Available online at http://scik.org

J. Math. Comput. Sci. 11 (2021), No. 3, 3244-3262

https://doi.org/10.28919/jmcs/5682

ISSN: 1927-5307

PUBLICITY AND PRESERVATION IMPACT ON MULTIPLE SUPPLY CHAIN NETWORK DESIGN (MSCND): A LITERATURE REVIEW

KAILASH CHANDRA NAYAK[1], JIBENDU KUMAR MANTRI[2], MONALISHA PATTNAIK[3,*]

[1]Dept. of Mathematics, Maharaja Sriram Chandra Bhanja Deo University, Baripada, Odisha 757003, India

[2]Dept. of Computer Application, Maharaja Sriram Chandra Bhanja Deo University, Baripada, Odisha 757003, India

[3]Dept. of Statistics, Sambalpur University, Sambalpur, Odisha 768019, India

Abstract: Success of Multiple Supply Chain Supply Network Design depends upon how its factors are systematically analyzed and the best possible ideas are placed in the design for Profit Maximization. Basically we discuss about few general factors like deterioration, multi-level and multi-items for design of Supply Chain Network but the hidden factor are always count for success of design like publicity of Products, Transportation, Preservation Technology and its awareness etc. used by the concerned organization in the Network Model. The layers of supply chain involves variety of people but efficiency to be maintained at every level for easy reachable of products to its customers and generating profits. If profit to be analyzed, it is not to be consider at a particular level rather every level's profit margin to be calculated for analysis to design an optimized supply chain network. A network design can be successful whenever customers are not only able to get their products at right time, affordable price, easy available of products at the door steps but also to be focused on how to reduce deterioration, increase demand for a particular products, enhance publicity, effective preservation strategy, less movement of goods etc. for gaining profits. The review analyzed various authors paper published between the years 2010 to 2020 and conclude a summary how best practices to be maintained in product publicity and preservation level, so as to get an optimized Supply Chain for Industrial use.

Keywords: preservation strategy; publicity; deterioration; multi-items; multi-level; optimized supply chain.

2010 AMS Subject Classification: 90B06.

---

*Corresponding author

E-mail address: monalisha_1977@yahoo.com

Received March 13, 2021

1. INTRODUCTION

Growth of the organization begins with the focus to analyze all aspects of functioning of the activities whether internal or external to it. Demand begins with the publicity of the organization in media or marketing of its product and services by the employee or its representatives, which alternatively requires keeping enough products in the stock for sale and also trying to pressurize the organization to carry a suitable preservation strategy to reduce the deterioration of products.

In general, publicity is the public visibility or awareness for any products, services or organization itself and refers to the movement of information from its source to the general public. It includes the factors like public interest, quality of goods and services, demand of organization and how the workforce operating the activities. In other way we can say that promotion refers to marketing communication to inform or persuade target audiences of the relative merits of a product, service, brand or issue. It helps marketers to create a distinctive place in customers' mind. The aim of promotion is to increase awareness, create interest, generate sales or create brand loyalty.

The way of managing customers through different networks is called multiple supply chains. Managing multiple supply chains is the next big challenge for logistics professionals. The trend towards multiple supply chains stems from various factors, including the proliferation of new product introductions, rising expectations for fast and differentiated service, and outsourcing. Each new chain brings with it a host of additional relationships and also associated with a greater risk of problems. Success in managing multiple supply chains requires each chain to be clearly identified and designed to meet both external and internal needs.

The objective is optimizing the core activities to maximize the speed of response. For satisfying the customer demand every industry is broadening its product lines to provide the variety of choices. The challenge is not only to produce so many different products but also to distribute the multiple products to a customer. The strong supply chain is the key to the company’s success. The supply chain should be structured to meet the needs of multi-item and customer demand and enhancing its operations which stimulate the revenue growth in variety of ways.

Due to demand in the market, every organization wants to enhance their production, push the retailers to keep more products, increase transportations, recruits more people for effective management, creating more retailers, giving rewards for retailers and many other strategies which require a big investment. But when all items successfully sale in the market, it enhance the

profit margin as per expectation. No one can say that all items can easily pushed in the market in a day, hence it require to keep the items as intact whether the item is perishable or non-perishable, which avoids deterioration and it can be done through effective preservation strategy.

2. LITERATURE REVIEW

The emergence of an increasingly competitive global economy has brought supply chain management to the top of agenda of the supply chain partners. For the sustainable and competitive supply chain, procurement and inventory control are truly large scale problems, often involving more than hundreds of items. In a multi-item distribution channel, considerable savings can be realized during the replenishment by coordinating the ordering of several different items. Multi-level, multi-item replenishment strategies are already widely applied in the real world, for example, Tsao and Sheen [32] and others have developed models and algorithms for solving multi-item replenishment problems for different constraints and Multi-level coordination is frequently applied in current business practice.

Ouyang found that if the retailer can reduce effectively the deteriorating rate of item by improving the storage facility, the total annual relevant inventory cost will be reduced. Many enterprises invest on equipments to reduce the deterioration rate and extending the product expiration date. For example, refrigeration equipments are used to reduce the deterioration rate of fruits, flowers and sea foods in the supermarket. Moreover, during the vacuum technology are introduced to reduce the deterioration rate of medicine and food stuff. so it is an essential component in supply chain model Hence the multi-level , multi-deteriorated item supply chain is the focused in this study.

