

Logistics Simulation Game User's Manual

SCM 460
Decision Models for Logistics
And Operations Management

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1. Overview

This simulation game allows you to learn how to make good transportation scheduling decisions within a logistics network, along with demand forecasting, facility location analysis, and production planning. You are a logistics manager of a laundry detergent manufacturer which has 3 manufacturing plants and 4 regional distribution centers (warehouses). The company has only one product, the "Super-star laundry detergent". There are four sales regions, each of which has exactly one warehouse and four customers (see Figure 1). The goods are shipped from plants to warehouses and then to ultimate customers (retailers and wholesalers). No direct shipping from plant to customers is allowed. You can only ship goods to a customer from the warehouse which is located within the region where the customer in question is located. Your task is to make logistics decisions over the next ten months for the company in order to maximize the profitability, which is defined as the ratio of revenue to cost. The profitability can be maximized by maximizing revenue, minimizing cost, or both. The revenue is defined as the sum of laundry detergent revenues in all sales regions. The cost includes the followings: production cost, transportation cost, warehouse cost (fixed and variable costs), warehouse location change cost, and inventory carrying cost.

2. Decisions to Make

Your decisions include warehouse lease/buy decisions, warehouse location decisions, transportation planning, and production planning. Table 1 shows the spread-sheet format that you will be using to indicate your decisions from month to month, the detailed description of which is provided in the paragraphs that follow.

2.1. Warehouse Selection. In this table you indicate your warehouse decisions. First indicate the preferred location of the warehouse for each region by using horizontal and vertical grids. Your warehouse location must be within the region boundary (for example, your warehouse location for region 1 must be between 500 and 1,600 for horizontal grid and between 1,500 and 2,000 for vertical grid. In the column "lease or buy", you indicate whether you want to lease or build (buy) the warehouse by using the figure 0 or 1, where 0 means leasing and 1 means building. Leased warehouse and built warehouse have different fixed and variable cost structures (see the parameter section). You can change your warehouse location and/or type (lease or buy) at any time, but if doing so, you will incur a cost (per change).

2.2. Shipment Plan. In this table you indicate your transportation decisions (all of your goods are shipped by trucks). Input the desired number of units to ship from each origin to each destination by using the table. You can ship goods to any warehouse from any plant. You can also perform "transshipment", or the shipment among warehouses. However, you cannot ship goods from a plant to another plant, or from a warehouse to a plant. If your shipment plan from a particular origin exceeds the available number of goods at the origin, the computer will reduce the shipment to each destination by the same percentage (for example, if your plan is to ship 100 units from plant 1 to warehouse 1 and another 100 units from plant 1 to warehouse 2, but only 100 units are available at plant 1, 50 units will be shipped to both warehouses 1 and 2). The available number of product in a plant for a given month is defined by the following formula: beginning inventory of the plant for the month + actual production at the plant during the month.

The available number of product in a warehouse for a given month is defined by the following formula: beginning inventory of the warehouse for the month + receipt from plants and other warehouses during the month. Your shipment figures must be specified in *integers* (1, 2, 3,).

2.3. Production Plan. In this table you indicate your production decisions *for the next month* (you must plan your production one month in advance). Your first month production plan is given (5,000 units for each plant). Your production figures must be in integers. Also, your production plan for each plant must be less than or equal to 11,000 units per month, because this figure is the production capacity of each plant. If you input figures greater than 11,000, the simulation program will automatically convert the figure into 11,000.

You must specify a production plan for each plant every month. If you do not wish to produce any unit, you must write "0" in appropriate area(s). If you leave one or more production input blank, the computer assumes that your production plan is 11,000 units (plant managers want to produce up to capacity unless they hear from you).

Production cost per unit is different from plant to plant. You may want to consider producing more units in plants which have lower production cost (but do not forget to consider cost of transportation - the cheapest plant may be far from the warehouses).

It is recommended that you first perform demand forecasting at each sales region, and then plan transportation and production schedules based on the predicted demand. Also keep in mind that warehouse location and type will affect your cost.

