University College of Takestan

Volume 2,Issue 3

Available online at **http://UCTjournals.com**

UCT Journal of Research in Science, Engineering and Technology

UCT . J. Resea. Scien. Engineer.Techno. (UJRSET)

2(3): ***109-116 (2014)***

ISSN:2382-977X

Calculating raw material and work-in-process inventories in MTO/MTS production

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ABSTRACT

We examine the role of inventory in a hybrid Make-to-Stock (MTS)/Make-to-Order (MTO) production environment, based on a case study performed in a fruit juice company. In this example, demands for Finished Good (FG) inventories follow normal distribution .We propose a model to calculate economic order quantity (EOQ) by obtaining demands for Raw Material (RM) inventories through Work-in-process (WIP) and FG inventories. For validity of our claim we illustrate some samples of production in different days and compare it with old method estimation of WIP and EOQ.

Original Article:

Received 14 Mar. 2014
Accepted 17 Jun. 2014
Published 30 Sep. 2014

Keywords:
FG inventories,
RM inventories,
WIP inventories
Hybrid MTS/MTO

1.Introduction

Firms use different production strategies (e.g. make-to-order (MTO), make-to-stock (MTS), assembly-to-order (ATO), and engineer-to-order (ETO)) to produce their products. The primary goal of each manufacturing firm is to ensure long-term profitability [1]. Simply put, the firm has to produce products with high quality and short delivery time by considering minimum cost. In MTO system, demands are responded when orders enter the system. MTO system is tailored for more expensive products which are highly customized. MTO is known to have short delivery lead-time, capacity planning, order acceptance/rejection, and high due-date adherence. Vis-à-vis in MTS system, demand is responded through finished products inventories. MTS systems have lower variety of customization and usually less expensive products. MTS systems are claimed to have high fill rate, planning for inventory, defining lot size and forecasting of demand [2].

In recent years, researchers have studied many features of hybrid MTO/MTS system for reaching the benefits of both pure MTS and pure MTO systems .However, no research instances are found about different aspects of the inventory management system and their efficacy on the MTO/MTS system .Inventory has an important role in production systems. Having optimal quantity of each kind of inventory (RM, WIP and FG) and controling them is one of the most important goals of any firm. For example RM has an important role in service level and due date. On one hand, scheduling timely RM supplies in desired quantity bring profit for the firms; on the other hand delays in supplies will cause back order or lost sale. It is better to have WIP inventory by considering factors such as lead time, tardiness, earliness and perishable goods, in order to response to large number of orders. So we should hold variety of WIP and RM inventories and choose the optimal level of each kind of inventory to respond to customer's demands, as well as to minimize holding and preparation costs at the same time. In this study we propose a model that calculates WIP and RM through demands of FG to reach the above claim.

2. Related works

Hybrid MTS/MTO system have attracted attention of the researchers in recent years and there are some studies about lead time, accepting or rejecting orders, controlling and sequencing ,investigating three level of hierarchical production planning (HPP), prioritizing MTO over MTS, etc…

Williams [3] proposed a method for analyzing one-stage systems by considering the demand as stochastic with limited interactions and capacity using queuing theory. His investigation tried to address some questions such as how many goods should be stock and how many made-to-order? Which particular business must be accepted? What effect do the specials have on the stock system what effect do the specials have on the stock system and how can the stock system improve this effect? Arreola-risa and DeCroix [4] worked on optimization of MTO and MTS policies. They considered a company in which multiple products were manufactured by a single machine. Manufacturing was based on the first-come first-served rule. Manufacturing times were i.i.d. random variables, assuming there were different manufacturing-time distributions for different products .The arrival rates of demands for each product were independent Poisson operations. Inventory holding and backordering costs were the parts of the costs of managing the production-inventory system. The authors investigated the effect of different manufacturing-time on MTO/MTS decision for backorder cost cases of dollar per unit and dollar per unit per time. Optimization parameters were independent of manufacturing times in the first backorder-cost case and but not in the second case. For the second case the manufacturing-time distributions played a role in the optimality of MTO/MTS. Whether MTO versus MTS decision could be made entirely on first-moment information were investigated with regards to different circumstances. They presented proof that diversifying the manufacturing-time may or may not approve a MTO policy, and examined to what extent decreasing manufacturing-time randomness leads to MTO production.

