

A Study on Different Supply Chain Strategy for e-Shopping Agencies



Statistics

KEYWORDS : Supply Chain Management, e-shopping, optimal order quantity, Maximize Profit.

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ABSTRACT

The e-shopping is a form of electronic commerce which allows consumers to directly buy goods or services from a seller over the internet using a web browser. The aim of this study was to investigate different supply chain strategy of e-shopping agencies. We have considered two models for e-shopping supply chain strategies to find out optimal order quantity and profit for inventory. The solution for optimal order quantity and maximum profit of inventory under different demand distribution is shown with numerical example. The results illustrated that only supplier / manufacturer supply strategy was dominant to only e-shopping supply strategy.

Introduction

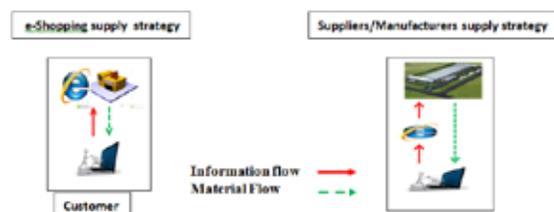
E-business is defined as the process of using electronic technology to do business. It is the day and age of electronic business. E-business has become standard operating procedure for the vast majority of companies. Setting up and running an e-business, especially one that processes a large number of transactions, requires technical, marketing and advertising expertise [3]. The sudden increase in the use of the Internet has covered the way for several path-breaking innovations. One of the most interesting and exciting aspects of this evolution is the emergence of electronic business (e-business) as a mainstream and feasible alternative to more traditional methods of businesses being conducted today.

The e-shopping is a form of electronic commerce which allows consumers to directly buy goods or services from a seller over the Internet using a web browser i.e. e-web-store, e-shop, e-store, Internet shop, web-shop, web-store, online store, online storefront and virtual store etc [2]. The e-shopping can lower inventory levels and cost by improving supply chain management. Due to space limit of fulfilling centers, geographic location and high transportation cost. Some e-shopping agencies design their supply network through suppliers/manufacturers to deliver products directly to customers, though the customers place order online [6]. Another supply network is that the customers place orders online and e-shopping agencies supplied products through their warehouse center.

Today, customers are conscious about products, and manufacturers move quickly to meet demands quick order fulfillment, and fast delivery. Various e-shopping agencies follow different supply network strategies. In point of view, the main objective of study is that which one supply network better to follow for profit of inventory.

Materials and Methods

The customers place an order for products through website of e-shopping agencies. The product can be delivered to customers from fulfilling supplier/manufacturer warehouse center (MWC) or e-shopping agency warehouse center (EWC). Guoqing and Xuan (2014) was determined the optimal order quantity in both retailers fulfilling center and the supplier warehouse for dual channel supply network [6]. Here considered two models for e-shopping to find out order quantity and profit for inventory:



Information flow Material Flow

Assumptions:

1. The demand in the planning period is d .

Where d is a random variable with a continuous distribution function F that has finite support $[0,1]$.

Notations:

We used suffixes **e** and **m** for e-shopping agency strategy and supplier / manufacturer strategy respectively.

R - Revenue from unit sales.

d - Random variable of demand.

$F(d)$ - Continuous distribution function that has finite support $[0,1]$.

U - Understocking cost of e-shopping agency.

C_e, C_m - Product price of unit at warehouse center.
(Include transportation and delivering cost)

O_e, O_m - Overstocking cost for warehouse center.

P_e, P_m - Profit from inventory.

β - Proportion of the order switching from fixed supplier/ manufacturer warehouse center to other nearby supplier / manufacturer warehouse center.

i) The e-shopping agency supply strategy

The e-shopping agency use only one e-shopping agency supply strategy to fulfill demand. The function of e-shopping website is to market and promote the product. The customers place orders online and they got product delivered from fulfillment EWC. In this case no demand is fulfilled from the direct manufacture warehouse. In case of that the stocks are out of in EWC the order are losses then

Decision Variable:

Q_e - Order quantity for fulfilling EWC, where $0 \leq Q_e \leq 1$.