2.1 Deterioration in MSCN

Over the last four decades a lot of work has been published for controlling the inventory of deteriorating items. The analysis of decaying inventory problems began with Ghare and Schrader (1963), who developed a simple economic order quantity model with a constant rate of decay. Products are assumed to deteriorate with time resulting in a decreasing utility or price from the original one. Some of the examples of perishable items are fresh sea foods, medicines, battery, volatile chemicals and semiconductor chips. Covert and Philip extended Ghare and Schrader‘s model and obtained an economic order quantity model for a variable rate of deterioration by assuming a two-parameter Weibull distribution. Misra [28] developed the first production lot

size model in which both a constant and variable rate of deterioration were considered and obtained approximate expressions for perishable items, such as medicine, volatile liquids, and food, product quantity decreases because of deterioration during a normal storage period. Different authors are carried the different research police for deteriorated items up to 2010 and we focused different views by authors in different years.

Sicilia et al. [10]: *An inventory model for deteriorating items with shortages and time-varying demand*

This paper studied a deterministic inventory system for items with a constant deterioration rate where demand varies in time and it is assumed that it follows a power pattern. Shortages are allowed and backlogged.

Chang et al. [3]: *Optimal manufacturer's replenishment policies for deteriorating items in a supply chain with up-stream and down-stream trade credits*

This study presents the optimal retailer‘s replenishment policies in the economic production quantity model for deteriorating items with two –level trade credit, in which the retailer receives the supplier trade credit and provides the customer trade credit .The author propose a simple arithmetic-geometric inequality method to find the optimal solution when the deterioration rate is sufficiently small.

Liao et al. [12]: *Lot-sizing decisions for deteriorating items with two warehouses under an order-size-dependent trade credit*

This study attempts to determine economic order quantity for deteriorating items with two-shortage facilities where trade credit is linked to order quantity. This study involves how retailers decide whether to rent an additional warehouse to hold more items and obtain a trade credit period. A deterministic inventory model is developed for deteriorating items and demonstrates that the total cost function per unit time.

Soni et al. [9]: *Optimal strategy for an integrated inventory system involving variable production and defective items under retailer partial trade credit policy*

In this study an integrated inventory model with variable production rate and price –sensitive demand rate under two-level trade credit is investigated. The Model considers two-level trade credit policy in which the retailer receives a full trade credit from supplier and offers partial trade credit to its customers. This study attempts to offer a best policy for retail price, the

replenishment cycle, and the number of shipment from the supplier to the retailer in one production that maximize the joint expected total profit per unit time.

2.2 Multi-echelon and Multi-item in MSCN

In general, a supplier produces different products for a single customer and ships to the customer simultaneously in a single truck where as in the grocery supply industry for fast moving consumer goods industry different types of refrigerated goods can be shipped in the same truck to the same supermarket or retail store. Chen [24] and Tsao and Sheen [32] and others have developed models and algorithms for solving multi-item replenishment problems for different constraints because it requires coordination which frequently applied in current business practices.

It is also studied from different papers that payment against delivery will be made to the suppliers immediately after receiving the consignment where as others provide a fixed time period which attracts the retailers to keep their products in the shop and allow favourable customers to purchase. This is also a promotional activity made by the business organizations for retailers not only aware about the products to the customers but also contributing in the enhancement of sales. The following papers describes about optimal deteriorating inventory models for multi-item and multi-echelon supply chain.

Yu [11]: *Optimal deteriorating items inventory model with a three-echelon supply chain strategic alliance*

This study develops a mathematical inventory model for deteriorating item taking into a vertical integration of a three –echelon supply chain through strategic alliances. The objective of this study is to minimize the joint total relevant cost or the integrated inventory model. Heuristic is used to derive the optimal solution. The model has demonstrated how an integrated approach to decision making can achieve a global optimum and outperform three typically individuals models that is independent model, dominant supplier‘s model, dominant retailer‘s model.

Tsao et al. [32]: *A multi-item supply chain with credit periods and weight freight cost discounts*

In this study, a multi-item supply chain with a credit period and weight freight cost discounts is considered. The retailer bears the freight costs, but the freight carrier provides freight-transport discounts that are positively related to the weight of the cargo transported. This paper consider two profit optimization models, with credit periods and weight freight cost discounts, from both the individual and channel perspectives, for this the dual problems of determining the ideal

supplier credit period and for the retailer to make multi-item replenishment and pricing decisions to maximizing the profit.

Duan et al. [35]: *Two level supply chain coordination with delay in payments for fixed lifetime products*

This study based on a single-vendor, single-buyer supply chain system for fixed lifetime products is considered in the settings of both decentralized and centralized models. And it makes coordination between the vendor and the buyer. It evaluate the efficiency of the proposed delay in payments policy

Teng et al. [13]: *Economic order quantity model with trade credit financing for non-decreasing demand*

This paper established lot size models under trade credit financing with demand function increases with time at the growth stage of product life cycle (high –tech product) .this paper also obtain the robust and generalized result for both growth and maturity stages of a product life cycle.

Chen et al. [24]: *Economic production quantity models for deteriorating items with up-stream full trade credit and down-stream partial trade credit.*

This proposes an economic production quantity (EPQ) model for deteriorating items in a supply chain with both up-stream and down-stream trade credit financing. By using fractional programming results, and it suggested that optimal solution not only exists but also is unique.