Soman et al. [2] studied hybrid MTO/MTS production on the food processing industries, focusing mainly on the food processing industries as food processing industries had competitive supply chains market and had to provide to an increasing number of products and stock keeping units of varying logistical demands like proper aspect, special packaging and short due dates. The kind of products, market characteristics, the production process, and the production control also made them different. They proposed a comprehensive hierarchical planning framework to decide on issues such as limited shelf life of products and presence of sequence-dependent set-ups in managing a combined MTO-MTS system.

Another case study about Hybrid MTO/MTS system was done by [5]. The aim of the proposed model was to minimize the total costs and achieve the desirable fill-rate, by classifying FGs to three classes based on ABC analysis. Standard (s,S) inventory was considered for fast moving items of the A and B classes and (s,Q) for the fast moving items of the C class. The demand of this category was computed by a Normal distribution and the demand of the slow move in items was computed either by Poisson or Laplace distribution. The goal was to increase the fill-rate up to 6% and reduce the total inventory cost 2.5% by using the standard inventory system forms, emphasizing on RM in MTO items. So every FG was exploded to RMs requirement according to their Bill of material (BOM). They developed three inventory systems for MTO items: MRP, standard (s,Q) system and modified (s,Q) inventory system.

Federgruen & Katalan [6] considered an extensive range of options on how to prefer MTO production over MTS ones. Limited capacity, remarkable uncertainty due to demands, and unit production and setup times are inseparable elements in production systems. Stochastic Economic Lot Scheduling Problems involve settings where products need to be produced in provision with these elements. They proposed efficient methods for evaluation and optimization of a variety of cost and performance measures through analytical methods such as Inventory level and waiting-time distributions, average setup, holding costs, in order to suggest which of the priority options in to be preferred .The numerical study in this paper lead to find the effect of the product-line diversification or standardization on the performance of the manufacturing system. Carr and Duenyas [7] developed a model for addressing the joint admission control and sequencing in a hybrid MTO/MTS system was as a simple two-class (MTO and MTS) M/M/1 queue, making suggestions on how a company should react to an extra order, accept it or reject it and then on type of products and quantity of orders when signing a new contract to in the case of MTS. In the first stage of MTS. CARR and DUENYAS assumed the arrival rates of demands were random, and counted a penalty if demand faced delay. The second stage was aftermarket orders. Depending on the mood of the system, orders could be rejected or accepted by the company. Rejected orders considered as a loss. There was no need for set-ups to switch from one stage to another. There was no backordering for MTS product. A structure of optimal admission control and sequencing policies to find switching point in production threshold curve and acceptance threshold curves based on MTS inventory level and MTO queue size were designed.

Ebadian et al. [1] develop an efficient decision-making structure at the order entry stage in hybrid MTO/MTS through a modeling the arriving. Their model dealt with price and delivery time of arriving orders. The proposed structure had five major steps. At the two first steps, the orders that were not beneficial for system were rejected and appropriate decisions for non-rejected order were made. Then the optimal prices of non-rejected orders were defined by a mixed-integer programming model. In the fourth step another mathematical programming model was used to select the suppliers and subcontractors if the customers approved with delivery time and offered cost. The model leaded to identify undesirable orders so firms could have better control and planning for non-rejected orders. In the proposed structure the role of all affected parties of the supply chain was considered. With variety alternative for cost and delivery time, customers had many options so the chance of accept the orders increase. Zaerpour et al. [8] proposed a Comprehensive decision-making approach to select the appropriate method for producing the goods by prioritizing MTO products over MTS ones based on several criteria so that the production environment needed an impressive and helpful measurement structure to modify decision quality. Their proposed model included Analytical Hierarchy Process and Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) methods for partitioning of goods.

