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AN IMPACT OF E-TAILING IN INVENTORY SYSTEM

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Abstract: In the present scenario of competitiveness, enhancement efforts and the adoption of new technologies is crucial for a company to reach high levels of effectiveness. Online retailing is one such strategy and it is continuing to expand quickly. As Information Technology progresses rapidly, consumers can access the internet more convenient and thus they are more interested in online shopping. Retailers who have effectively used the internet to manage their business operations have been able to discover new ways to handle their inventories and save costs. With powerful inventory control and order management features firms can increase sales and fulfil orders economically. Internet retailers must optimize inventory replenishment decisions to enhance their profits. This paper develops an innovative mathematical model for E-tailing inventory system and provides the optimal values in order to maximize the benefits. A numerical example is provided to illustrate the proposed E-tailing model.

Keywords: Consumers, Inventory, Internet, E-tailing, Professional cost, Online shopping, Optimal values.

Introduction

In today's business world, even small and average-sized businesses have come to depend on computerized inventory management systems. Information technology in inventory management goes about as a tool for improving productivity and cost minimization. The internet is an intense medium that can serve as a unique platform for the development of retail brands in India. The retail area has encountered a noteworthy change over a period of the last few decades. The Indian retail market is observing an insurgency. Currently e-retailers in India are concentrating on creating beneficial business procedures for their Internet-based operations. The journey of consumer from Kirana store shopping to e-portal experience has been advancing. The technology has added extra flavour to this experience with a strategic orientation. The innovation in upcoming technologies will make this experience more spicing. The role of consumer and technology will keep dominating in retail division and companies will require re-orienting their strategies around these factors.

1.1 E-Tailing

The word E-tail has its extraction in the word retail. Here the letter E stands for electronic, as the shopping process occurs through the electronic media that is the internet. It is the Electronic retailing or business-to-consumer. With the help of a web-space a virtual shop is created and the items are displayed through the images in this space with the description and price tags. By accessing this shopping site a consumer can select their products into a cart. The payment for this product can be done in a variety of modes as specified by the shopping site. The items would be delivered to the address mentioned by the customer. E-tailing is an Integrator of technology, logistics, and infrastructure that generates moderately cost-effective marketplace for vendors and consumers. The formalization and development of E-tailing will play an essential role in bringing sustainability and economic feasibility to many facets of the economy. It will offer both direct and indirect employment. E-tailing decreases the space engaged by retail outlets in the real world. It gives quick and easy way to a shopping space at any time and from any place where there is access to the internet. It conserves time of the purchaser that is spent on travelling to a shopping place. It produces a new platform for goods from different parts of the world which could be imported by placing an order.

1.2 Online Shopping

Online shopping was created and spearheaded by Michael Aldrich in the UK and is picking up grounds in India too. Online shopping is far superior to customary shopping as everything is accessible to us at our door step just with the accessibility of the web. Consumers need not to go to crowded markets, wait in queues and spending hours searching for the items to be purchased. Online shopping is helpful for purchasers as well as dealers, because they get detailed information about the product joined together with the reviews of the existing users. Online shopping is like a web-mart where all the goods are obtainable. Online shopping portal furnishes us with advantages to shop every item extending from minor purchases of books, grocery, clothing, footwear

etc. to that of major things like furniture, electronics, cars, residential buildings etc. Online shopping gateways are seeing an incredible development in the sale of electronic things consistently. This is driven by the demands like mobile phones, iPods and MP3 players not only from metros but also from smaller cities. Clothes and accessories emerged as the second biggest product category after consumer electronics and relied upon to become bigger than consumer electronics this year. Other popular searched categories include books, beauty & personal care, home & furnishings, baby products and healthcare. Some Online Shopping sites in India are www.Homeshop18.com, www.flipkart.com, www.yebhi.com, www.myntra.com. American online retail giant Amazon.com has also made an entry into the Indian market in 2012 with Junglee.com, an online shopping site powered by the $ 48 billion company [8].

Online shopping sites include a wide range of goods both high-quality and mild-quality keeping in mind the level of people. The buyers can get the full data about the item with its reviews being posted by existing users. Challenges with offline shopping personal circumstances had made people to depend more on the internet. Now-a-days lifestyle is so busy that people are unable to go to congested markets so E-shopping is a boon as it saves a lot of time. Online stores offer consumers with lots of new schemes and discounts on a variety of purchases. Online shoppers usually use a credit card or PayPal account in order to make payments. Some other use Cash on Delivery, Debit Card, Online e-Payment, Mobile Payments, Bank Transfer. According to the reviews the basic mode of payment used is cash on delivery (COD) as it is safe. Some people do not prefer online shopping because of some issues related to their privacy and security. Sellers also risk fake purchases using stolen credit cards. Consumers have the fear that their credit card information is leaked out and stolen. Hacking is the major problem with the web. Hackers break into a seller's website and steal names, addresses and credit card numbers [19].

