QUID 2017, pp. 1877-1884, Special Issue N°1- ISSN: 1692-343X, Medellín-Colombia

CONSIDERING COOPERATION CONTRACTS IN THE SUPPLY CHAIN OF PERISHABLE GOODS USING GAME THEORY

(Recibido el 08-05-2017. Aprobado el 15-09-2017)

Khalafi, S
Department of Industrial Engineering, Faculty of Industry, Islamic Azad University, South Tehran Branch, Tehran, Iran

Hafez Alkotob, A
Associate Professor of Industrial Engineering, Faculty of Industry, Islamic Azad University, South Tehran Branch, Tehran, Iran
a_hafez@azad.ac.ir

Mohammadi Tabar, D.
Assistant Professor, Department of Industrial Engineering, Faculty of Industry, Islamic Azad University, South Tehran Branch, Tehran, Iran

Sayyadi, M.K.
Assistant Professor of Industrial Engineering, Faculty of Industry, Islamic Azad University, South Tehran Branch, Tehran, Iran

Resumen: En diversas actividades de componentes y niveles de una cadena de suministro para mejorar el estado general del sistema, se observan muchas contradicciones entre los objetivos de los componentes y los distintos niveles en el logro de los objetivos globales de la cadena de suministro que, con el tiempo , contribuyen a la reducción de la potencia y la competitividad de la cadena de suministro. La interacción entre las dos partes de la cadena de suministro determina aspectos tales como el tamaño del lote, la cantidad de la orden, el precio de la oferta y el precio final. Cada uno de los puntos anteriores se discute en el proceso de negociación de las partes y los contratos finales se alcanzan en cumplimiento de los objetivos de cada una de las partes. Existe una plétora de modelos para resolver problemas y problemas de interacción entre minoristas y productores de la cadena de suministro considerando muchos factores, tales como factores de coste o cuestiones relacionadas con los principios de competencia entre las dos partes. El uso de la teoría de los juegos para crear una cooperación entre las partes en la cadena de suministro conduce a la determinación del punto de equilibrio, en el cual el tamaño óptimo del lote, el precio de la oferta, la cantidad de deficiencia, considerando los movimientos y las consecuencias de cada parte. Además, y desde otro ángulo de la cadena de suministro, la cadena de suministro de productos perecederos ha sido siempre uno de los temas más importantes y desafiantes de la gestión de la cadena de suministro en momentos diferentes. El diseño adecuado de la cadena de suministro tendrá un impacto óptimo en el rendimiento del sistema, ya que un diseño inadecuado causará muchos problemas. La pérdida de bienes, además de ser perjudicial económicamente para las empresas, aumenta los daños ambientales y conduce a una mayor contaminación del medio ambiente.

Palabras clave: Cadena de Suministro, Contratos de Cooperación, Mercancías Perecederas, Teoría de Juegos

Citar, estilo APA: Khalafi S, Hafez A, Mohammadi D & Sayyadi M.K. (2017).Considering cooperation contracts in the supply chain of perishable goods using game theory. Revista QUID (Special Issue). 1877-1884.

Abstract: In various activities of components and levels of a supply chain to improve the overall state of the system, many contradictions are seen between the objectives of the components and the various levels in achieving the overall goals of the supply chain, which, over time, contribute to a reduction in the power and competitiveness of the supply chain. The interaction between the two parts of the supply chain determines items such as batch size, order quantity, bid price, and final price. Each of the above points is discussed in the bargaining process of the parties and the final contracts is reached in pursuance of the goals of each of the parties. A plethora of models exists in solving problems and interaction issues between retailers and producers in the supply chain considering many factors, such as cost factors or issues related to the principles of competition between the two parties. The use of game theory to create cooperation between the parties in the supply chain leads to the determination of the equilibrium point, in which the optimal batch size, the bid price, the amount of deficiency, as well as the optimal final price are determined by considering the moves and consequences of each party. Moreover, and from another angle of supply chain, the supply chain of perishable goods has always been one of the most important and challenging issues of supply chain management at different times. Proper design of the supply chain will have optimal impacts on the performance of the system, as inappropriate design will cause many problems. Perishing of goods, in addition to being economically damaging to enterprises, increases environmental damage and leading to further pollution of the environment.