Rafiei and Rabbani [9] studied the capacity coordination of hybrid MTS/MTO analyzing pure MTS, pure MTO and hybrid MTS/MTO in capacity coordination of hybrid MTS/MTO system. They proposed model with the aim of handle policy of order acceptance/rejection, setting of order due-date, lot-sizing of MTS goods and defining desired capacity during the planning horizon. The model included qualitative and quantitative measurements to afford the mentioned problems and mathematical assumptions were not too many. Since there were not too many mathematical assumptions, the strong point of this model, it could be applied to various cases, plus it was comprehensible for managers because of its simple use. However, on the downside of this model, it limited itself to distinct industries as it had no-buffer production system and layout for the shop- floor consider as job shop. Kalantari et al. [10]

proposed a decision support system for order acceptance/rejection in hybrid MTS/MTO production system, for helping both company and customer to obtain their desirable need. In the proposed decision support system, first the customers were prioritized based on a fuzzy TOPSIS method, and then the undesirable orders were identified and rejected by rough-cut capacity and rough cut inventory check. There after delivery time of non-rejected orders were determined by a mixed-integer linear programming model. At the fourth step negation guidelines over price and due date of orders are introduced. In the last step, if the customer accepted the suggestions of the company, the order was considered an accepted order, otherwise the order is rejected. Adan and van der Wal [11] studied the impact of the hybrid MTO/MTS system on production lead times, by assigning orders a unit size and taking the production times to be exponential but independent of the product type. The conclusions obtained from their research were: 1-when there was a system with (fast moving) standard products and (slow moving) non-standard products, stocking the standard products instead of non-standard. 2- producing the standard phase to stock in a system with a two phase production, a standard phase and a customer specific phase because it helped a larger reduction in the production lead time 3-by a moderate stock levels the firm could reach the reduction in production lead time.

Soman et al. [2] investigated the problem of scheduling and Sequencing in hybrid MTO–MTS food processing. They assumed that a production system as single equipment, which was determined by limited capacity, and stochastic demand, measuring several run-out time scheduling and sequencing heuristics and achieved to a comprehensive managerial understanding in the hybrid MTO-MTS environment through an extensive simulation study. Rafiei et al. [12] proposed a novel bi-level HPP in hybrid MTS/MTO production consisting of three kinds of products: pure MTS, pure MTO and hybrid MTS/MTO, and examining the third level of HPP (scheduling and controlling level) with the aim of decreasing WIP so as to make forecasted demand, in addition to reducing the total amount of the earliness and tardiness time of orders to meet the due date. The proposed planning was of two production planning levels, mid-term (tactical) and short-term (operational). Sequence dependent, setup times and maintenance tasks were considered in this job-shop system. Since the model with considering pre-emption was NP-hard, a hybrid meta-heuristic algorithm is developed in order to solve the problem.

Lode [13] modeled the role of inventory in delivery-time competition. By considering lead time uncertainty, he recognized three important factors in a firm's decision on production/ inventory policies: discounting, customer characteristics and competition. Comparing optimal production/inventory policies among the oligopoly racing market, the monopoly market, and the demand sharing market, suggested a respective decline in incentive for make-to-stock in the mentioned markets. They discovered that delivery-time competition enhanced the buyer's welfare while decreasing the producer's welfare. Demeter & Golini, [14] investigated inventory configurations and the factors impacting on the choice of this configuration, observing that decoupling point position and type of production played a key role in inventory levels and ratios. Actual chosen configuration of each company, and the policy making behind it, proved to be stable and consistent over time.

DeCroix & Arreola-risa [4] proposed a modified base-stock policy to gain the optimal production and inventory policy for multi-production, infinite-horizon inventory systems, where demand for products is stochastic and finite resource are considered in every period. The optimal policy for the case of homogeneous products as well as a heuristic policy for practical use is reached. Ebadian et.al. [1] proposed a novel HPP and scheduling structure for MTO systems to reach to short and reliable delivery dates of arriving orders. They achieved their goal by putting forward new decision-making techniques at three levels of HPP: (1) the order entry level, (2) the order release level and (3) the order sequencing/dispatching level. Hendry & Kingsman [15] investigated production planning approaches in MTO companies, including Manufacturing Resource Planning, optimised Production Technology and Just-In-Time. They identified the different requirement s for MTO and MTS firms in three points of view: production scheduling, capacity control and the setting of delivery dates. Huiskonen et al. [16] presented a framework to control complexity of the required product and analyze customer's assessment when defining inventory and production control policies for specific product in a firm, measuring a customer's business importance and defining the estimation on the effects of service level changed on the purchased volumes. The inventory policy that they selected for their investigation was consisted of selecting the production mode from MTO, MTS, or one of their variations.