If $d \geq Q_e$ demand from customer is more than the order quantity in fulfilling EWC. The profit for EWC strategy is as follows:

$$P_e' = RQ_e - C_e Q_e - U (d - Q_e) \text{ ----- (1)}$$

When $d \leq Q_e$ demand from customer is less than the order quantity in fulfilling EWC. The profit for EWC strategy is as follows:

$$P_e'' = Rd - C_e Q_e - O_e (Q_e - d) \text{ ----- (2)}$$

To maximize expected profit for e-shopping agency we can formulate problem as follows.

$$P_e = E[R \min (d, Q_e) - O_e (Q_e - d) - U (d - Q_e)] - C_e Q_e \text{ ----- (3)}$$

Where $(Z)^* = \text{Max}(Z, O)$ with given distribution

$$P_e = \int_0^{Q_e} [Rd - O_e (Q_e - d)]dF(d) + \int_{Q_e}^1 [RQ_e - U(d - Q_e)]dF(d) - C_e Q_e \text{ ----- (4)}$$

Maximize P_e can be obtained by $\frac{\partial P_e}{\partial Q_e} = 0$. Then we have

$$F(Q_e) = \frac{R+U-C_e}{R+U+O_e} \text{ ----- (5)}$$

And

$$\frac{\partial^2 P_e}{\partial Q_e^2} = - (R + U + O_e) f(Q_e) \leq 0 \text{ ----- (6)}$$

Thus the function (6) is negative, then solution for Q_e from (5) is optimal.

ii) The supplier / manufacturer supply strategy

The e-shopping agency use only one supplier / manufacturer supply strategy to fulfill demand. The customers place orders online and they got product delivered from fulfillment MWC strategy. In this case no demand is fulfilled from the EWC then

Decision Variable:

Q_m - Order quantity for fulfilling MWC, where $0 \leq Q_m \leq 1$.

If $d \geq Q_m$ demand from customer is more than the order quantity in fulfilling MWC. In this case the amount of demand $\beta (d - Q_m)$ would be delivered from other nearby MWC if it is available their then that case amount of demand $(1 - \beta) (d - Q_m)$ will be lost. The profit for e-shopping agency is as follows:

$$P_m' = RQ_m - C_m Q_m - U (1 - \beta) (d - Q_m) + R\beta (d - Q_m) - C_m \beta (d - Q_m) \text{ ----- (7)}$$

When $d \leq Q_m$, demand from customer is less than the order quantity in fulfilling MWC. Then profit for e-shopping agency is as follows:

$$P_m'' = Rd - C_m Q_m - O_m (Q_m - d) \text{ ----- (8)}$$

To maximize expected profit for e-shopping agency we can formulate problem as follows.

$$P_m = E[R \min (d, Q_m) - O_m (Q_m - d) - U (1 - \beta) (d - Q_m) + R\beta (d - Q_m) - C_m \beta (d - Q_m)] - C_m Q_m \text{ ----- (9)}$$

Where $(Z)^* = \text{Max}(Z, O)$ with given distribution

$$P_m = \int_0^{Q_m} [Rd - O_m (Q_m - d)]dF(d) + \int_{Q_m}^1 [RQ_m - U(1 - \beta) (d - Q_m) + R\beta (d - Q_m) - C_m \beta (d - Q_m)]dF(d) - C_m Q_m \text{ ----- (10)}$$

Maximize P_m can be obtained by $\frac{\partial P_m}{\partial Q_m} = 0$. Then we have

$$F(Q_m) = \frac{R+U-C_m-\beta(R+U_m-C_m)}{R+U+C_m-\beta(R+U_m-C_m)} \text{ ----- (11)}$$

And

$$\frac{\partial^2 P_m}{\partial Q_m^2} = - (R + U + O_m - \beta(R + U - C_m)) f(Q_m) \leq 0 \text{ ----- (12)}$$

Thus the function (11) is negative, then solution for Q_m from (12) is optimal.

Numerical illustration

In this section we considered model to evaluate order quantity for that we need to know distribution of demand. We consider a model with two types of distribution: Uniform distribution U (0.4, 0.9) and Normal distribution N (0.7, 0.3).The data for the same is given in below tables.

Table 1: Different costs, order quantities and profits for inventory of e-shopping agency supply strategy

R	C _e	U	O _e	e-shopping		F _{e1}	N(0.7,0.3)		F _{e2}
				U(0.4,0.9)	F(Q)		*Q _{e1}	*Q _{e2}	
20	6	0.9	0.5	0.696	0.748	4.708	0.995	3.780	
20	6	0.9	0.4	0.700	0.750	4.735	0.997	3.820	
20	6	0.9	0.3	0.703	0.751	4.761	0.998	3.861	
20	7	0.9	0.4	0.653	0.726	4.028	0.977	2.965	
20	6	0.9	0.5	0.696	0.748	4.708	0.995	3.780	
20	7	0.9	0.5	0.650	0.725	4.004	0.976	2.927	
20	6	0.9	0.4	0.700	0.750	4.735	0.997	3.820	
20	5	0.9	0.4	0.746	0.773	5.477	1.000	4.707	
20	6	0.9	0.5	0.696	0.748	4.708	0.995	3.780	
20	7	0.9	0.5	0.650	0.725	4.004	0.976	2.927	

*Qe1, Qe2 – optimal order quantity for uniform and normal distribution demand respectively.