Keywords: Supply Chain, Cooperation Contracts, Perishable Goods, Game Theory

1. INTRODUCTION

In recent years, many researchers and artisans have focused on the supply chain. A supply chain is a set of methods used for effective integration and efficiency of suppliers, manufacturers, distributors, and retailers to minimize costs of system, production, and distribution of goods as many as needed at the right time and place and meeting customer needs. In this regard, supply chain is managed to achieve the best combination of responsiveness and efficiency for market success (Kovačić, D., et al, 2015).

This paper examines the two-tier supply chain and the relationship between producer and retailer. This particular mode represents a manufacturer that sells its product massively to retailers and delivers the product to customers as well. In each supply chain, there is a close interaction between the two levels. This paper has considered the relationship between these two parts as a kind of game to determine each of the above-mentioned points in the process of interaction between producer and retailer. In this game, each player (whether producer or retailer) wants to reach the point at which they get the highest outcomes due to their movements, as well as the consequences of each move of themselves and the opponent. Using the game theory approach, this goal, which is the game's equilibrium, is examined using the non-cooperative game method. The paper states the problem, reviews the literature, and then performs indexing. Later on, the paper introduces the variables of the model, presents model hypotheses and objectives functions of both players - manufacturer and retailer - and finally, with the theory of non-cooperative games obtains the balance between the retailer and the producer.

2. PROBLEM STATEMENT

The primary goal of each supply chain is to meet the needs of customers, and the outcome of this process is earning profits and revenues for the producer and other elements involved in the chain. In general, the movement of materials from suppliers to manufacturers, and then to distributors and retailers, and ultimately to customers throughout the chain illustrates the flow of supply chain activities. Here, the display of information and financial flows throughout the chain is of great importance. In a supply chain, a manufacturer may supply the raw material required from several suppliers rather than from one supplier and, on the other hand, send its products to a large number of distributors. Therefore, many supply chains are in the form of supply networks. Moreover, the supply chain is a network of organizations that deal with upstream downstream processes and activities and value the products and services provided to the final customer. The goal of all those involved in the supply chain is to increase the competitiveness or increase of customer service because today, from a final customer perspective, an entity alone is not responsible for the competitiveness of its products or services, and the supply chain of all organizations involved together; considering these issues, companies competition move towards supply chains (Kovacic D, and Bogataj M 2013).

In recent years, many researchers in the food supply chain have focused on the importance of supply chain management (Khani, M. 2009). Providing healthy and quality food, especially those with more specific conditions, such as perishable goods, is one of the concerns of the companies of these supply chains (Morganti, E., & Gonzalez-Feliu, J. 2015)..

Dangers of food can occur at each stage of the food supply chain, making it necessary to determine the critical control points for information on materials, construction, expiry dates, etc., and to provide it in a transparent manner for participants and suppliers of the supply chain (Li, Y., & Zhao, D. 2014). In the food supply chain, specific circumstances of the chain, such as climatic conditions, seasonality of raw materials, perishing at specified times, and special storage conditions lead to more uncertainties (Lee, H., & Whang, S. 1999).

Based on the studies, complex supply chain of food industry is constantly changing. Changing food preferences, shopping habits and lifestyles increase pressure for easy preparation of products. Furthermore, demographic developments have led to higher demand for fresh products and products with high value added. In addition, given the variety of products in the market, the challenge of predicting and responding to customer demand for manufacturers and retailers is even more important. In addition, manufacturers and retailers must focus more on managing delivery times to grant customer satisfaction. Thus, given the importance of the discussion of food-supply chain and the challenges that exist in this field, such as customer demand changes, delivery times, inventory shortages, etc., and given that perishable foods have more specific conditions compared to non-perishable food, managing supply chain of perishable foods becomes more important. This is because if the products do not reach the customer in a timely manner and corrupt during the cycle, great costs will be imposed on the entire supply chain. The importance and emphasis on competition and collaboration in supply chains have revolutionized the theory of games as an ideal tool for analysis of the actions in the supply chain. Supply chain players compete to improve their profits and performance. For example, multiple factors can compete among members of a chain, such as resource constraints, competition for customer demand, and others. Supply chain members may have to have a commitment and contract to coordinate their strategies to improve the overall system performance. Naturally, a primary methodological tool for examining these issues is the theory of non-cooperative and cooperative games that focuses on sequential or simultaneous decision-making by players under conditions where information is complete or incomplete. (Jain, A., Seshadri, S., & Sohoni, M. 2011)