Chang et al. [4]: *Optimal pricing and ordering policies for non-instantaneously deteriorating items under order-size-dependent delay in payments*

Here authors consider an inventory system with non-instantaneously deteriorating items in circumstances where the supplier provides the retailer with various trade credits linked to order quantity. First, they develop a mathematical model to identify the optimal pricing and ordering policies for maximizing the retailer's total profit. And propose some algorithms for finding the optimal solutions.

Shah [21]: *Manufacturer-retailer inventory model for deteriorating items with price-sensitive credit-linked demand under two-level trade credit financing and profit sharing contract*

This study deals a single manufacturer and single retailer of the supply chain when units in warehouse are subject to deterioration at a constant rate. The demand is a decreasing function of a selling price and increasing function of credit period offered by a retailer to the customers. This

study considers sharing of profit between the players during the credit period. The objective is to maximize the total joint profit with respect to replenishment time, selling price, and credit period. An author proposed model to incorporate preservation technology investment to control the deterioration of items in the inventory system.

Taxakis et al. [14]: *A design model and a production-distribution and inventory planning model in multi-product supply chain networks*

In this paper the authors proposed two models. The first model is a mixed-integer linear programming model by concerning with the supply chain network design problem, whereas the second operational model is a mixed-integer non-linear programming model in respect to the production-distribution and inventory planning problem in a supply chain network. By knowing the number of customers and suppliers as well as their demand and capacities two steady-state genetic algorithms is implemented in MATLAB in order to solve both the design and the operational model. By applying two genetic algorithms the multi-product supply chain network design problem, the multi-product, multi-time period production-distribution and inventory problem are solved. These two models could provide the practitioners with useful tools in making critical decisions for the supply chain at a strategic as well as at a tactical and operational level for perfection of their supply chain. The results are compared with GAMS for both first and second models. It is found that for some cases GA provides better results with accuracy than GAMS.

Islam et al. [25]: *A joint economic lot size model for a supplier-manufacturer-retailer supply chain of an agricultural product*

The paper presented a three-tier joint economic lot size supply chain model of delivering agricultural products which are comprising of a single seasonal supplier, a single manufacturer and multiple retailers. Demand is assumed as deterministic constant. The objective of this study is to find the number of shipments and shipments size in a cycle from the supplier to the recipient to minimize the total cost of ordering, setup, shipment and holding. Considering the strategic use of a seasonal supplier‘s time and the modern integrating tendency among the supply chain players for greater benefits, the authors have developed a new agro based joint economic lot sizing model. They have considered conversion ratio of raw materials to finished product. Both algebraic and the differential methods of solution to the model are employed to provide the

results theoretically to validate numerical example problems. The used parallel multiple jumps technique applied for shipments and also calculated optimal result.

Zhang et al. [29]: *Optimal trade credit and replenishment policies or supply chain network design. International journal production*

Here paper proposed an integrated supply chain network design model that incorporates payment time. And to minimize the system-wise location, transportation, multi-echelon inventory, and financing costs. It also suggested the optimal network will be more consolidated with higher financing costs and significant cost reduction can be achieved by considering financial decisions at the strategic supply chain design stage.

Ramezaanian et al. [23]: *Blood supply chain network design under uncertainties in supply and demand considering social aspects*

In this paper authors to attempt to increase blood donors' utility in order to reduce shortages and harmful damages. Parameters including distance of blood donors from blood facilities, experience factor of donors in blood facilities and advertising budget in blood facilities are considered social aspects t, a deterministic location-allocation model is proposed applying a mixed integer linear programming (MILP) optimization. Due to the stochastic nature of demand and cost parameters, the aforementioned model is developed to incorporate uncertainty using a robust optimization approach that can overcome the limitations of scenario-based solution methods, i.e., without excessive changes in complexity of the underlying base deterministic model.

2.3 Publicity and Preservation effort in MSCN

The aforesaid papers focused a little on preservation technology (PT) for reducing deterioration. Basically factors like sales, inventory and order quantities are very sensitive to the rate of deterioration, especially for fast deteriorating products. Ouyang found that annual relevant inventory cost will reduce the deteriorating rate by improving the storage facility. Many enterprises invest on equipments to reduce the deterioration rate and extending the product expiration date.

The mentioned studies on perishable items have considered deterioration an exogenous variable, which cannot be controlled by the company. In practice, however, specialized equipment or processes, such as freezer equipment and cold storage techniques, can be used to control deterioration, many enterprises have examined deterioration causes and have developed

preservation technologies to control them and increase profit. Dye and Hsieh [5], Hsu et al. [22] determined replenishment and preservation technology investment policies under a constant deterioration rate and partial backlogging. Dye and Hsieh [5] and Dye [7] have considered preservation technology cost a function of the length of replenishment cycle time. Dye and Hsieh [6] have considered the effect of preservation technology investment costs on preservation equipment for reducing deterioration rate under two-level forward financing. In the current study, both preservation technology cost and the deterioration rate functions of preservation effort will be considered.

The model with promotional effort factor provides the decision maker with useful and practical insights. Tsao and Sheen [32] discussed dynamic pricing, promotion and replenishment policies for a deteriorating item under permissible delay in payment. This study addresses the problem by proposing an inventory model under promotion. So optimization of the proposed model has been studied by adding promotional effort cost with promotion constraint.

