Inventory Management at Three Jay's Corporation

Three Jays (3Js) bases its inventory management and production scheduling decisions on the Economic Order Quantity (EOQ) model and the Reorder Point (ROP), utilising data from its first full year of operations in 2010 to determine the optimal production batch sizes and reorder points. However, this model needs to be updated according to the demand in 2012. This has been calculated for the five SKUs scheduled to be produced in the last week of June in **Table 1**. Overall, due to the increase in demand and constant costs, the EOQ and ROP for all five SKUs are higher in 2012 than in 2010. For the EOQ, this increase is equivalent to the square root of the multiplier that represents the increase in demand. For the ROP, this increase is equivalent to the percentage increase in demand. This has also been calculated for the five SKUs in **Table 1**.

Table 1: Updated EOQ and ROP based on 2012 Demand

SKU	Total Set Up Costs	2012 Demand	Carrying Costs	Unit Costs	EOQ	ROP	Demand Increase	EOQ Increase	ROP Increase
Strawberry Jam	63.70	3,869	9%	28.34	440	223	29%	14%	29%
Raspberry Jelly	63.70	3,006	9%	30.52	373	173	29%	13%	29%
Peach Jam	63.70	1,970	9%	26.86	322	114	32%	15%	32%
Blueberry Jam	63.70	1,211	9%	29.01	243	70	37%	17%	37%
Apple/ Mint Jelly	63.70	832	9%	26.32	212	48	33%	15%	33%

In addition to updating the EOQ based on the latest demand, there remains scope to review the costs presented in Exhibit 2 used in determining the EOQ. According to the EOQ model, the EOQ is the order quantity that minimizes the sum of ordering costs and holding costs, which can be given by $\sqrt{2RK/h}$, where R is the demand, K is the ordering costs, and h is the holding costs. As such, we recommend rearranging the costs in Exhibit 2 to better represent the ordering and holding costs. The recommendations and assumptions are as shown in **Table 2**. Essentially, the ordering costs should only reflect the costs required to **order** (i.e. the difference in costs between ordering X times and X-1 times). The holding costs should also only reflect the costs of **holding inventory** (i.e. the difference in costs between holding X inventory and X-1 inventory), which includes the opportunity costs of capital in terms of committing production and material costs upfront to increase inventory. In that regard, the cost of the

three idle part time workers should be included as part of the opportunity costs of committing capital upfront for production.

Table 2: Recommendation for EOQ and ROP Formula

Costs	Recommendation	Assumptions
Setup Costs		
Order Processing Cost	Ordering Costs	Assumed To Be Incurred Per Order
Product Prep, Cooking and Cleaning Cost	Holding Costs	Assumed To Be Constant Regardless Of Number of Orders; Forms Part of Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Size Changeover Cost	Ordering Costs	Assumed To Be Incurred Per Order
Production Line Cleaning Cost	Holding Costs	Assume To Be Constant Regardless of Number of Orders; Forms Part of Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Unit Costs		
Materials Cost	Holding Costs	Forms Part of Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Production Labour Cost	Holding Costs	Forms Part of Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Fixed Overhead Allocation	To Omit	Assumed To Be Constant Regardless Of Inventory
Variable Overhead	Holding Costs	Forms Part of Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Carrying Cost		
Cost of Capital	Holding Costs	Opportunity Costs Of Capital From Committing Costs Upfront To Increase Inventory
Storage Costs	Holding Costs	Assumed to Increase With Size of Inventory
Carrying Costs	Holding Costs	Assumed to Increase With Size of Inventory

The recalculated EOQ and ROP based on the 2012 annual demand and our recommendations are shown in **Table 3**. There is a significant fall in the EOQ quantity as the previous data had overstated the order costs and understated the holding costs. In particular, the previous model had included production costs as part of the order costs. However, these should not be included as these are independent of the number of orders made. The previous model had also omitted production costs as part of the inventory holding costs. However, these should be included, as these require capital to be committed upfront, which would either incur opportunity costs of capital at best or at worst result in depreciation with expiry of products. There is no change to the ROP quantity, as there is no change to the 2012 demand and the three weeks lead-time. With a lower EOQ and a constant ROP figure, this leads to more frequent production cycles and reduced inventory levels, thereby aiding the goal of reducing current inventory. Most importantly, this minimizes costs.