3. Simulation Parameters

Parameters of simulation game are shown in Table 2. Most of the figures are clear and self-explanatory. The only terms which need further explanation are the "cost per unit-mile" and "customer sales proportion".

The transportation cost is measured in terms of dollars per unit-mile in this simulation game (as well as in practice). This means that the cost represents the amount of dollars that you must pay to transport one unit of good for one mile. Thus, if the cost is \$1 per unit-mile, you must pay \$100 to ship two units of goods for 50 miles ($\$1 \times 2 \times 50$).

The figures in the "customer sales proportion" table represent the share of demand for each customer within the region. For example, Table 2 indicates that 10% of region 1 sales (units) come from customer 1. These figures are stationary (does not change from month to month). These figures are used to calculate the transportation cost from your regional warehouses to customers (see discussions "calculating revenue and cost").

The sales patterns (in units) of the previous year by region and month are shown in Table 3. You should carefully examine these figures to determine the sales patterns of your product by region and month for the coming year.

4. Output

At the end of each month, you will receive an output report that looks like the one shown in Table 4. You should use this report to make your decisions for the next month.

5. Calculating Revenue and Costs

5.1. Revenue. Revenue is calculated by multiplying the amount of products sold in all sales regions (units) and the per-unit revenue of the product (unit value). The amount of goods sold in a sales region is defined as: (1) the demand (in units) in the region in question if the product availability in the region is greater than or equal to the demand, or (2) the product availability in the region if demand in the region is greater than the availability in the region (see section 2.2 for the definition of product availability).

5.2. Production Cost. The cost of production at each plant is calculated by the product of the actual number of goods produced during the month and the per-unit production cost of the plant in question. The total production cost is defined as the sum of production costs at all plants.

5.3. Transportation Cost. Using the warehouse location information that you provide, the computer first calculates, for all origin-destination pair, the distance matrix (see Table 4 "W/H-Plant distance matrix" and "Distance from W/H to Customers"). A distance between any given two points is defined as the length of the straight line connecting the two points. Using this distance matrix, the computer calculates transportation cost for each origin-destination pair by multiplying the distance, shipment volume (units), and transportation rate per unit-mile for the origin-destination pair in question. The overall transportation cost represents the sum of transportation costs for all origin-destination pairs.

5.4. Warehouse cost (location change). As discussed previously, you can change your warehouse location and/or type (lease or buy) at any time. When you make these changes, however, you will incur a cost of \$5,000 per change. If you simultaneously change both the location and type, your cost is only \$5,000, not \$10,000.

5.5. Warehouse cost (Fixed and Variable). Fixed cost of a warehouse is the cost that you must pay regardless of the amount of goods that are handled by the warehouse. Your fixed cost of a warehouse can be different depending on whether you lease or buy the warehouse (see Table 2). The variable cost that you incur varies depending on your warehouse output. The variable cost of a warehouse is calculated by multiplying the output of the warehouse and its per-unit variable cost. The output is defined as the sum of products (in units) that came into the warehouse and the products (in units) dispatched from the warehouse to customers and/or other warehouses in a given month (throughput). Notice that per-unit variable cost is different depending on the type of warehouse (lease or buy - see Table 2).

5.6. Inventory Carrying Cost. Inventory carrying cost is calculated by multiplying the per-unit inventory carrying cost and the ending inventory (units) of the month. Notice that per-unit inventory carrying cost is different between plants and warehouses (see Table 2). The overall inventory carrying cost is the sum of inventory carrying costs at all warehouses and plants.

6. Sources of Uncertainties

In the simulation game, there are three sources of uncertainties. First, regional demands tend to follow specific patterns, but they are rather stochastic and hard to predict with accuracy. Second, the production may or many not be performed as you planned. Sometimes the raw materials supplies may not be sufficient and/or a plant(s) may have technical problems. For these reasons, your actual production units may be less than the planned production units. The past record indicates that the actual production fluctuated between 90% and 100% of the planned production. Third, your transportation plan may not always be implemented in the way you planned. Some times your goods are damaged during transit, and not all of the goods shipped may arrive at destinations. If goods are damaged in transit, your carrier(s) will return the damaged goods to the origin(s) free of charge, and they will also pay for repairing the damaged product. This pattern indicates that if a good is damaged, it will not get to its destination in the current month, but it will be "available" for transportation from the origin in question to any destination for the coming month. You should consider these sources of uncertainties when making decisions.