Hsu, et al. [22]: *Preservation technology investment for deteriorating inventory*

This study focused on deteriorating inventory policy for retailer's investment in preservation technology and to reduce the rate of product deterioration. it provides a solution to determine the optimal solution on based on preservation technology ,order quantity and period . and also provides a sensitivity analysis.

Teng et al. [13]: *Economic order quantity model with trade credit financing for non-decreasing demand*

This paper established lot size models under trade credit financing with demand function increases with time at the growth stage of product life cycle (high –tech product) .this paper also obtain the robust and generalized result for both growth and maturity stages of a product life cycle.

Dye et al. [5]: *An optimal replenishment policy for deteriorating items with effective investment in preservation technology*

The authors are formulated inventory model with time –varying deterioration and partial backlogging. It focused to find the optimal replenishment and preservation technology strategy for investment to achieve profit maximization then provide a simple algorithm to figure out the optimal preservation technology cost and replenishment schedule for the proposed mode

Alejandro et al. [8]: *A multi-product lot-sizing model for a manufacturing company*

This study presents an integer linear programming model for a multi –product lot sizing problem. The problem considers demands, inventory policies, backorder costs and the search of an efficient use of resources. The real-world case different used to illustrate the model is from a Colombian company, which produces raw material for the bakery industry. The short term planning for the company under study is critical, because there is a multi-product environment whit shared resources by different products and processes.

Dye et al. [7]: *The effect of preservation technology investment on a non-instantaneous deteriorating inventory model*

This study based on the joint problem where the replenishment policy and preservation technology cost is taken as decision variables. And it provides some results on finding the optimal replenishment and preservation technology strategies. Again study investigates the change of the optimal solution and the total profit per unit time

Dye et al. [6]: *A particle swarm optimization for solving lot-sizing problem with fluctuating demand and preservation technology cost under trade credit*

In this paper consider the effect of preservation technology cost investing on preservation equipment for reducing deterioration rate under two-level trade credit. The preservation technology cost is allowed for periodical upward or downward adjustments due to the time varying demand and the strategy of trade credit within the planning horizon. They establish a deterministic economic order quantity model for a retailer to determine his optimal preservation technology cost per replenishment cycle that will maximize the present value of total profit.

Tsao et al. [33]: *Heuristic for the joint multi-item replenishment problem under trade credits*

This study deals with a joint multi-item replenishment problem under the trade credit. Joint multi-item replenishment has been widely in many industries to take advantage to transport economies of scale. This paper extends the traditional inventory model by considering trade credit and multi-item replenishment in order to better reflect the real-world business situation. The objective is to determine the optimal replenishment schedule for each item while minimizing the total cost. Two heuristics namely, cost balancing and extreme finding are developed to resolve this problem.

Tsao et al. [31]: *Joint location, inventory, and preservation decisions for non-instantaneous deterioration items under delay in payments*

This paper focused of models in joint location, inventory and preservation decision-making problem for non-instantaneous deteriorating items under delay in payments. Again studied the deteriorating rate will decrease and the reservation cost will increase as the preservation effort increases. Therefore, how much preservation effort should be made in decision? The objective of this paper is to determine the optimal locations and number of DCs, the optimal replenishment cycle time at DCs, and the optimal preservation effort with profit is maximization

Pal et al. [2]: *Two-echelon manufacturer-retailer supply chain startegies with price, quality, and promotional effort sensitive demand*

This study deals with the two-layer supply chain model of one manufacturer and one retailer for a single commodity where market demand is assumed to be dependent on selling price, quality of the products, and promotional effort of the retailer. The objective of this paper is to determine the optimal selling price and promotional effort of the retailer, while the optimal wholesale price and quality of the products are determined by the manufacturer so that the above strategies are maximized.

Tsao et al. [30]: *Designing a supply chain network for deteriorating inventory under preservation effort and trade credits*

This paper focused factors of preservation effort and preservation technology in supply chain as PT cost increases and deterioration rate decreases. An algorithm based on piecewise nonlinear optimization is provided for solving supply chain network design problems efficiently

Pattnaik et al. [18]: *Preservation effort effects on retailers and manufacturers in integrated multi-deteriorating item discrete supply chain model*

The paper deals with the study on three layer supply chain model for manufacturer and retailer for multiple commodity. Here different parameters are considered on selling price, quality of the products, and promotional effort of the retailer and the overall objective is to determine the optimal selling price and promotional effort of the retailer with profit maximization.

The below mentioned table is the summary of the study which based on different factors as suggested by different authors.

Table - 1: Literature studied from 2010 to 2020 on the basis in Supply Chain Models