1.3 Inventory Management

Inventory management is pivotal in any effective and efficient organization. The most important objective of inventory management lies in balancing the contradictory economics of not wanting to hold so little or too much stock. Such a golden stability is considerable in two ways; firstly as it saves the organization from having to tie up unused capital, acquiring huge costs of storage, pilferage, spoilage and obsolescence of inventory and secondly to prevent the cost of not meeting customer requirements. An inventory management system is a coordination that includes all aspects of managing firms' inventories such as purchasing, receiving, shipping, turnover, tracking, warehousing and storage and reordering. Retail companies can obtain immense benefits by integrating its inventory management systems with both logistics and its upstream supply chain. This would propel inventory system to just-in-time demand-pull supply systems which implies essentially linking reordering to real-time electronic point-of-sale. Sustaining optimum level of inventory is the primary aim of inventory management. Unnecessary investment in inventory leads to additional cost of fund being tied up so that it reduces the profitability, inventories may be distorted, lost, spoilt and hold costs in terms of large space and others. At the same time, inadequate investment in inventory creates stock-out problems, disruption in production and selling operation. Therefore, the company may lose the customers as they move to the competitors. Financial manager, as he is concerned with inventory management, should always try to put neither excessive nor insufficient investment in inventory. Hence inventory management is more necessary for a successful firm. The main advantage of E-Tailing is the avoidance of holding cost in the inventory management. But the major risk lies in stock out cost.

2. Literature Review

The first decision model to aid managers in determining the size and timing of an inventory replenishment order appeared ten decades ago with the contribution of the economic order quantity (EOQ) model of Harris (1913) [14]. Research areas widely concentrated on different types of inventory models. Papers on deteriorating and perishable items were contributed by Bakker et al. [1] Karmakar and Choudhury [16] Li et al. [18]. The joint economic lot sizing or integrated inventory models were developed by Glock [13] Ben-Daya et al. [2] Newsvendor model related paper was published by Qin et al. [20] Inventory decisions can be linked to the level of carbon emissions, which has been published by Bouchery et al.[4] Bonney and Jaber, [3]

There are many people right now thinking of selling online due to the current economic issues and opportunities. For the retailer, the Internet can represent everything from just another distribution channel to being the organizations' sole sales outlet. It can attract new customers, penetrate new markets, promote company brands and improve customer retention. The acceptance of the Internet as a retail outlet for the consumer has been the focus of much research. Some studies have focused on the consumers' attitudes towards Internet shopping [7]. Regan [22] examined the factors that would most strongly increase online shopping. In 2000, twenty million Americans shopped online. By 2002, almost 26 million people purchased something from

a website, up from 17 million in 1998 and 10 million in 1997. Internet sales have been estimated at $327 billion worldwide in 2002 with all U.S. Internet transactions during that same time period of $144 billion. The third quarter 2002, U.S. online retail sales were 10.5 billion dollar figure and rose to 13.3 billion in the third quarter of 2003 [24].

There are a number of research works have been done by researchers but only a few has been given, related to the paper. Ratchford et al. [21] have told that through Internet, consumers can gather information about merchandise and they compare a product across suppliers at a low cost. Eroglu et al. [11] have advocated that the most important thing in the traditional retailing is physical store setting and advantages of e-tailing. Zeithaml [27] has defined that the success of e-tailing depends on the efficient web site design, effective shopping and prompt delivery. Doolin [9] has specifically pointed out that e-tailing is the sale of products and services to individual customers. According to him, the definition of e-tailing encompasses the sales of products or services online.

Studies that focused on e-sale analysed the effects of auctions on transaction costs [12], their benefits to buyers [15] and effects on buyer–supplier relationships, the differences between the users and non-users of online auctions in terms of the importance they place on supplier collaboration, cost management, sales revenue and profit improvement [17], and so on. A few studies focused on other B2B functional activities such as e-marketing and e-distribution. Some of the research topics covered included the factors that contribute to e-procurement success the effects of process characteristics on the value of e-procurement, antecedents and consequences of e-procurement and the use of B2B EC for e-marketing [10] and various other functional activities.

Some of the research issues tackled by the studies in the category of E-integration across functions or supply chain included barriers and the performance effects of e-integration, key drivers and performance impacts of web technologies in supply chain management [26], organisational and environmental factors that moderate the effects of internet-based inter organisational systems on firm performance [23], the impact of e-business technologies on operational performance, and the factors that affect the adoption [5]. Unlike from the above literature discussed, this paper develops a mathematical model based on E-tailing inventory that meets the real market behaviour. The paper is organized as follows section 3 comprises of problem description with the mathematical formulation of the E-tailing inventory model. Section 4 presents a numerical example and Section 5 concludes the proposed work.