7. Risk of Stock Out

If you do not have enough inventory to meet customer demands in a given region (warehouse), you will experience a stockout. In this event, your demand for the subsequent months in the region in question will be less than what would otherwise be. Specifically, if you experience a stockout in a given month (month t), the demand for the next month (month $t+1$), will be 10% less than the amount which you would attain if you had experienced no stockout, and the demand for the month after next (month $t+2$) will be 5% less than the amount that you would attain if you had experienced no stockout. The demand will get back to a "normal" level from month $t+3$.

If you experience stockouts for multiple months in a row, your demand will be kept at "10% less than normal" level for the entire months in which you experienced stock outs (excluding the first month of stock out), will be 10% less for the month immediately following the final month of stock out, and will be 5% less in the following month. The demand will get back to the normal level from 3 months after the final month of stockout.

Example 1: stock out in month 2 only.

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|--------------|---------|---------|---------|---------|---------|---------|
| Demand level | 100% | 100% | 90% | 95% | 100% | 100% |

Example 2: stock outs in months 2 and 3.

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|--------------|---------|---------|---------|---------|---------|---------|
| Demand level | 100% | 100% | 90% | 90% | 95% | 100% |

Example 3: stock outs in months 1 and 3.

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 |
|--------------|---------|---------|---------|---------|---------|---------|
| Demand level | 100% | 90% | 95% | 90% | 95% | 100% |

8. Rules of the Game

The following rules apply in our simulation game. First, you can talk within your group, but you are not allowed to talk about the game with people outside of your group. Violation of this rule will be considered an act of cheating. Second, you must submit your input sheet (Table 1) to the specified email address electronically by the specified due date. Your output (Table 4) will be distributed in class. You can also pick up your output report at my office (3125 Gerdin). Third, at the end of the game, each group can submit a paper that describes what were good and bad about your decisions, and how you plan to improve your performance in the future (2 page maximum). This paper is optional, and should be submitted by only those groups that did not do perform well in the simulation game to help increase their simulation grade.

9. Grading

Two factors are considered in grading your simulation game performance. The first criterion is how good your group's profitability is relative to the performances of the entire class. The top group receives a numerical score of 100. The score for other groups are calculated by the following formula: $100 - (30/(n - 1)) \times (\text{Rank of group} - 1)$, where n is the number of groups in your section. That is, for every rank you are below the top, you lose $30/(n - 1)$ points. For example, if your section has 7 groups and your rank in the section is 5th, your score is $100 - (30/(7 - 1)) \times (5 - 1)$, or 80.

The second criterion is how well the final paper is written (optional). For the second criterion, the emphasis is placed on what you have learned from the simulation game. You should write this paper as if you are writing a business report to company executives. The paper should be composed of two parts. In the first part, you should review your performance for the past 10 weeks and evaluate why your performance was not so good. In the second part, you should develop a plan for the next year; i.e., pretend as if you are given another chance to play the game for 10 more weeks and write a business plan for the next round of game. Be specific as to what changes you would make to improve your performance. If you choose to write this paper, your final simulation game grade would be determined by the (un-weighted) average of the ranking score and the paper score.

APPENDIX

Submitting Simulation Game Input Sheets

When you submit your decision sheets for the simulation game, strictly follow the rules given below.

1. Use only Microsoft Excel for data inputs. Save the Excel file by the file name created by using the following rule.
2. File name = [group name]–[month].xls
For example, if your group name is Snake, and your decision is for month 2, then your file should be named as: Snake–2.xls
3. Your [group name] is the name shown in the "Group name" sheet which is distributed in class. Use the file name created by the above procedure all the time.
4. When sending your file, use an email. Send your email to: _____ with the subject name: **Sim-460**. Send the Excel input file as an attachment to your email.
5. Submission due date is Tuesday 5PM every week. Your results will be distributed in Thursday class.