The application of game theory dates back to the 40's when countries such as Japan and Argentina pioneered this new discipline of mathematicians that focused mostly on proving relationships rather than using theories in practice. However, over time, this new branch of science is a composition of mathematics and economics showing its place in solving conflicts in application and practice Rasmussen, E., & Blackwell, B. (2005). In 1950, John Nash presented an equilibrium point to solve a collaborative problem (Nash Jr, J. F. 1950) as well as a new solution to bargaining issues (Nash, J. F. 1950). He then presented an equilibrium solution to non-cooperative games. Cooperative game refers to situations in which a player's competitive environment tends to co-opt for more profit; but in a non-cooperative game, none of the players is interested in decision-making under cooperative terms and consider individual decision-making as a more appropriate option (Nash, J. 1951).

The term game refers to all situations in which the players' action has interdependence, i.e. the action of each player leads to a positive or negative reaction on the opposite side (opponent), but in the common practice, the following three conditions are required to be established to define the game.

1. There are at least two people, organizations, and so on.

2. The two sides, known to the players, should have conflicting interests.

3. Each player tries to win and achieve a further outcome, but the victory or defeat of a player is not only dependent on his own efforts, but depends on the opponent's movements (Abdoli, Q. 2007).

In the two-tier supply chain, the manufacturer produces the product and provides it to retailers and they take the product to the end customer. The production rate for the producer is a linear function dependent on the amount of market demand. Market demand is also sensitive to selling prices. In the case of demand dependence on the price of the goods, the value of the demand for the product depends on the producer's price and offer price.

System structure

In this research, closed-loop supply chain system is considered similar to dairy systems, including manufacturer and retailer as shown in Figure 1.

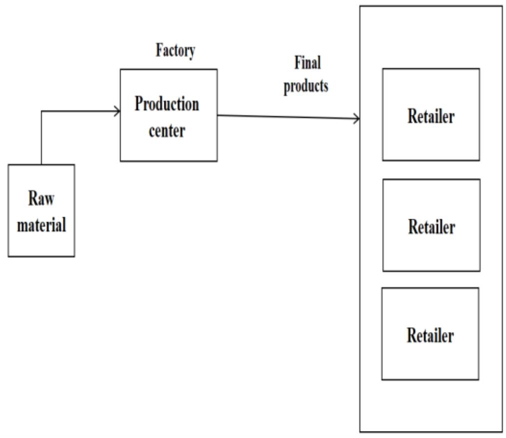

Figure 1. The schematic diagram of the supply chain discussed

The other thing about the model is that the manufacturer initially declares the price to the retailer and, based on the price offered, the retailer can decide on its size and economic order.

3. LITERATURE REVIEW

Many studies have been conducted on the supply chain of perishable materials and the solutions to them, which is summarized in Table 1.