3. Mathematical Model With Description

Online retail businesses are a trendy option for industrialists with minimal capital to invest. Starting an online retail business entails patience, diligence and the right online business tools. The E-Commerce landscape provides a wide range of business advantages, together with operating a store 24 hours each day. The essential costs of E-tailing inventory are discussed here. When starting an online business selling goods or services there are few costs which you can anticipate before making the first sale. The Online store is a sales channel and acts like a sales person in the business. Selling online can be very cost effective as there are less human resource and infrastructure costs, unlike a bricks and mortar business [6].

Open source online shop software is needed to create a virtual store. The initial costs are possibly lower, but the longer term costs of maintenance and management can be very high. The software varies with the quality of service and products. Setting up of an online business requires research and planning to design a professional E-Commerce site. You need a well-designed website to create brand recognition and draw in visitors. Once somebody visits the store they expect to find simple navigation and features such as easy to locate product displays, search options, shopping carts, checkout, and secure payment options. An online shop can be a low cost start up business associate to the start up cost for a business in the traditional venue of an on-site retail location. The start up cost includes the cost of obtaining a license for online sale, getting a domain name, designing a dynamic site and most importantly SSL certificate which is necessary to accept credit cards. The SSL or Secured Socket Layer provides security and confidence in the online shop.

Advertising cost is the one to be considered for the promotion of the business. Advertising has an intense significance in today's society. It is a powerful tool for reaching and motivating the customers. Any medium can be used for advertising such as billboards, television followed by web pages and email. Social media, contests, blogs, emails and search engines are few easy and cheap ways to promote business online and get people shopping at your store. In today's technological landscape, you would be diligent not to use social media as a means for online business promotion. Social media platforms like Facebook and Twitter connect large groups of people together and are perfect to promote business online. Search engine optimization is a methodology of strategies, techniques and tactics used to enhance the amount of visitors to a website by acquiring a high-ranking position in the search results page of a search engine including Google, Bing, Yahoo

and other search engines. Search Engine Optimization and Search Engine Marketing can cost a lot of money. Next is the maintenance cost, it is obligatory to upgrade to the trend and to avoid major breakdown which causes heavy loss.

Professional cost includes the cost associated with Insurance, Tax, Legal advisor and administrative costs. The most important task in online sales is transaction. The bank will also charge some fees to set up an Online Merchant Account. If the company wants to accept credit cards online then it has to use a Payment Service Provider and process the credit cards via a Payment Gateway. This leads to the transaction cost. The next cost under the list has Drop shipping cost. Drop shipping is a supply chain management technique in which the retailer does not keep goods in stock, but instead transfers customer orders and shipment details to either the manufacturer, another retailer, or a wholesaler, who then ships the goods directly to the customer. It eradicates some duplication of efforts as only one warehouse will pick, pack and ship the product. This approach can reduce total inventory management and shipping costs. Next is the traditional cost of the inventory, namely ordering cost and purchasing cost. Since there is no need to hold the items holding cost is eliminated. [6]

3.1 Notations

S	-	Cost to obtain the software
D_S	-	Demand for the site
O_R	-	Ordering rate
D	-	Demand for the items
Q	-	Ordering quantity of various items
L	-	License cost
D_o	-	Domain name cost
D_e	-	Cost to design the website
C	-	Cost to obtain the SSL certificate
V	-	Fixed cost of casting advertisement
n	-	Number of impressions
p	-	Cost per impression
S_E	-	Search Engine Optimization cost
T_v	-	Cost of advertising in television
U_p	-	Software update cost
C_D	-	Downtime cost
C_P	-	Prognosis cost
C_U	-	Number of persons working in customer service
R	-	Cost of rent and utilities
S_A	-	Salary per person working in customer service
L_E	-	Expenses associated with Legal advisor
A	-	Administrative costs
T_B	-	Business tax rate
I	-	Insurance cost
B_C	-	Bank charges
C_C	-	Cost per container to be drop shipped
N_D	-	Number of shipments
K_d	-	Number of kilogram to be delivered
O	-	Ordering cost per order
P	-	Purchasing cost
T	-	Cycle time
TC	-	Total annual cost
$*$	-	Optimal values

3.2 Assumptions

1. All the demand is satisfied on the specified time.
2. A fixed amount (V) is paid by the firm in advance for casting advertisement.
3. The firm mainly concentrates on internet users
4. The returned items from the customer are directed to the manufacturer
5. All orders are placed independently
6. The products are delivered to the customers within the specified period
7. Transaction costs are for the orders placed through net banking or debit card and some company bulk orders