FIGURE 1: Plant and Customer Locations

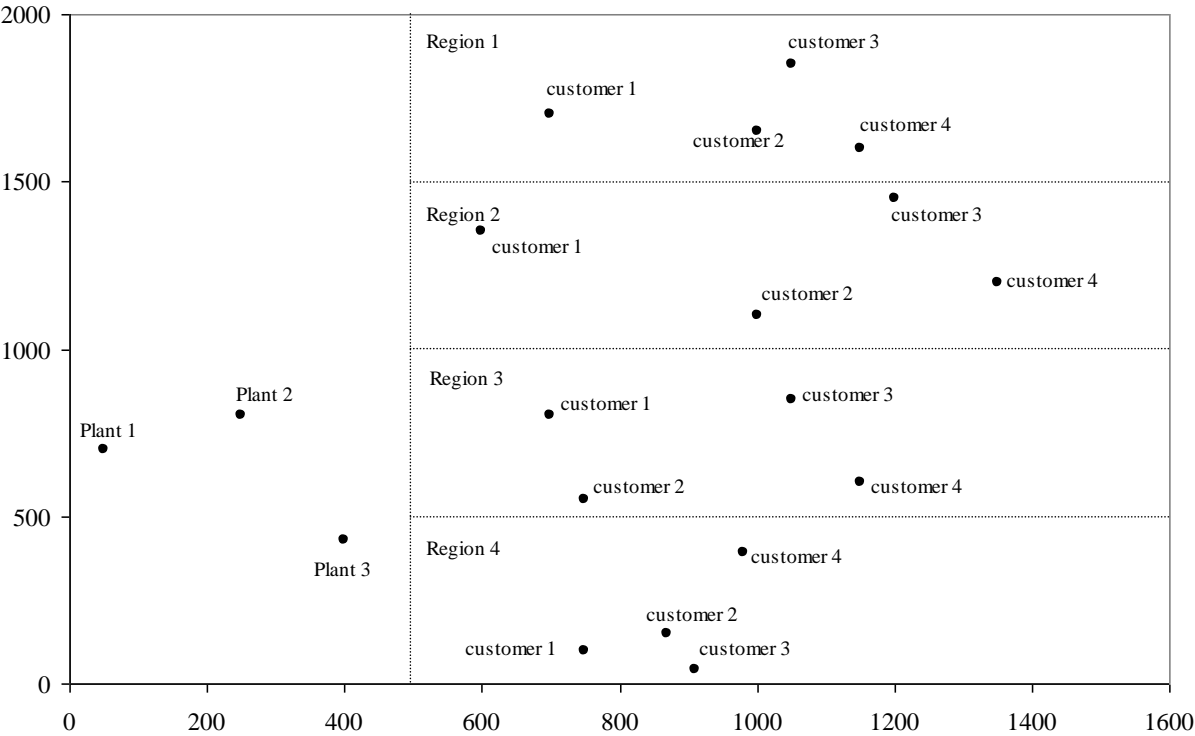


Table 1: Sample Input

TrLog 460 Simulation Game Input Sheet

Group:

Month =

Warehouse selection

| | Grid coordinate | | Lease (0) or buy (1) |
|----------|-----------------|----------|-------------------------|
| | Horizont. | Vertical | |
| Region 1 | 950 | 1450 | 0 |
| Region 2 | 1000 | 1200 | 0 |
| Region 3 | 980 | 780 | 1 |
| Region 4 | 1050 | 240 | 1 |

Production plan

| | units |
|---------|-------|
| Plant 1 | 8000 |
| Plant 2 | 7500 |
| Plant 3 | 9000 |