Table 1. Background and research records

Writer(s)	Title	Variables	Tools	Results
Cachon, G. P . (Cachon, G. P. 2003)	Supply chain coordination with contracts	......	The use of newspaper seller problem	Introduction of the instruction
Ömer Faruk Görçün1, Mehmet Saygılı (Görçün, Ö. F., & Saygılı, M. 2008)	Assessing the important factors of perishable food transportation industry	......	....	The importance of temperature in perishing of products
Ilic, A., Staake, T., & Fleisch, E.(Ilic, A., Staake, T., & Fleisch, E. 2009)	Simulation of study on the effects of sensitive information in the supply chain of non-perishable products	-Leadtime of the supplier -Leadtime of Distribution Center -Sales price -Number of sold products - Order level	Simulation	- Reducing costs
Sandberg-Hanssen, T. E., & Mathisen, T. A . (Sandberg-Hanssen, T. E., & Mathisen, T. A. 2011)	Investigating the factors that facilitate the transportation of perishable products	-- Export rate of the product - Consumption - Transport cost	Route and transport mode	- Reducing greenhouse gases
Pishvayi et al. (Pishvaee, M., Razmi, J., & Torabi, S. 2014)	Designing an algorithm based on graph theory	- The amount of customer demand - -The fixed cost of the distribution center - Factory fixed cost - Maximum Production Capacity - The amount of product shipped from the factory and from the distribution center	Math planning	Identify the factors affecting international transportation for perishable products
Gumasta, K., Chan, F. T., & Tiwari, M. K . (Gumasta, K., Chan, F. T., & Tiwari, M. K. 2012)	Combined inventory system with two types of customers	- Fixed and variable costs - Maximum transportation capacity	transportation planning	Network design by balancing costs
Huang, Y., Huang, G. Q., & Gang, K. I . (Huang, Y., Huang, G. Q., & Gang, K. I. 2013)	Dynamic game theory model for coordinating pricing and inventory decisions in a supply chain	- The number of retailers - The cost of maintaining each unit - Ordering fee - Wholesale price	Game Theory	- Maximizing Income
Morganti, E., & Gonzalez-Feliu, J . (Morganti, E., & Gonzalez-Feliu, J. 2015).	Urban procurement for perishable products	- The amount of demand - Delivery period - Frequency of goods request	Analytical review	- Minimizing costs
Kovačić, D., Hontoria, E., Ros-McDonnell, L., & Bogataj, M . (Kovačić, D., et al. 2015)	Location and diversion of lead time in multi-assembly systems for perishable products	- NPV - Product sales price - transport cost	EMRP theory	Playing with Nash equilibrium
Xu, X., Cheng, X., & Sun, Y (X., & Sun, Y. 2015).	CAs for outsourcing supply chain with financial constraints	- Variable and fixed costs - Demand	Math planning	Plans for food delivery to distributors
Dubey, R., Gunasekaran, A., & Childe, S. J .(De Keizer, et al. 2017)	Designing a sustainable supply chain network	- The amount of product shipped from node i to node j - price product - Resale price	CLSC model	Examining the increase in the value added
de Keizer, M., Akkerman, R., Grunow, M., Bloemhof, J. M., Haijema,	Designing a logistics network for perishable products with a period of quality	- Delivered product revenue - Fixed and variable costs - Variance of demand	MILP model	Improving profits

R., & van der Vorst, J. G .(De Keizer, et al. 2017)	decline			

4. SUPPLY CHAIN MODELING

For the modeling of the supply chain, the following assumptions are considered and the parameters and variables of the research are shown in Table 2.

1) An unlimited period of planning is considered.

on the sale price.

Table 2. Parameters and model variables

Row	Symbol	Concept	Type	Explanations
1	P_0	Ordering Price	Variable	Riyal
2	Q	Order Quantity	Variable	Unit
3	P	Final Price	Variable	Riyal
4	C_M	Marketing Cost	Variable	Riyal
5	K	Seller setup Cost	Parameter	$k > 0$
6	i	Seller Purchase Cost	Parameter	Annual
7	α	Buyer Profit	Parameter	$\alpha > 1$
8	$C_S(B)$	Seller Profit	Parameter	Riyal
9	$C_s(S)$	Seller Stock out Cost	Parameter	Riyal
10	$C_P(S)$	Stockout	Parameter	Riyal
11	D	Ordering Price	Parameter	Annual
12	Pr_B	Order Quantity-	-	Annual
13	Pr_s	Final Price -	-	Annual
14	$C_b(s)$	Marketing Cost	Parameter	Riyal
15	b	Seller setup Cost	Variable	-

According to the aforementioned explanation, demand is a function of the price of the product; in particular, $D = f(P)$ and according to Lee and Kim's (1993) model, the demand can be calculated via $D = f(P) = K.P^{-\alpha}$ (Yue, Jinfeng, et al. 2006).