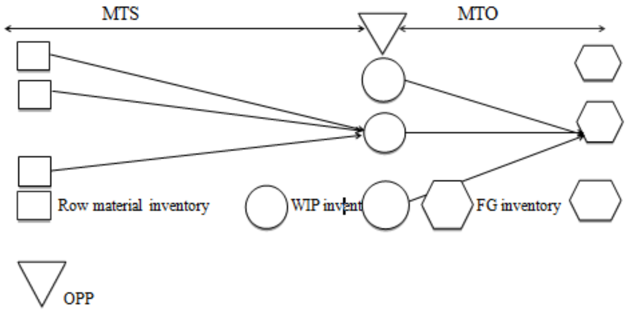

Figure 1. Schematic of inventory in production line in a hybrid MTS/MTO system

3. Methods

3.1. Problem description

There are different types of FG in the model and each of them consists of different type of WIP and row material. Each of the WIPs is include different type of RM. We calculate optimal order quantity for WIPs under some conditions and constraints before OPP in a hybrid MTS/MTO system. By assumption of understanding safety stock for RM and have preferred quantity for WIP, we calculate demands for RM so we gain EOQ for RM by considering shortage is not allowed and then calculate cost for model including cost of ordering and cost of holding.

3.2. Assumption

The model's assumptions are as follows:

- We accept customer's orders in specific days and specific day of acceptance of order is determined beforehand;
- The maximum cost due to earliness of each type of WIP are known and given;
- The maximum cost due to tardiness of each type of WIP are known and given;
- The maximum process time of each kind of WIP are known and given;
- The upper and lower limit for earliness and tardiness are known;
- The maximum holding time for each kind of WIP is known;
- Demand for orders of FGs normal distribution with known mean and variance.
- Variable back ordering cost per unit and Fixed cost of back ordering cost per unit are zero.

3.3. List of Symbols

Notations for the problems:

Indices:

i: index for RM inventory types; *i (1,2,...,I)*

j: index for WIP inventory type; *j (1,2,...,J)*

k: index for FG inventory types; *k (1,2,...,K)*

Parameters:

C_{tr} Maximum cost for tardiness of each type of WIP;

C_{er} Maximum cost for earliness of each type of WIP;

c_{tr} Cost for tardiness of each per WIP inventory kind *j* per day;

c_{er} Cost for earliness of each per WIP inventory kind *j* per day;

τ Maximum allowable duration for process each kind of WIP inventory;

C_{suj} Cost for set up of each type of WIP kind *j*;

α_j Cost of production each per WIP inventory kind *j*;

C_h Cost of holding each per WIP inventory kind *j* per day;

T Duration of period ;

C_{RMi} Cost of each unit of RM kind *i ;*

A_i Ordering and setup cost for each per unit of RM inventory kind *i*;

h_i Holding cost per unit of RM inventory kind *i* per day;

$\hat{\pi}$ Variable back ordering cost per unit of RM inventory kind *i* per day;

π Fixed cost of back ordering cost per unit of RM inventory kind *i*

Y_j Cost of set up each per WIP kind *j*;

ss_i Safety stock of RM inventory kind *i*;

t_{er} Earliness days of WIP inventory kind *j*;

t_{tr} Tardiness days of WIP inventory kind *j*;

t_{jm} Duration of process WIP kind j on work station kind *m* ;

s Price sale of each unit of WIP kind *j*;

β_{ij} Rate of consumption RM kind of *i* in WIP kind *j*;

Variables

WIP_j Number of WIP inventory kind *j*;

C_{suj} 1: if set up for WIP kind *j* is done; 0: Otherwise;

d_j Duration of holding WIP kind *j*;

D_i Demand for each type of RM inventory;

b_i Optimal Number of demand *i* counter with shortage in back order sale;