Sl. No.	Authors' Detail	Objective Function (C/P/M)1	Number of Echelons in the Supply Chain	Number of Commodities (S/M)2	Demand (D/S)3	Number of Time- Periods (S/M)2	Deteriorated Items (+/-)	Forward Financing (+/-) & (F/P)	Publicity Effect (+/-)	Preservation Technology Effect (Y/N)	Industrial Applications (I/N)
1	Hsu, et al .[22]	P	2	M	D	S	+	F	-	Y	I
2	Chang et al. [3]	P	2	M	D	S	+	F	-	N	N
3	Yu (2010)[11]	C	3	M	D	M	+	F	-	N	N
4	Tsao, et al. [32]	P	3	M	D	M	+	+ & F	-	N	I
5	Liao , et al [12]	C	2	M	D	M	+	F	-	N	I
6	Dye et al. [5]	P	1	S	D	M	+	-	-	Y	I
7	Duan ,et al .[35]	C	2	M	D	M	-	F	+	N	I
8	Soni, et al .[9]	P	2	M	D	M	+	F	-	N	I
9	Teng , et al. [13]	C	2	S	D	M	-	F	-	N	I
10	Dye ,et al. [6]	P	3	M	D	M	+	F	-	Y	I
11	Dye ,et al. [7]	C	3	M	D	M	-	F	-	Y	I
12	Tsao, et al. [33]	C	1	M	D	S	-	+ & F	-	N	I
13	Tsao ,et al. [34]	P	3	M	D	S	-	+ & F	-	N	I
14	Alejandro et al. [8]	P	2	M	D	S	-	F	-	N	I
15	Tsao , et al. [31]	C	3	M	D	M	+	F	-	Y	I
16	Chen, et al. [24]	P	3	M	D	M	+	F	+	N	I
17	Sicilia et al. [10]	P	2	M	D	S	-	F	-	N	N
18	Shah [22]	P	2	M	D	M	+	F	+	N	I
19	Chang, et al. [4]	C	3	M	D	S	-	-	-	N	I
20	Pal, et al. [2]	C	2	M	D	S	+	-	+	N	N
21	Tsao, et al. [30]	P	3	M	D	M	+	F	-	N	N
22	Taxakis et al. [14]	C	3	M	D	M	-	+ & F	-	N	I
23	Zhang , et.al.[29]	C	3	M	D	M	+	F	+	N	I
24	Islam et al. [25]	C	2	M	D	M	+	F	-	N	N
25	Ramezaanian, et al [23]	P	3	M	D	M	+	F	+	N	I
26	Pattnaik, M. [19]	P	3	M	D	M	+	F	-	N	I
27	Pattnaik, M.et al. [20]	P	3	M	D	M	+	F	+	Y	I

1: C: Cost, P: Profit. 2: S: Single, M: Multiple 3: D: Deterministic, S: Stochastic,

4: F: Fully Forward Financing 5: P: Partially Forward Financing

6: Y-Yes; N-No; I-Industrial Application; N-Not Applicable.

3. REVIEW METHODOLOGY

The current review paper gathers relevant data on literatures available between the year 2010-2020 on deterioration and publicity with preservation technology in multiple supply chain networks. Table-1 represents different factors focused by the authors in their study and Table -2 represents abstract list on publicity and preservation technology and industrials application which are compared; how much efforts have been made during the years and how they contribute to the industry with the objective to get easy availability of products at retails shop, contributing the role of publicity factors in the demand of products, enhance profit margin, and suggest for an optimized solution for multiple supply chain network.

4. ANALYSIS

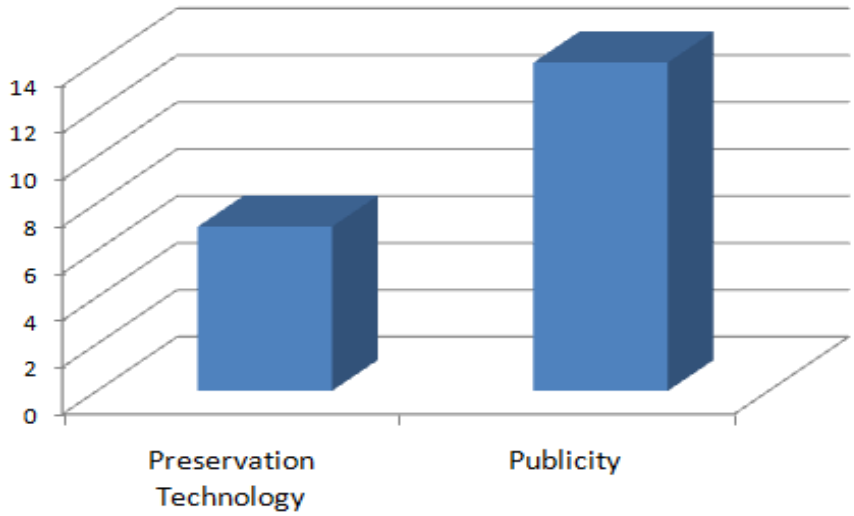
After thorough analysis on the abstract factors like key objectives (Preservation Technology / Publicity), no. of commodities, deteriorated items and industrial applications of Table-1, the below mentioned chronological list has been designed. The extracted data used in Table-1 is analyzed in variety of ways to conclude specific results and also generating areas which are to be analyzed further to enhance the existing study.

Table -2: Chronological List of Previous Literature Review on various Topics in MSCN

Sl. No.	Author's Name	Focused Area	Key Objectives	NC (S/M)	DI (+/-)	IA (I/N)
1.	Hsu, et al .[22]	Preservation technology investment for deteriorating inventory	PT	S	+	I
2.	Liao , et al [12]	Lot-sizing decisions for deteriorating items with two warehouses under an order-size-dependent trade credit	P	M	+	I
3.	Dye et al. [5]	replenishment policy for deteriorating items with effective investment in preservation technology	PT	S	+	I
4.	Duan ,et al .[35]	Two level supply chain coordination with delay in payments for fixed lifetime products	P	M	-	I
5.	Soni, et al .[9]	Optimal strategy for an integrated inventory system involving variable production and defective items under partial trade credit policy	P	M	+	I
6.	Teng , et al. [13]	Seller's optimal credit period and replenishment time in a supply chain with up-stream and down-stream trade credits	P	M	+	I
7.	Dye, et al. [7]	Effect of preservation technology investment	PT	M	+	I