4.1. Retailer model

The retailer's goal is to determine the amount of sales price and marketing costs in a way that maximizes its net profit. The selling price affects the amount of demand, and consequently the size of the manufacturer's category will change. Therefore, the annual profit function for retailers will be as Relation 1. In the following, the profitability of retail sales in the two-tier supply chain is derived from the function $D = f(P) = K.P^{-a}$ for the value of D in the above relation and the producer's profit function will change as follows:

$$Pr_S(P_0, Q) = P_0.D) - (C_P(S).D) - (C_S(S).\frac{D}{Q}) -$$

$$(\frac{i.C_P(S).(Q-b)^2}{2.Q}) - (\frac{C_b(S).b.D}{Q}) - (\frac{C_b(S).b^2}{2.Q}) \qquad (4)$$

2) The deterministic and predetermined model parameters are considered.
3) Inventory and maintenance costs are considered high for the manufacturer.
4) The annual demand depends

(5) A shortage of authorized inventory systems is considered, and for each deficit item, there are penalties for defective costs.
difference in sales revenue from the cost of buying, ordering and storing goods (Esmaeili, M., et al, 2008).

$$Pr_B(P) = (P.D) - (P_0.D) - (C_S(B).\frac{D}{Q}) - (\frac{1}{2}.i.P_0.Q)$$

(1)

We place the amount of demand according to $D = f(P) = K.P^{-\alpha}$ in the above function, and the above relation will change as 2:

$$Pr_B(P) = (K.P^{1-\alpha}) - (K.P_0.P^{-\alpha}) - (\frac{1}{2}.i.P_0.Q) - (C_S(B).\frac{K.P^{-\alpha}}{Q})$$

(2)
We derive from the above function in terms of product price and set it equal to zero. Assuming the other variables as constant, we will have the final price value for retailers in the form of Relation (3):

$$\frac{\partial Pr_B(P)}{\partial} = 0 \rightarrow P^* = \frac{\alpha.(P. + \frac{C_S(B)}{Q})}{\alpha - 1}$$

(3)

4.2. Manufacturer model

The manufacturer's goal in interaction with supply chain retailer is to determine batch optimal size and the suggested price to the retailer in such a way as to maximize its profit in the supply chain. With the development of Abed & Weng (1998) model and adding batch size to their model, the net profit of the supplier can be calculated as follows (Relation 4).
We replace demand

$$Pr_S(P_0, Q) = (K.P_0.P^{-\alpha}) - (K.C_P(S).P^{-\alpha}) - (\frac{K.C_s(S).P^{-\alpha}}{Q}) -$$

$$(\frac{i.C_P(S).(Q-b)^2}{2.Q}) - (\frac{K.C_b(S).b.P^{-\alpha}}{Q}) - (\frac{C_b(S).b^2}{2.Q})$$

(5)

By assuming the manufacturer's bid price constant and making the derivation of the profit function obtained equal to zero in Relation (5), we will calculate the ratio of the size of the economic order, the optimal amount of the economic order (batch size) as well as the optimal amount of deficiency for the producer as follows (Haj Shir Mohammadi, A. 2007).

$$\frac{\partial \Pr_S(P_0,Q)}{\partial Q}=0 \Rightarrow Q^{*s}=\sqrt{\frac{2.D.C_S(S)}{i.C_P(S)}}\times\sqrt{\frac{C_b(S)+(i.C_P(S))}{C_b(S)}}$$

(6)

$$\frac{\partial \Pr_S(P_0,Q)}{\partial b}=0 \rightarrow b^*=\sqrt{\frac{2.D.i.C_s(S).C_P(S)}{C_b(S).\left[(C_b(S)+(i.C_P(S))\right]}}$$

(7)

We place the above value in the producer's profit function and set it to zero, the price of the producer to the retailer, in which the producer's profit is zero, can be calculated as Relation 8:

5. SOLVING THE MODEL USING GAME THEORY

In this section, the interaction between the manufacturer and the retailer is considered and examined as the non-cooperative game by Stackelberg. In the non-cooperative game of Stackelberg, one of the players dominates the other and is somehow played in a dynamic and sequential manner, and one of the players has the advantage of delay in the move (Osborne, Martin J., 2004).

