retailer's optimum order quantity q^0 to take full advantage of his profit, then the expected profit of supplier will be $L_S^0(q) = L_S(\alpha_R^0(q), q)$ and which will be given by the following expression in which,

$$L_S^0(q) = (1-r)p\int_0^q xf(x)dx + (1-r)pq\int_q^\infty f(x)dx + (1-r)s\int_0^q (q-x)f(x)dx - [c - rp + r(p-s)\,F(q)]q$$

…….. (3.8)

For getting the maximum profit following equation should also satisfy,

$$p - c - (p-s)F(q_S^0) - (p-s)rq_S^0 f(q_S^0) = 0$$

…….. (3.9)

4.Conclusion

It can be concluded that on SC revenue-sharing contract, various types of problems SCM players faced such as sharing of information, maintaining the balance,etc. For example, consider a supplier-customer relationship where the customerfaces a problem when the supplier is not able to meet uncertain demand. Hence customers generally switch over to the other supplier. This unmet demand reduces the revenue ofthe supplier and finally,the supplier has to fulfill that unmet demand. These problems have been found due to

- The availability of quantity is less than the demand at the supplier.
- The supplier has not enough information to decide or maintain his inventory level.
- Customer demand has increased randomly.
- Neither the manufacturer nor retailer has found accurate forecast demand.

It can also be concluded that SCM players were not able to maintain their relationship. Hence the efficiency of the total supply chain has reduced because they were not sharing the

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

information and every party wants to make maximize his profit. Authors proposed that these problems can be resolved, considering the following points:

- Information sharing is a must among the parties (manufacturer and retailers)
- Every party should think about the whole profit of the supply chain nor of an individual
- A contract is needed to increase the information sharing which finally increases the efficiency of the whole supply chain

References:

1. Cachon Gerard P. and Lariviere Martin A., "Supply chain coordination with Revenue-Sharing Contracts: Strengths and Limitations", *Management Science,* Vol. 51, 2005, pp. 30-44.

2. Chauhan S. Satyaveer and Proth Jean-Marie, "Analysis of a supply chain partnership with revenue sharing", *International Journal of Production Economics,* Vol.97, 2005, pp. 44-51.

3. Erhun F. and Keskinocak P., "Game Theory in Business Applications", working paper, 2003.

4. Giannoccaro, Ilaria, Pontrandolfo Pierpaolo, "Supply chain coordination by revenue sharing contracts", *International Journal of Production Economics* Vol. 89, 2004, 131-139

5. Leng Mingming and Parlar Mahmut., "Game-Theoretic Applications in Supply Chain Management: A Review", INFORMS Vol. 43, No. 3 Aug, 2005, pp 187-210.

6. Leng Mingming and Parlar Mahmut., "Allocation of Cost Savings in a Three-Level Supply Chain with Demand Information Sharing: A Cooperative-Game Approach," *Operations Research*, Vol. 57, No. 1, 2009, pp. 200-213.

7. Li Xuping and He Jinsheng, "Coordination of supply chain with revenue sharing contract in a fuzzy environment: Investigation and analysis."

8. Nagarjan Mahesh and Sosic Greys, "Game-Theoretic Analysis of Cooperation Among Supply Chain Agents: Review and Extensions", to appear in *European Journal of Operational Research*, Marshall School of Business Working Paper No. IOM 04-06.

9. Osborne Martin J., "An introduction to game theory", *Oxford University Press,* 2007.

10. Qin Zhaoqiong, "Towards integration: a revenue-sharing contract in a supply chain", *IMA Journal of Management Mathematics,* Vol. 19, 2008, pp. 3−15.

11. Wang, Hongwei, Guo Min and Efstathiou Janet, "A game-theoretical cooperative mechanism design for a two-echelon decentralized supply chain", *European Journal of Operational Research*, Vol. 157, 2004, pp. 372–388.

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-37-December -2019

Copyright ⓒ 2019Authors