Sl. No.	Author's Name	Focused Area	Key Objectives	NC (S/M)	DI (+/-)	IA (I/N)
		on a non-instantaneous deteriorating inventory model				
8.	Dye ,et al. [6]	swarm optimization for solving lot-sizing problem with fluctuating demand and preservation technology cost under trade credit	PT	M	+	I
9.	Dye ,et al. [7]	Effect of preservation technology investment on a non-instantaneous deteriorating inventory model	PT	M	+	I
10.	Tsao, et al. [34]	Effects of maintenance policy on an imperfect production system under trade credit	P	M	+	I
11.	Tsao ,et al. [33]	Joint multi-item replenishment problem under trade credits	P	M	+	I
12.	Tsao , et al. [31]	Joint location, inventory, and preservation decisions for non-instantaneous deterioration items	PT	M	+	I
13.	Chen, et al. [24]	Economic production quantity models for deteriorating items with up-stream full trade credit and down-stream partial trade credit	P	M	+	I
14.	Shah [21]	Manufacturer-retailer inventory model for deteriorating items with price-sensitive credit-linked demand under two-level trade credit financing and profit sharing contract	P	M	+	I
15.	Chang, et al. [3]	Optimal pricing and ordering policies for non-instantaneously deteriorating items under order-size-dependent delay in payments	P	M	+	I
16.	Pal, et al. [2]	Two-echelon manufacturer-retailer supply chain strategies with price, quality, and promotional effort sensitive demand	P	M	+	N
17.	Tsao, et al. [30]	deteriorating inventory under preservation effort and trade credits	PT	M	+	I
18.	Zhang , et.al.[29]	Optimal trade credit and replenishment policies or supply chain network design. International journal production	P	M	+	I
19.	Ramezaanian,etal . [23]	Blood supply chain network design under uncertainties in supply and demand considering social aspects	P	M	+	I
20.	Pattnaik, M. et al. [18]	Preservation effort effects on retailers and manufacturers in integrated multi-deteriorating item discrete supply chain model.	P	M	+	I

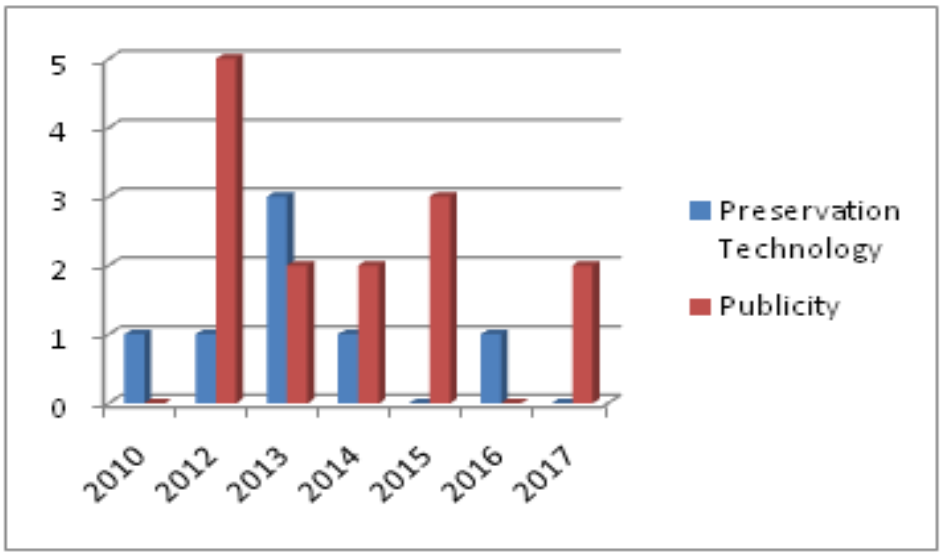
NC - Number of Commodities; DI - Deteriorated Items (+/-); IA - Industrial Application (I/N); P - Publicity; PT- Preservation Technology; S- Single; M- Multiple; I-Industrial Application; N- Not Applicable



(Figure -1: No. of Papers contributed on Preservation Technology and Publicity)

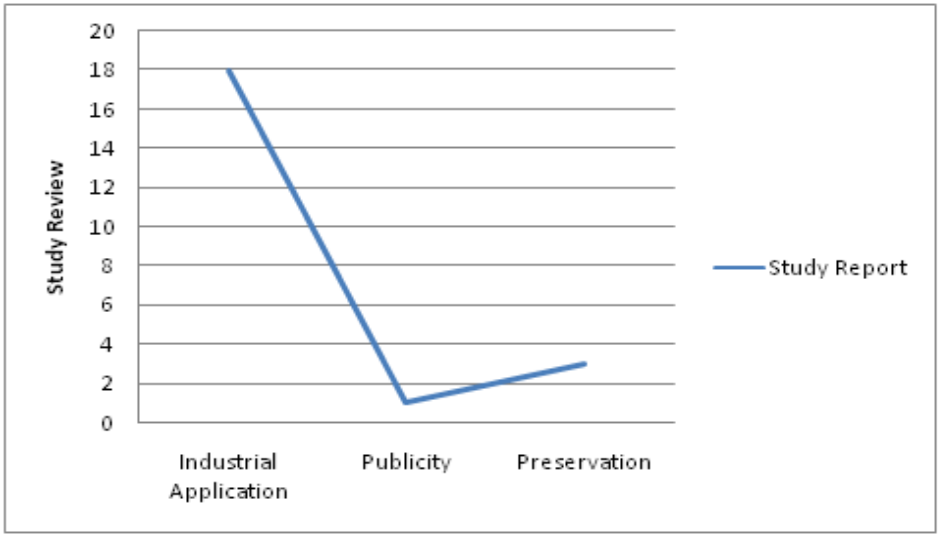
During the analysis it is found that the publicity effort has given more importance rather focusing on the preservation technology as stated in the Figure-1. Here it concludes that publicity to be the key strategy for enhancing the profit margin of the organization. But, the strategies have been made to keep the products in the warehouse or with the retail shops for long time have been given less importance, which encourage deterioration of products as well as loss to the organization.