Q_i Optimal order quantity of RM;

k_i Total cost of model for RM

P_j Profit of sale each unit kind of WIP kind *j* ;

3.4.Mathematical model for cost of WIP inventory

$$max\ P_j = (s \times WIP_j) - \begin{pmatrix} (C_h \times d_j \times WIP_j) \\ +(\alpha_j \times WIP_j) + (C_{suj} \times Y_j \times WIP_j) \end{pmatrix} \quad (1)$$

Subject to

$$c_{tr} \times t_{tr} \times WIP_j \leq C_{tr} \quad (2)$$

$$c_{er} \times t_{er} \times WIP_j \leq C_{er} \quad \forall j = 1 \dots J \quad (3)$$

$$\sum_{m=1}^{M} t_{jm} \times WIP_j \leq \tau \quad \forall j,m=1 \dots M \quad (4)$$

$$WIP_j \geq 0 \quad \forall j=1 \dots M \quad (5)$$

The objective function in Eq.1 minimizes the total sum of the holding, production and set up cost of WIP inventory. Constraint (2) and (3) are considered for maximum allowable tardiness and earliness cost that WIP could have in a production system. Constraint (4) ensures that all WIP should be prepared before OPP and we have no tardiness. Constraint (5) show variables type of the problem.

The model for RM follows as:

$$D_i = \sum_{j=1}^{J} WIP_j^* \times \beta_{ij} + \sum_{i=1}^{I} SS_i \quad \forall i,j = 1 \dots J \quad (6)$$

$$Q_i = \sqrt{\frac{2 \times D_i \times A_i}{h_i}} \quad \forall i = 1 \dots I \quad (7)$$

$$k_i = C_i \times Q_i + h_i \frac{Q_i}{2} T + A_i \quad \forall = i \dots I \quad (8)$$

Eq.6 is considered for demands of RM inventory. Demand of each kind of inventory depends on the safety stock of RM and rate of consumption of the RM in WIP inventory. Eq.7 shows the optimal order quantity of RM inventory.

3.5.Description of the case study

For validity and applicability of our model, we choose a fruit juice company. Demand for FG product is followed normal distribution. Production process is shown in fig3. Products follow MTS production before OPP, when orders of customer arrive in different package size and distinct products, so after OPP we follow MTO strategy. We have four FG products in this company: 1-Orange juice with %40 acidity and 0.1 brix.2-chary juice with %50 acidity and 0.11 brix.3-Orange &pin apple juice with %39 acidity and 0.11 brix.4-pin apple juice with %35 acidity and 0.12 brix. Each kind of these products has distinct WIP due to amount of acid and their demand. WIP consists of Sugar syrup with amount of acid. There were always shortages in firm for WIP due to shortage in RM material. The cost of shortage is not desirable. We find optimal WIP in such a way that leads to increase profit and remove shortages. The model costs are lower than the previous costs.

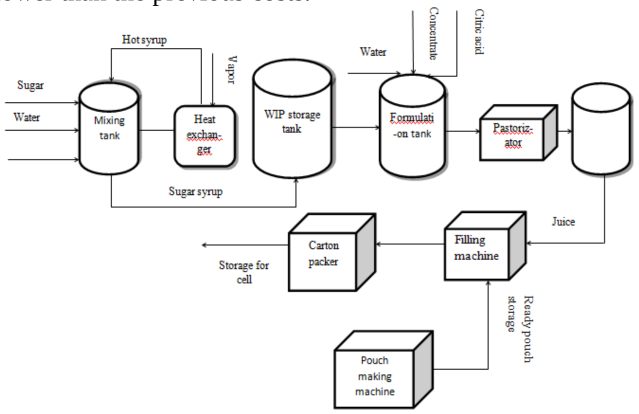

Figure 2. Schematic of Juice making line

4. Results

We performed the proposed model for a period of production which lasts 26 days. In table 1, demand for products in each day, quantity of WIP of firm, calculated WIP from constraint 1 and 2, and calculated profit from each kind of WIP are shown. For example demand for orange juice is 77000packets in a day and each packet has 200gr. Juice, so production quantities for that day are 15400 lit juice. The firm's WIP here is 2370 lit, which is faced to shortage for respond to this quantity of demand. By using the model in the firm, quantity of optimal WIP calculate 2738 lit.