5.1. The producer's non-cooperative game model of Stackelberg

In this case, the manufacturer is a pioneer and the retailer has a following role. In proportion to the value of the proposed price and the size of the specified category by the manufacturer, the customer should receive the best final price and marketing cost according

5.2. The retailer non-cooperative game of Stackelberg

price and order batch size.

$$\text{MaxZ} \quad \Pr_B(P)=(K.P^{1-\alpha})-(K.P_0.P^{-\alpha})-(\frac{1}{2}.i.P_0Q)-(C_S(B).\frac{K.P^{-\alpha}}{Q})$$

Subject To:

$$Q^*=\sqrt{\frac{2.D.C_S(S)}{i.C_P(S)}}\times\sqrt{\frac{C_b(S)+(i.C_P(S))}{C_b(S)}}$$

$$b^*=\sqrt{\frac{2.D.i.C_S(S).C_P(S)}{C_b(S).(C_b(S)+(.C_P(S))}}$$

$$P_0^*=R.(\left[C_P(S)\right]+[\frac{C_S(S)+C_b(S)}{Q}]+[\frac{[i.C_P(S).(Q-b)^2]+[C_b(S)/b^2]}{2.K.Q.P^{-\alpha}}])$$

$$P\geq 0$$

Solving two non-linear programming models above with the aid of MATLAB software calculates the equilibrium of the retailer-producer game, and the unknown values of the producer's initial price, the amount of the economic order, the amount of

$$P_0=\left[C_P(S)\right]+\left[\frac{C_S(S)+C_b(S)}{Q}\right]+\left[\frac{\left[i.C_P(S).(Q-b)^2\right]+\left[C_b(S).b^2\right]}{2.K.Q.P^{-\alpha}}\right]$$

(8)

Given that the profit function for the producer is a linear and upward function, the optimal point in such a function is at the highest price that the manufacturer can offer to the retailer. Therefore, the optimum price offered by the manufacturer to the retailer is as follows:

(9)

$$P_0^*=R.P_0 \qquad \text{IF} \quad R>1$$

to the manufacturer's actions and the model. In this case, the producer seeks to maximize his profit but based on the final and optimal retailer's price, which in some way expresses the best responses of the other player (Osborne, Martin J., 2004), so the mathematical model of the problem will be based on the objective function and its constraints are as follows:

$$\text{MaxZ} \Pr_s(P,Q)=(k.P_0.P^{-\alpha})-(K.C_P(S).P^{-\alpha})-(\frac{K.C_S(S).P^{-\alpha}}{Q})-(\frac{i.C_P(S).(Q-b)^2}{2.Q})$$

$$-(\frac{K.C_b(S).b.P^{-\alpha}}{Q})-(\frac{C_b(S).b^2}{2.Q})$$

subject To:

$$P^*=\frac{\alpha.(P_0+\frac{C_S(B)}{Q})}{(\alpha-1)}$$

$$P_0,Q,b\geq 0$$

In this model, based on the target function calculated, the retailer seeks to maximize his profit based on the manufacturer's bid

deficiency, and the final price of the product are obtained.

6. CONCLUSION

With sensitivity analysis of the above models relative to , one can measure the sensitivity of the model to this parameter. By plotting the producer and retailer's profit functions according to this parameter and changing the parameter value, one can determine the sensitivity of the two-level supply chain objective functions relative to this parameter. This paper examined the challenge between producer and retailer in a two-tier supply chain and used game's theory with non-cooperative approach to solve the challenge. Since there are different categorizations for games, one can examine non-cooperative strategy of this paper with other game theories, such as static game with full information, static game with incomplete information, dynamic game with full information, and cooperative game as well as dynamic game with incomplete information and calculate and analyze solutions such as Nash equilibrium, dominant balance, poor equilibrium, recursive equilibrium, or sub-game equilibrium.

The demand function used in the model has only considered dependence of demand on the product part as the demand pull factor. However, in perishable products industry, in particular dairies, in addition to the final price of the product, other factors, such as the level of freshness of the product affect the demand for the product. Thus, in future research, the researchers can consider the demand function in a more sophisticated and realistic way to establish cooperation in the supply chain with the game theory approach.

REFERENCES

Abdoli, Q (2007). Game theory and applications: University Jihad of Tehran University.

Cachon, G. P. (2003). *Supply chain coordination with contracts.* Handbooks in operations research and management science, 11, 227-339.

De Keizer, M., Akkerman, R., Grunow, M., Bloemhof, J. M., Haijema, R., & van der Vorst, J. G. (2017). *Logistics network design for perishable products with heterogeneous quality decay*. European Journal of Operational Research, 262(2), 535-549.