Profit in Supply Chain Network can be calculated efficiently by adding the values generated by the publicity and efforts have been made to overcome the deterioration.



(Figure -2: No. of Papers Published Year Wise on the Covered Study)

The analysis have also been made how literatures contributed in the years from 2010 to 2020 in the field of Preservation Technology and Publicity which has been reflected in the Figure-2. From studied it is found that paper published in the year 2010 has given importance to preservation technology and less to the publicity. But in the subsequent years there has been remarkable change in the field of Publicity and also giving importance to the preservation technology which is an encouraging factor towards reduction of deterioration and enhance the profit margin whether the supply chain functioning on single or multiple items.



(Figure -3: Supply Chain Models with IA along with Preservation Technology and Publicity)

It has been clear from the study that most of literatures supported industrial use of Supply Chain Network whether there is any importance on publicity as well as preservation technology which will not create field for demand of the products and allow deterioration of items whether perishable or non-perishable as stated in Figure-3. The implementation of such concept in industry will not helpful in the competitive scenario where many competitors competing for the same products. Hence there must be publicity for products which demands a good market for the organization and in the same time preservation technology to be properly installed in the retail markets to avoid deterioration.

5. SCOPE AND FUTURE DIRECTION OF THE STUDY

The review studied under consideration of the factors like preservation technology, publicity, no. of commodities and industrial use along with the focus on deterioration concept. But there are

many areas which are going to be focused like trade credit policy, investment on preservation technology, preservation equipments, forward financing, maintenance, types of publicity, products quality etc along with the factors of current study. The profit of any organization depends not only few factors but also all the network hubs in the supply chain network. Every additional analysis of such factors will help to enhance the profit margin and also allow creating an optimized supply chain network for industrial use.

6. CONCLUSION

To optimize the channel profit as well as organizational profit, publicity is the key and in the same time technology based preservation strategy added values to it and also reduces deterioration cost. This automatically brings advantages in many ways to the organization like demand of the product, managing commodities, bringing efficiency in supply chain network and allied services. In the study, the researchers put their views on the general parameters without focusing the keys issues i.e. publicity and preservation. In modern days people watching TV, scrolling latest news, using mobile phones to know about the products and comparing the same with brands of other manufacturers. Publicity will automatically force the customers to rethink their ideas before purchasing from the market, which indirectly encourage others to buy the same product through word of mouth. In the same time people will search for the product from nearby shops or market. So availability of product is the key and it can be done successfully by effective preservation strategy. This is also allows the retailers to keep the product for a long time and it automatically fill-up gap between the customers and organization.

CONFLICT OF INTERESTS:

The author(s) declares that there is no conflict of interests.

REFERENCES

[1] B. Pal, S.S. Sana, K. Chaudhuri, A multi-echelon supply chain model for reworkable items in multiple-markets with supply disruption, Economic Modelling. 29 (2012) 1891–1898.

[2] B. Pal, S.S. Sana, K. Chaudhuri, Two-echelon manufacturer-retailer supply chain strategies with price, quality, and promotional effort sensitive demand, Int. Trans. Oper. Res. 22 (2015), 1071–1095.

[3] C.-T. Chang, J.-T. Teng, M.-S. Chern, Optimal manufacturer's replenishment policies for deteriorating items in a supply chain with up-stream and down-stream trade credits, Int. J. Product. Econ. 127 (2010), 197–202.

[4] C.-T. Chang, M.-C. Cheng, L.-Y. Ouyang, Optimal pricing and ordering policies for non-instantaneously deteriorating items under order-size-dependent delay in payments, Appl. Math. Model. 39 (2015), 747–763.

[5] C.-Y. Dye, T.-P. Hsieh, An optimal replenishment policy for deteriorating items with effective investment in preservation technology, Eur. J. Oper. Res. 218 (2012), 106–112.

[6] C.-Y. Dye, T.-P. Hsieh, A particle swarm optimization for solving lot-sizing problem with fluctuating demand and preservation technology cost under trade credit, J Glob Optim. 55 (2013), 655–679.

[7] C.-Y. Dye, The effect of preservation technology investment on a non-instantaneous deteriorating inventory model, Omega. 41 (2013), 872–880.

[8] G.-H. Juan Alejandro, E. John Willmer, F.-C. Álvaro, A multi-product lot-sizing model for a manufacturing company, Ingen. Invest. Tecnol. 14 (2013), 413–419.

