

LINKS Tutorial #5: Inventory or Emergency Production?

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Every simulation round, your firm decides on manufacturing volumes to meet sales demand in each region. If your sales forecasts were always 100% accurate, you'd probably produce just enough to meet demand. You wouldn't need inventory or emergency production. But in LINKS and the real world, demand is rarely known with certainty. That means you face the "inventory or emergency production" tradeoff every simulation round:

- Should you make more products than you expect to sell, building a safety stock of inventory just in case your sales forecasts are too low?
- Or, should you estimate close to what you really expect sales demand to be and resort to emergency production if demand exceeds your sales forecasts?
- And what if you already have a huge inventory of a particular product? How low should you go with your inventory?

This tutorial presents a "hands-on" exercise for you to assess the inventory or emergency production tradeoff for a LINKS firm. What you learn in this exercise can also be applied to your own LINKS firm. This tutorial consists of three parts:

Starts On Page:

<u>PART 1: "Hands-On" Exercise</u>		2
Question:	Purpose:	Page:
1 a-d	Profitability Analysis: Step-by-step analysis of the relative costs between FG inventory and emergency production on a per unit basis.	2
2	Other Factors that could influence your decision to either inventory or resort to emergency production.	3
3	Consequences: Unfilled orders.	3
4	Links to the LINKS Performance Evaluation Report	4
<u>PART 2: Exercise Answers</u>		5
<u>PART 3: TIPS for Your Own Analysis</u>		8

PART 1: "Hands-On" Exercise

NOTE!

To get the most from this exercise, you should be familiar with P&L statements, inventory tracking, balance sheets, and the metrics they influence on the LINKS Performance Evaluation Report. If you are unfamiliar with any of these, you may wish to work through the appropriate LINKS Tutorial (#1, #2, and/or #3) before you start this tutorial.

Question 1 - Profitability Analysis: Since a product sold from either inventory or emergency production results in the same revenue, the secret to making the most profitable decision relies on your understanding of costs. The lower-cost option will result in higher profit. Let's explore the costs of holding inventory as compared to producing emergency goods by using an example scenario.

- a. Assume your firm produces a product H77432 at your plant for shipment to all regions. The bill of materials required for this product and some associated costs are listed in the table below. Please refer to your LINKS manual to find and write-in the missing data:

	Required for H77432:	Total Cost:
Alpha	7	
Beta	7	
Bandwidth	4	
Warranty	3	
Packaging	2	14.00
Gamma	1	12.96
Epsilon	1	30.53
Production Cost		20.00
Labor Cost		30.00
Unit Total:		233.49

}

Complete these!

(Want to check your work? See **Exercise Answers** on page 5...)

- b. Calculate the cost of holding one unit of H77432 in inventory for one simulation round in each of the following regions (Assume normal shipping is via Shipper I by Air):
- (1) DC2 - (assume you own this facility)
 - (2) DC3 - (assume you subcontract to a third party)

- c. Calculate the incremental cost (costs above and beyond the \$233.49 unit cost from question 1a) of emergency production for one unit of H77432. Assume that emergency procurement is not necessary, and you need fewer than 5,000 emergency units produced. Assume you normally ship units via air from your plant to DC2 and DC3 using Shipper I.
- (1) The incremental cost for one unit of emergency-produced H77432 shipped from your plant to **DC2**:

 - (2) The incremental cost for one unit of emergency-produced H77432 shipped from your plant to **DC3**:
- d. Which option appears to be the more profitable (lower-cost) choice: keeping one unit of inventory **or** making one unit through emergency production:
- (1) For Region 2?
 - (2) For Region 3?

Question 2 - Other Factors: In question 1, you based your decision of inventory or emergency production strictly on the costs of each option. List some other factors that could influence your decision to choose either inventory or emergency production.

Question 3 - Consequences: If emergency production were not an option or if the maximum limit for emergency production were less than total customers' orders, you experienced unfilled orders. What implications (if any) could unfilled orders have on your business during the current simulation round and in the future?

Question 4 - Links to the LINKS Performance Evaluation Report: Whether you choose to inventory products or produce on an emergency basis, you will affect various performance metrics on your firm's Performance Evaluation Report.