Table 2: Different costs, order quantities and profits for inventory of Supplier/ Manufacturer supply strategy

R	C _m	U	O _m	R	Supplier / Manufacturer		P _{m1}	N(0.7,0.3)		P _{m2}
					F(Q)	*Q _{m1}		*Q _{m2}		
20	4	0.9	0.6	0.25	0.788	0.794	8.616	0.938	9.862	
20	4	0.9	0.5	0.2	0.794	0.797	9.348	0.946	10.777	
20	5	0.9	0.5	0.2	0.739	0.769	8.158	0.891	9.150	
20	6	0.9	0.4	0.15	0.693	0.747	7.673	0.853	8.473	
20	4	0.9	0.6	0.25	0.788	0.794	8.616	0.942	9.897	
20	6	0.9	0.6	0.2	0.688	0.744	7.043	0.848	7.738	
20	4	0.9	0.6	0.3	0.777	0.788	7.897	0.929	9.006	
20	3	0.9	0.5	0.25	0.843	0.822	9.848	0.987	11.645	
20	4	0.9	0.4	0.2	0.790	0.795	9.357	0.942	10.782	
20	5	0.9	0.5	0.15	0.750	0.775	8.823	0.904	9.967	

*Qm1, Qm2 – optimal order quantity for uniform and normal distribution demand respectively.

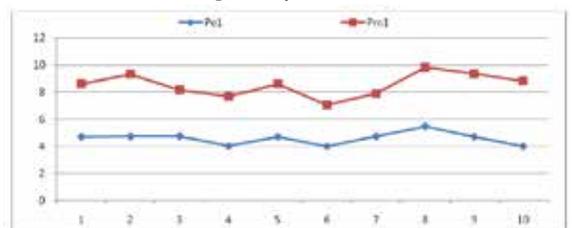


Fig 1. Comparison between e-shopping agency and supplier / manufacturer supply strategy for uniformly distributed demand

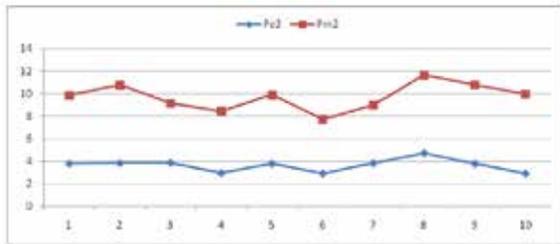


Fig 2. Comparison between e-shopping agency and supplier / manufacturer supply strategy for normally distributed demand

Results and Discussion

In first model customers place orders online and they got product delivered from fulfillment EWC. In this case no demand is fulfilled from the direct manufacture warehouse. In case of that the stocks are out of in EWC the order are losses. The different costs, order quantities and profits for inventory of e-shopping agency supply strategy (Table 1).

In second model customers place orders online and they got product delivered from fulfillment MWC strategy. In this case no demand is fulfilled from the EWC. In this case the proportion of demand would be delivered from other nearby MWC if it is available. The different costs, order quantities and profits for inventory of supplier/ manufacturer supply strategy (Table 2).

The main objective of any e-shopping agency to gain maximum profit in relation to give better services to customers. We have taken the numerical example of e-shopping agency supply strategy and supplier / manufacturer supply strategy with different parameters to calculate optimal order quantity [6] and profit for inventory. In order to compared the supply chain strategies, the computational result are given in fig 1 and 2. On the basis of results was obtained (Fig1 and 2) indicated that the maximum profits of inventory for optimal quantities for supplier / manufacturer supply strategy is more than e-shopping agency supply strategy.

Conclusion

In this paper we study two models for e-shopping supply chain strategies to find out optimal order quantity and profit for inventory. Based on numerical example we found that supplier / manufacturer supply strategy was dominant to e-shopping agency supply strategy. So here it is suggested that supplier / manufacturer supply strategy is better for e-shopping agencies to getting maximum profit. The e-shopping agency with supplier / manufacturer supply strategy is able to avoid shortages and also satisfied customers demand.

Acknowledgment

This research was supported by INSPIRE FELLOWSHIP [DST/INSPIRE Fellowship/2013/1048] Govt. of India, Ministry of Science & Technology, Department of Science & Technology, New Delhi, India. This support is acknowledged gratefully.

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