Dubey, R., Gunasekaran, A., & Childe, S. J. (2015). The design of a responsive sustainable supply chain network under uncertainty.

Esmaeili, M., Aryanezhad, M.B., Zeephongsekul, P., A (2008). *Game Theory Approach In Seller And Buyer Supply Chain*., Europearn Journal Of Operarion Research.

Görçün, Ö. F., & Saygılı, M. (2008). Important Factors on Perishable Foods Transportation and Food Logistic Systems and Turkish Food Logistic Sector.

Gumasta, K., Chan, F. T., & Tiwari, M. K. (2012). *An incorporated inventory transport system with two types of customers for multiple perishable goods*. International Journal of Production Economics, 139(2), 678-686.

Haj Shir Mohammadi, A. (2007). *Principles of Planning and Control of Production and Inventories,* Fifth Edition, Isfahan, Arkan Danesh Publication.

Ilic, A., Staake, T., & Fleisch, E. (2009). Simulation Study on the Effect of Sensor Information in Supply Chains of Perishable Goods.

Huang, Y., Huang, G. Q., & Gang, K. I. (2013, June). Dynamic game-theoretic model for coordinating pricing and inventory decisions in a supply chain with retailer competition. In Proceedings of the Paper presented at the International Conference on Education Technology and Information System.

Kovačić, D., Hontoria, E., Ros-McDonnell, L., & Bogataj, M. (2015). *Location and lead-time perturbations in multi-level assembly systems of perishable goods in Spanish baby food logistics.* Central European journal of operations research, 23(3), 607-623.

Kovačić, D., Hontoria, E., Ros-McDonnell, L., & Bogataj, M. (2015). *Location and lead-time perturbations in multi-level assembly systems of perishable goods in Spanish baby food logistics.* Central European journal of operations research, 23(3), 607-623.

Kovacic D, Bogataj M (2013) *Reverse logistics facility location using cyclical model of extended MRP theory.* Cent Eur J Oper Res 21(1):41–57.

Khani, M. (2009). Identifying Effective Factors on Supply Chain Management. Master's Degree in Mazandaran University of Science and Technology.

Jain, A., Seshadri, S., & Sohoni, M. (2011). Differential pricing for information sharing under competition. Production and Operations Management, 20(2), 235-252 .

Li, Y., & Zhao, D. (2014). *Low-carbonization supply chain two-part tariff coordination based on fairness preference*. Management Review, 1, 159-167 .

Lee, H., & Whang, S. (1999). *Decentralized multi-echelon supply chains: Incentives and information*. Management science, 45(5), 633-640 .

Morganti, E., & Gonzalez-Feliu, J. (2015). City logistics for perishable products. The case of the Parma's Food Hub. Case Studies on Transport Policy, 3(2), 120-128.

Nash Jr, J. F. (1950). The bargaining problem. Econometrica: Journal of the Econometric Society, 155-162 .

Nash, J. F. (1950). *Equilibrium points in n-person games*. Proceedings of the national academy of sciences, 36(1), 48-49 .

Nash, J. (1951). Non-cooperative games. Annals of mathematics, 286-295.

Pishvaee, M., Razmi, J., & Torabi, S. (2014). An accelerated Benders decomposition algorithm for sustainable supply chain network design under uncertainty: A case study of medical needle and syringe supply chain. Transportation Research Part E: Logistics and Transportation Review, 67, 14-38.

Osborne, Martin J., An introduction to game theory,. Oxford University Press., 2004.

Rasmussen, E., & Blackwell, B. (2005). Games And Information; An Introduction To Game Theory (fourth ed.): Indiana: Indiana University Press.

Sandberg-Hanssen, T. E., & Mathisen, T. A. (2011). Factors facilitating intermodal transport of perishable goods–Transport purchasers viewpoint.

X., & Sun, Y. (2015). *Coordination contracts for outsourcing supply chain with financial constraint.* International Journal of Production Economics, 162, 134-142.ing Management, 4, 54-58 .

Yue, Jinfeng, Austin, Jill, Wang, Min Chiang, Huang, Zhimin.., *Coordination of cooperative advertising in a two-level supply chain when manufacturer offers discount*,. European Journal of Operational Research., 2006.