[9] H.N. Soni, K.A. Patel, Optimal strategy for an integrated inventory system involving variable production and defective items under retailer partial trade credit policy, Decis. Support Syst. 54 (2012), 235–247.

[10] J. Sicilia, M. González-De-la-Rosa, J. Febles-Acosta, D. Alcaide-López-de-Pablo, An inventory model for deteriorating items with shortages and time-varying demand, Int. J. Product. Econ. 155 (2014), 155–162.

[11] J.C.P. Yu, Optimal deteriorating items inventory model with a three-echelon supply chain strategic alliance, Asia Pac. J. Oper. Res. 27 (2010), 693–711.

[12] J.-J. Liao, K.-N. Huang, K.-J. Chung, Lot-sizing decisions for deteriorating items with two warehouses under an order-size-dependent trade credit, Int. J. Product. Econ. 137 (2012), 102–115.

[13] J.-T. Teng, K.-R. Lou, Seller's optimal credit period and replenishment time in a supply chain with up-stream and down-stream trade credits, J. Glob. Optim. 53 (2012), 417–430.

[14] K. Taxakis, C. Papadopoulos, A design model and a production–distribution and inventory planning model in multi-product supply chain networks, Int. J. Product. Res. 54 (2016), 6436–6457.

[15] M.A. Miranda-Ackerman, C. Azzaro-Pantel, A.A. Aguilar-Lasserre, A green supply chain network design framework for the processed food industry: Application to the orange juice agrofood cluster, Computers Ind. Eng. 109 (2017), 369–389.

[16] M. Varsei, S. Polyakovskiy, Sustainable supply chain network design: A case of the wine industry in Australia, Omega. 66 (2017), 236–247.

[17] M. Imran, C. Kang, M. Babar Ramzan, Medicine supply chain model for an integrated healthcare system with uncertain product complaints, J. Manufact. Syst. 46 (2018), 13–28.

[18] M. Pattnaik, P. Gahan, Preservation effort effects on retailers and manufacturers in integrated multi-deteriorating item discrete supply chain model, OPSEARCH. (2020). https://doi.org/10.1007/s12597-020-00477-2.

[19] M. Pattnaik, P. Gahan. Multi-product discrete supply chain models, Academic Publishing, Lambart, Germany, (2019).

[20] M. Pattnaik. Milk supply chain network design (SCND): a case of milk industry in western region of Odisha, Int. J. Strat. Decis. Sci. 11(3) (2020), 1-58.

[21] N.H. Shah, Manufacturer-retailer inventory model for deteriorating items with price-sensitive credit-linked demand under two-level trade credit financing and profit sharing contract, Cogent Eng. 2 (2015) 1012989.

[22] P.H. Hsu, H.M. Wee, H.M. Teng, Preservation technology investment for deteriorating inventory, Int. J. Product. Econ. 124 (2010), 388–394.

[23] R. Ramezanian, Z. Behboodi, Blood supply chain network design under uncertainties in supply and demand considering social aspects, Transport. Res. Part E: Log. Transport. Rev. 104 (2017), 69–82.

[24] S.-C. Chen, J.-T. Teng, K. Skouri, Economic production quantity models for deteriorating items with up-stream full trade credit and down-stream partial trade credit, Int. J. Product. Econ. 155 (2014), 302–309.

[25] S.M.S. Islam, M.A. Hoque, A joint economic lot size model for a supplier-manufacturer-retailers supply chain of an agricultural product, OPSEARCH. 54 (2017), 868–885.

[26] T. Paksoy, C.-T. Chang, Revised multi-choice goal programming for multi-period, multi-stage inventory controlled supply chain model with popup stores in Guerrilla marketing, Appl. Math. Model. 34 (2010), 3586–3598.

[27] T. Pham, P. Yenradee, Optimal supply chain network design with process network and BOM under uncertainties: A case study in toothbrush industry, Computers Ind. Eng. 108 (2017), 177–191.

[28] V.K. Mishra, L.S. Singh, R. Kumar, An inventory model for deteriorating items with time-dependent demand and time-varying holding cost under partial backlogging, J. Ind. Eng. Int. 9 (2013), 4.

[29] Y. Zhong, J. Shu, W. Xie, Y.-W. Zhou, Optimal trade credit and replenishment policies for supply chain network design, Omega. 81 (2018), 26–37.

[30] Y.-C. Tsao, Designing a supply chain network for deteriorating inventory under preservation effort and trade credits, Int. J. Product. Res. 54 (2016), 3837–3851.

[31] Y.-C. Tsao, Joint location, inventory, and preservation decisions for non-instantaneous deterioration items under delay in payments, Int. J. Syst. Sci. 47 (2016), 572–585.

[32] Y.-C. Tsao, G.-J. Sheen, A multi-item supply chain with credit periods and weight freight cost discounts, Int. J. Product. Econ. 135 (2012), 106–115.

[33] Y.C. Tsao, W.G. Teng. Heuristics for the joint multi-item replenishment problem under trade credits, IMA J. Manage. Math. 24(2013), 63–77.

[34] Y.C. Taso, T.H. Chen, Q.H. Zhang. Effects of maintenance policy on an imperfect production system under trade credit. Int. J. Product. Res. 51 (2013), 1549–1562.

[35] Y. Duan, J. Huo, Y. Zhang, J. Zhang. Two level supply chain coordination with delay in payments for fixed lifetime products, Computers Ind. Eng. 63 (2012), 456–463.