Printing Solutions, Inc. (A)

Printing Solutions, Inc. (PSI) specializes in producing and servicing laser printers for business and personal use. The company has been quite successful over the last few years, earning over $150 million on $2 billion in sales last year alone. To cut costs, PSI contracts with electronic manufacturing firms in Asia to produce all of its base printers. These printers are then shipped to assembly facilities around the world, near where it will be sold, to be customized for a particular customer. This use of postponement has helped PSI to keep manufacturing costs low, while still offering a high level of variety to its customers.

The business model of manufacturing in Asia and customizing close to the point of sale was working well; however, the primary customization facility for North America had a problem. Due to all of the different printer types and the variety of features that could be added, the facility in Mexico had run out of warehouse space on numerous occasions. Costs increase tremendously for the company when all of the warehouse space is filled. In order to combat this problem; John Smith, an MBA supply chain intern, was hired for the summer.

John's job was to create a model to predict if and when the Mexican warehouse would run out of space over the next year. By using the model, the company could then contract for additional space through either leasing or building onto the current facility. The model would be critical for the next year as the K15 series of printer was being phased out and the new K20 printer was coming into production. During this transition, space would be at a premium since two products would be using the facility.

Available Data

John had a significant amount of data available to him. This includes information on the warehouse space at the Mexican facility, packing information for both printers and their accessories, the current inventory, scheduled orders, and the current demand forecast for both products.

Warehouse Information

The warehouse at the Mexican facility has 228,000ft^2 of total space. Since 33% of the total space is allocated for isles and forklift areas only 153,000ft^2 remains as storage area. The warehouse group has determined that if more than 85% of the storage area is used that significant congestion problems will occur. This leaves only 130,000ft^2 of viable storage area. Additionally, the warehouse has no racks. This means that all pallets must be stacked on top of one another. The facility has space to stack pallets. For the printers, pallets could be stacked 2 high while the accessories could be stacked 3 high.

Prepared by Herbert S. Garnes, IV, MBA/MMM '05 and Andrew Davis, MBA '06 in consultation with Professor Gary Bolton.
Smeal College of Business, The Pennsylvania State University.

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Packing Information
All materials at the facility are packed on the same sized pallet. This is a standard 40"x48" wood pallet. The K15 has four accessories associated with each printer, while the K20 has only two accessories. A summary of the packing information is in Table 1.

	K15	K20
Printers Per Pallet	4	6
Printer Pallet Stack Height	2	2
Accessories Associated With Each Printer	4	2
Accessories Per Pallet	8	10
Accessories Pallet Stack Height	3	3

Table 1 - K15 and K20 Packing Information

To simplify the model John assumed that for each printer in inventory, there would be the corresponding number of accessories in inventory. Additionally, he assumed that the pallets were stacked as efficiently as possible.

Order and Inventory Information
Determining the proper order requirements and associated lead times for each base printer is difficult. Therefore, John simplified the model using a deterministic arrival rate for each base printer and corresponding accessories.

In addition to the incoming order information, John also had the beginning inventory balances for each printer. This amounted to 20,000 units for the K15 and 5,000 units for the K20.

Forecast Data
The most variable data in John's model is the forecast data. For both printers, the forecast and standard deviation are available. As expected, the standard deviation increases as the forecast goes further out. Table 2 provides a detailed breakdown of the respective printer forecasts.

	K15		*K20*	
Month	**Forecast**	**Standard Deviation**	**Forecast**	**Standard Deviation**
1	15,000	1,000	6,000	400
2	20,000	1,600	4,500	300
3	25,000	2,400	5,000	400
4	17,500	2,000	7,500	700
5	14,000	1,900	10,000	1,100
6	14,500	2,300	12,500	1,600
7	12,500	2,300	14,000	2,100
8	10,000	2,200	14,500	2,600
9	7,500	1,900	15,000	3,200
10	5,000	1,500	17,500	4,400
11	4,500	1,600	20,000	6,000
12	6,000	2,500	25,000	9,000

Table 2 - Printer Forecast Detail

Options

John figured he had three options for warehouse space. One, PSI could lease additional space for three months at a time, two; PSI could build onto the current facility and utilize the space for a number of years (one can make assumptions regarding future forecasts and the belief of the company continuing as a going concern), and three; PSI could do nothing and incur the emergency storage rates. The cost for each option is as follows:

		Costs	
Up To	**Leasing for 3 Months**	**Building**	**Emergency for 1 Month**
2000	$100,000	$160,000	$100,000
4000	$192,000	$312,000	$200,000
6000	$276,000	$456,000	$300,000
8000	$352,000	$592,000	$400,000
10000	$420,000	$720,000	$500,000
10000+	$40/foot	$70/foot	$50/foot

Note: Ignore all tax and amortization effects from building. Assume that the figures above account for all indirect benefits/costs.

Warehouse Space Modeling

Warehouse space modeling, similar to the type John was tasked with, is relativity simple. At its core is a basic mass balance. Essentially, the previous volume of goods in inventory adjusted for the volume of goods flowing through the warehouse provides a good estimate of how many items are in storage at a given time. Once this number is known, only the packing information and assumptions need to be applied. This is the methodology John believed he should use when designing his model.

What does his model show? More importantly, should PSI contract for more warehouse space? If so, how much would be required and when should it be acquired? What should the final decision be based on? Which option is most cost effective for PSI?