8. Cycle time is the time period to get order from the customers and then order it to the suppliers.

Finally the total E-tailing inventory cost is the sum of Software cost, Start-up cost, Advertising cost, Transaction cost, Drop shipping cost, Professional cost, Maintenance cost, Ordering cost and Purchasing cost. Here the cycle time T=Q/D

$$Total\ cost\ TC(Q,T) = \frac{SD_S}{O_R} + \frac{(L+D_o+D_e+C)}{T} + \frac{(S_E+V+pn+T_V)}{T} + B_C DT + \frac{N_D C_C}{K_d} DT$$

$$+\left(L_E + A + I + \frac{T_B * PRICE}{1+T_B}\right)\frac{1}{T} + \frac{(U_p + C_D + C_P + R + C_U S_A)}{T} + \frac{O}{T} + \frac{PQ}{T}$$

--- (1)

Using the differential calculus method the optimal values are found. The first order derivative with respect to Q and T are equated to zero in order to find the optimal order quantity and optimal cycle time respectively.

$$Total\ cost\ TC(Q,T) = \frac{SD_S}{O_R} + \frac{(L+D_o+D_e+C)D}{Q} + \frac{(S_E+V+pn+T_V)D}{Q} + B_C Q + \frac{N_D C_C}{K_d} Q$$

$$+\left(L_E + A + I + \frac{T_B * PRICE}{1+T_B}\right)\frac{D}{Q} + \frac{(U_p + C_D + C_P + R + C_U S_A)D}{Q} + \frac{OD}{Q} + PD$$

---- (2)

$$\frac{dTC}{dQ} = -\frac{D}{Q^2}\left(L + D_o + D_e + C + S_E + V + pn + T_V + L_E + A + I + \frac{T_B * PRICE}{1+T_B} + U_p + C_D + C_P + R + C_U S_A + O\right)$$

$$+ B_C + \frac{N_D C_C}{K_d}$$

---- (3)

$$Let\ H = L + D_o + D_e + C + S_E + V + pn + T_V + L_E + A + I + \frac{T_B * PRICE}{1+T_B} + U_p + C_D + C_P + R + C_U S_A + O$$

----- (4)

Now $\frac{dTC}{dQ} = 0$, Hence $B_C + \frac{N_D C_C}{K_d} = \frac{D}{Q^2} H$

$$Q^* = \sqrt{\frac{DH}{B_C + \frac{N_D C_C}{K_d}}}$$

----- (5)

$$\frac{dTC}{dT} = -\frac{1}{T^2}\left(\begin{matrix} L + D_o + D_e + C + S_E + V + pn + T_V + L_E + A + I + \frac{T_B * PRICE}{1+T_B} \\ +U_p + C_D + C_P + R + C_U S_A + O + PQ \end{matrix}\right) + B_C D + \frac{N_D C_C}{K_d} D$$

----- (6)

Now $\frac{dTC}{dT} = 0$, hence we get, $D(B_C + \frac{N_D C_C}{K_d}) = \frac{1}{T^2}(H + PQ)$

$$T^* = \sqrt{\frac{H + PQ}{D\left(B_C + \frac{N_D C_C}{K_d}\right)}} \qquad \text{----- (7)}$$

4. Numerical Example

Consider the following data

S	-	3000	n	-	10,000	T_B	-	2.6%
D_S	-	200	p	-	0.5	I	-	1000
O_R	-	15	S_E	-	29	B_C	-	2.50
D	-	5,00,000	T_v	-	`1500	C_C	-	5
A	-	450	U_p	-	1000	N_D	-	10
L	-	60	C_D	-	500	K_d	-	250
D_o	-	99	C_P	-	256	O	-	400
D_e	-	300	C_U	-	50	P	-	150
C	-	185	R	-	1200	S_A	-	8000
V	-	500	L_E	-	500			

On substituting the above values in the respective optimal equations we get,
H= 413701.22
The Optimal order quantity **Q*= 276787 units,** The Optimal cycle time **T*= 5.6 days**
The Annual total cost **= Rs.76, 534,652.66**

5. Conclusion

The web manipulates more than 80% of all retail sales and that percentage is rising annually, so failure to have a web presence with the company's product catalogue means it is harder to be successful and improve sales. Buying on the Internet is one of the fastest growing modes of shopping. Investing in inventory control can be a harm or loss, threat or challenge. Challenge refers to opportunities for growth or gain. Inventory control therefore, is both an opportunity and challenge to the firm. The E-tailing inventory model proposed here gives the optimal values which help the company to make profitable decisions. Optimal replenishment decisions will help e-tailers to achieve more effective and efficient online retail outlets. As a future direction the model can be developed with imperfect items and shortages.

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