Acid use in process two stages, the first time it mixes with WIP. Amount of acid that used in WIP is calculated by:

$$acid = \frac{amount\ of\ WIP\ \times 1.8}{100}$$

In equation above, 1.8 is considered for sugar syrup acidity. The second time, acid is used in RM. Amount of acid that used in WIP is calculated by:

$$acid = \frac{(amount\ of\ juice \times acidity) - (amount\ of\ WIP \times 1.8)}{100}$$

Amount of RM and WIP of each product is shown in tables 2,3,4,5.

Table 2. WIP and RM for Orange juice with %40 acidity and 0.1 brix

Demand(lit)	WIP		RM	
	Sugar syrup	ACID	Concentrates	ACID
13600	2331	42	418	18
16412	3009	54	505	24
9640	1581	28	296	12
11600	1976	35	356	15
15400	2738	49	473	21
12080	2331	42	372	19
9301	1581	28	286	12

Table 3. WIP and RM for Chary juice with %50 acidity and 0.11 brix

Demand (lit)	WIP		RM	
	Sugar syrup(lit)	ACID(kg)	Concentrates(kg)	ACID(kg)
15415	2800	50	521	32
17400	3070	55	588	43
10810	2000	36	365	23
14200	2800	50	480	32
11700	2000	36	396	23
13119	2390	43	444	27

Table 4. WIP and RM for orange & pineapple juice with %39 acidity and 0.11 brix

Demand(lit)	WIP		RM	
	Sugar syrup(lit)	ACID(kg)	Concentrates(kg)	ACID(kg)
12860	2300	41	435	30
14002	2708	49	435	35
12560	2300	41	473	30
10005	1993	35	425	26
8485	1660	30	338	21
13070	2300	41	287	30

Table 5. WIP and RM for pineapple juice with %35 acidity and 0.12 brix

Demand(lit)	WIP		RM	
	Sugar syrup(lit)	ACID(kg)	Concentrates(kg)	ACID(kg)
10680	2103	37	394	20
12861	2409	43	474	23
15215	2817	51	561	27
12920	2409	43	477	23
16261	3088	55	600	30
14200	2817	51	524	27
8810	1782	32	325	17

Amount of concentrates that used in RM is calculated by:

$$concentates = \frac{amount\ of\ juice \times brix \times \%20}{\%65}$$

In equation above %20 is the quantity of concentrate in each packet and %65 is the brix of sugar syrup. After calculating WIP for each product we obtain demands for RM for one period. RM consists of Sugar and concentrates and acid. We compare the result of demand before using model and after using it in tables 6 and 7.

Table 6. Demand of RM after using model

RM	Demand	
Sugar(kg)	(15547*650) + (15060*650) + (13261*650) + (17425*650)	=39840450
Acid(kg)	(15547*0.018) + (15060*0.018) + (13261*0.0178) + (17425*0.0181) + (121+180 +172+167)	=1742.36
Concentrates(kg)	2794 + 2704 + 2799 + 3355	=11655

Table 7. Demand of RM before using model

RM	Demand	
Sugar(kg)	(13543*650) + (13752*650) + (12012*650) + (16789*650)	=3642400
Acid(kg)	(13543*0.0176)+ (13752*0.018) + (12012*0.0179) + (116789*0.0177) + (108+165 +60+16)	=1361.44
Concentrates(kg)	2709 + 2797 + 2401 + 3357	=11264

By knowing the demands for each kind of RM we can calculate EOQ and the total cost includes ordering, purchasing and holding costs. In fact we calculate EOQ in a way that we would not have any shortage and backlog but in firm strategy there was shortage and backlog. Shortage and costs of it are calculated by Eq.9 and 10.

$$b_i = \sqrt{\frac{2D_i A_i h_i}{\hat{\pi}(\hat{\pi}+h)}} \quad (9)$$

$$k_i = A_i + h_i \times \frac{(Q_i - b_i)^2}{2D_i} \times T + \frac{b^2}{2Q_i} \times T + \pi b + C_{RMi} Q_i \quad (10)$$