Table 3: Comparison of EOQ and ROP Based on Previous and Recommended Model

Previous Model						
Products	**Setup Costs**	**Unit Costs**	**Carrying Costs (%)**	**Demand**	**EOQ**	**ROP**
Strawberry	63.70	28.34	9%	3869	440	223
Raspberry	63.70	30.52	9%	3006	373	173
Peach	63.70	26.86	9%	1970	322	114
Blueberry	63.70	29.01	9%	1211	243	70
Apple/Mint	63.70	26.32	9%	832	212	48
Recommended Model						
Products	**Ordering Costs**	**Unit Costs**	**Carrying Cost (%)**	**Demand**	**EOQ**	**ROP**
Strawberry	9.95	79.54	9%	3869	104	223
Raspberry	9.95	81.72	9%	3006	90	173
Peach	9.95	78.06	9%	1970	75	114
Blueberry	9.95	80.21	9%	1211	58	70
Apple/Mint	9.95	77.52	9%	832	49	48

While the EOQ/ROP model is able to determine the most cost-effective EOQ and ROP for each SKU, Jake and Josh have not been strictly adhering to the EOQ/ROP quantities, and have been over ordering and holding excess inventory in general. This is because they only schedule production of each jar size once every four weeks, and cater additional buffer stock as a result. A comparison between the procedure that Jake and Josh is using and the established EOQ/ROP procedure is shown in **Table 4**.

Table 4: Comparison Between Established EOQ/ROP with Jake and Josh Model

Factor	**EOQ/ROP**	**Jake/Josh**	**Rationale**
Frequency of Ordering	When SKUs fall below ROP	Every four weeks	Adjusting the production line takes half an hour and could cause the jars to hang up and shut the line down
SKUs to Order	SKUs that have fallen below ROP	SKUs that have fallen below ROP + SKUs that are expected to be used up in next six weeks	Production is only every four weeks, need to ensure sufficient stock until next production
ROP	Three Weeks	Six weeks	Include two weeks safety stock
Quantity to Order	EOQ	Predicted demand for next month based on previous month's sales + safety factor based on previous year's sales + adjustment from inventory on hand	Should produce enough based on the demand each month

We do not have the full details of the order quantities and frequency for Jake and Josh. However, based on the order quantity provided for the last week of June, we assess that the overall sum of ordering costs and inventory costs under the Jake and Josh system is generally higher. This is even under a "worst-

case" scenario for the EOQ/ROP model where we assume that all five SKUs need to be ordered in the last week of June, as compared to only Strawberry Jam and Raspberry Jam, which have fallen below the ROP based on the 2010 annual demand. As such, we prefer the EOQ system due to the lower overall costs.

Table 4: Estimation of Costs Between Established EOQ/ROP with Jake and Josh Model

SKU	EOQ/ROP				Jake and Josh			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Strawberry Jam	387	7.74	193.32	$986.19	750	3.99	375.00	$1,210.68
Raspberry Jam	329	7.10	164.54	$903.94	670	3.49	335.00	$1,142.18
Peach Jam	280	5.32	140.21	$677.87	75	19.89	37.50	$1,357.86
Blueberry Jam	208	4.26	103.96	$542.87	110	8.05	55.00	$656.67
Apple/Mint Jelly	183	3.41	91.67	$434.30	100	6.25	50.00	$516.57
Total Costs				$3,545.17				$4,883.95
A. Order Quantity, B. Number of Orders, C. Average Inventory, D. Total Costs								

Nonetheless, we also need to consider the potential costs of the machines breaking down. If the expected costs of production being disrupted (which can be calculated by the probability of breaking down multiplied by the costs of breakdowns) exceeds the costs saved by the EOQ/ROP model, we would favour the Jake and Josh model then. Moreover, the Jake and Josh model would also provide better predictability for the factory production cycles, which could have a positive impact on employee wellbeing. This could also be factored in as a "cost" of the EOQ/ROP model.

Should we decide to schedule the production as suggested by Jake and Josh, we could further refine their production frequency and quantity. In particular, we could adhere to the same order quantity prescribed by the EOQ model, but readjust the ROP to be at six weeks of the annual demand. This would help to reduce some of the inventory build-up. On the other hand, should we decide to continue with the EOQ/ROP model, we could reduce the likelihood of breakdowns happening by training part-time employees to better manage size changeovers. Other ways to manage the inventory build-up could include creating a more flexible inventory system, where the jams and jellies are stored separately from the jars and labels. This could reduce the need to overstock inventory, and potentially allow 3Js to lower costs, improve inventory management, and enhance service levels, ensuring product freshness and quality.