- a. Select the item(s) that complete the following: In general, the higher your ending inventory of finished goods, the...
- _____ ... lower your *Net Income to Revenues*.
 - _____ ... higher your *Net Income to Revenues*.
 - _____ ... lower your *Return on Assets*.
 - _____ ... higher your *Return on Assets*.
 - _____ ... lower your *Inventory Turnover*.
 - _____ ... higher your *Inventory Turnover*.
 - _____ ... lower your *Net Asset Turns*.
 - _____ ... higher your *Net Asset Turns*.
- b. Select the item(s) that complete the following: Emergency production results in...
- _____ ... lower net income than if you sold available inventory.
 - _____ ... higher net income than if you sold available inventory.
 - _____ ... a lower *Unplanned Production %*.
 - _____ ... a higher *Unplanned Production %*.

EXERCISE ANSWERS follow.

PART 2: Exercise Answers

Question 1:

a.

	Required for H77432:	Total Cost:
Alpha	7	21.00
Beta	7	28.00
Bandwidth	4	42.00
Warranty	3	35.00
Packaging	2	14.00
Gamma	1	12.96
Epsilon	1	30.53
Production Cost		20.00
Labor Cost		30.00
Unit Total:		233.49

b. (1) The incremental cost of one unit of H77432 in inventory for one round in DC2:
 $= \$233.49 \times 3\% \approx \mathbf{\$7.00}$

(2) The incremental cost of one unit of H77432 in inventory for one round in DC3:
 $= \$233.49 \times 5\% \approx \mathbf{\$11.67}$

c. The incremental cost of one unit of H77432 produced and shipped on an emergency basis (assuming no emergency procurement):

(1) For Region 2:

+ Product cost premium @50%	10.00
+ Labor cost premium @ 50%	15.00
+ Air shipping (\$8/unit) @ 50% premium	<u>4.00</u>
	\$29.00 more per unit.

(2) For Region 3: $\$10 + \$15 + (\$14 \times 0.5) = \mathbf{\$32}$ more per unit

d. (1) Keeping a unit in inventory, since: $\$7.00 < \29 .

(2) Keeping a unit in inventory, since: $\$11.67 < \32 .

Question 2: Here are some other factors that could influence your decision:

- Upcoming reconfiguration - if you plan on reconfiguring a product, you may reduce inventory of the existing product as much as possible to minimize disposal losses.

- Customer satisfaction - some firms aim for 100% customer satisfaction, and they are willing to have high inventories to be sure they never run out of stock.
- Large existing inventories - if you already have a very large inventory of a particular product, you will probably not add much safety stock beyond the sales you expect. In fact, you may produce fewer units than needed to fulfill expected sales to use up some of your existing inventory.
- Emergency production limit standby charges – you incur emergency production limit standby charges with emergency production limit of greater than 0 units. These would also have to be taken into account in your profitability assessment.

Question 3:

Customers would have to switch to competitors' products if they wanted to make purchases in round #7. If they prefer the competitors' products after use or if they fear future unavailability of your product, they may switch permanently. You could lose customers and potential sales in round #7 and beyond.

Question 4:

- a. In general, the higher your ending inventory of finished goods, the...
- ... lower your *Net Income to Revenues* (**since you're paying an inventory carrying charge**).
 - ... higher your *Net Income to Revenues*.
 - ... lower your *Return on Assets* (**since assets are higher**).
 - ... higher your *Return on Assets*.
 - ... lower your *Inventory Turnover* (**since you have more inventory**).
 - ... higher your *Inventory Turnover*.
 - ... lower your *Net Asset Turns* (**since you have higher assets**).
 - ... higher your *Net Asset Turns*.
- b. Emergency production results in...
- ... lower net income than if you sold available inventory (**since emergency production costs are higher**).
 - ... higher net income than if you sold available inventory.
 - ... a lower *Unplanned Production %*.
 - ... a higher *Unplanned Production %* (**since emergency production is, by definition, unplanned production**).

PART 3: TIPS for Your Own Analysis

- * Pay careful attention to your demand forecasts, since inventories and emergency production are directly related to sales forecast accuracy.
- * Calculate the per-unit cost to inventory and the per-unit cost to emergency produce the product in question. Compare these costs to understand the trade-offs you face.
- * Discuss the factors besides per-unit inventory and emergency production costs that should influence your decision. How important are these factors as compared to per-unit costs?
- * Keep the impact of this decision in perspective. What is the overall effect this decision can have on your firm's fixed costs and profitability during the next simulation round? Over the longer term?
- * After you make your decision, track your results. Did you achieve the results you expected? What did you learn to improve your decision making during the *next* simulation round?