Quantity of EOQ and cost are shown in table 8. SEM analysis of the resulting nano-composite scaffold is shown 4-3 . As seen in this figure is a composite of interconnected porous structure. In the picture we can see that with the increase of porosity, pore Hardystonit gets older . More than 5% to 20% Hardystonit go Hardystonit ago. Ceramic phase pore sizes less than nm 100 and distributed almost uniformly evident. This scaffold percent of the original variable in the process of making calcium silicate powder is added to the two-component composite .. Usually washing scaffold is also not fully exit the other hand, a high concentration of the solution remains soluble after drying is used to make gelatin Brittle is important so choosing the right concentration.

Table 8. Quantity of EOQ and cost

RM	Q*	Q	K*	K	saving
sugar	460.95	440.98	709422.56	710027.2	604.64
Acid	75.25	66.51	154420.966	171711.3	17290.334
Orange conc.	61.03	60.09	2748.59	3193.82	4450.23
chary conc.	60.4	61.6	2884.13	3428.45	544.32
Orange & pin apple conc.	61.09	56.58	2751.054	3006.9	255.846
Pin apple conc.	67.8	65.2	3010.83	3554.064	543.234

5. Conclusions and future works

Inventory has an important role in production systems .In recent years, researchers have studied many features of hybrid MTO/MTS system for reaching the benefits of both pure MTS and pure MTO systems .However, no research instances is found about different aspects of the inventory management system and on the MTO/MTS system. In this paper we examine the role of inventory in a hybrid MTS/ MTO production environment, based on a case study performed in a fruit juice company. In this example, demands for Finished Good FG inventories follow normal distribution. Our proposed model calculates EOQ by obtaining demands for RM inventories through WIP and FG inventories. For applicability and validity of our claim we illustrate some samples of production in different days and compare it with old method estimation of WIP and EOQ. By having optimal WIP we increase the profit of sales because many demands meet to shortage and backlog in firm old strategy. Costs of backlog and shortage were too high because coming across them suggests that general loss of profit on that day. Finally we obtain demands for RMs and remove shortage and backlog through optimal WIP.

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Table1: Information of production and WIP

Product	Demand (packet)	Demand (lit)	WIP	WIP(3)	WIP(4)	WIP*	Profit*
Orange juice	68000	13600	2092	2331	2371	2331	477855
chary juice	84080	16816	2609	3070	3162	3070	629350
pineapple juice	3400	10680	1971	2103	2173	2103	431115
Orange & pineapple juice	64300	12860	2176	2247	2357	2247	460635
Chary juice	77075	15415	2609	2800	2964	2800	574000
Orange & pineapple juice	70010	14002	2370	2708	2845	2708	555140
Orange & pineapple juice	68060	13612	2303	2247	2357	2247	460635
chary juice	80080	16016	2710	3070	3162	3070	629350
Orange juice	48200	9640	1483	1702	1581	1581	324105
Pineapple juice	64305	12861	2374	2409	2570	2409	493845
Orange juice	58000	11600	1785	2024	1976	1976	4045080
Orange & pineapple juice	62800	12560	2125	2300	2450	2300	471500
Orange juice	77000	15400	2370	2738	2766	2738	561290
chary juice	54050	10810	1830	2086	2000	2000	410000
Orange & pineapple juice	50025	10005	1694	1993	2055	1993	408565
Pineapple juice	64600	12920	2385	2409	2570	2409	493845
Orange juice	60400	12080	1585	2331	2371	2331	477855
chary juice	71000	14200	2403	2800	2964	2800	574000
Pineapple juice	88305	17661	3002	3088	3360	3088	633040
Orange & pineapple juice	41425	8285	1402	1671	1660	1660	340300
Pineapple juice	69050	13810	2621	1993	2964	2964	607620
chary juice	58500	11700	1980	3070	2000	2000	410000
Orange juice	46505	9301	1430	1702	1581	1581	324105
Orange & pineapple juice	65350	13070	2211	2409	1660	1660	340300
Pineapple juice	66025	13205	1625	2024	1779	1779	364695
chary juice	65595	13119	2220	2300	2570	2570	526850