Shipment plan (truck)

| | | To | | | |
|------|---------|-------|-------|-------|-------|
| | | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
| From | Plant 1 | 2500 | 2500 | 2500 | 2500 |
| | Plant 2 | 2500 | 2500 | 2500 | 2500 |
| | Plant 3 | 2500 | 2500 | 2500 | 2500 |
| | W/H 1 | | | | |
| | W/H 2 | | | | |
| | W/H 3 | | | | |
| | W/H 4 | | | | |

Table 2: Parameter Specifications

| | | | |
|----------------------------|--------|--------------------------|---------|
| Unit value | 14 | | |
| Production cost / unit (1) | 1.5 | | |
| Production cost / unit (2) | 2.7 | | |
| Production cost / unit (3) | 3.8 | | |
| W/H Fixed cost (lease) | 4,000 | | |
| W/H variable cost (lease) | 0.9 | | |
| W/H Fixed cost (buy) | 10,000 | | |
| W/H variable cost (buy) | 0.6 | | |
| | | W/H location change cost | 5000 |
| | | | |
| | | Plant 1 location grid | 50 700 |
| | | Plant 2 location grid | 250 800 |
| | | Plant 3 location grid | 400 430 |

Transportation cost (dollars / unit-mile)

| | | To | | | |
|------|---------|-------|-------|-------|-------|
| | | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
| From | Plant 1 | 0.005 | 0.002 | 0.003 | 0.002 |
| | Plant 2 | 0.002 | 0.006 | 0.003 | 0.005 |
| | Plant 3 | 0.007 | 0.005 | 0.004 | 0.004 |
| | W/H 1 | 0.000 | 0.003 | 0.001 | 0.005 |
| | W/H 2 | 0.007 | 0.000 | 0.003 | 0.004 |
| | W/H 3 | 0.002 | 0.003 | 0.000 | 0.008 |
| | W/H 4 | 0.004 | 0.002 | 0.004 | 0.000 |

Transportation cost to customers (per unit-mile)

0.008 dollars for all customers for all regions

Inv. carrying cost/unit (plant) \$ 1.25
Inv. carrying cost/unit (W/H) \$ 3.25

Plant production capacity 11,000

Customer locations

| | Region 1 | | Region 2 | | Region 3 | | Region 4 | |
|---------|----------|----------|----------|----------|----------|----------|----------|----------|
| | Horiz | Vertical | Horiz | Vertical | Horiz | Vertical | Horiz | Vertical |
| Cust. 1 | 700.0 | 1,700.0 | 600.0 | 1,350.0 | 700.0 | 800.0 | 750.0 | 100.0 |
| Cust. 2 | 1,000.0 | 1,650.0 | 1,000.0 | 1,100.0 | 750.0 | 550.0 | 870.0 | 150.0 |
| Cust. 3 | 1,050.0 | 1,850.0 | 1,200.0 | 1,450.0 | 1,050.0 | 850.0 | 910.0 | 40.0 |
| Cust. 4 | 1,150.0 | 1,600.0 | 1,350.0 | 1,200.0 | 1,150.0 | 600.0 | 980.0 | 390.0 |

Customer sales proportion

| | Proportion of shipment volume | | | |
|---------|-------------------------------|-------|-------|-------|
| | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
| Cust. 1 | 0.10 | 0.30 | 0.40 | 0.20 |
| Cust. 2 | 0.20 | 0.20 | 0.20 | 0.30 |
| Cust. 3 | 0.40 | 0.40 | 0.20 | 0.30 |
| Cust. 4 | 0.30 | 0.10 | 0.20 | 0.20 |
| Total | 1.00 | 1.00 | 1.00 | 1.00 |

Initial Inventory

| | Initial Inv |
|---------|-------------|
| Plant 1 | 2,942 |
| Plant 2 | 3,641 |
| Plant 3 | 8,902 |
| W/H 1 | 4,144 |
| W/H 2 | 3,865 |
| W/H 3 | 8,023 |
| W/H 4 | 4,059 |
| Total | 35,576 |

Table 3: Demand Pattern (Forecasts for this year)

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Region 1 | 5,000 | 6,000 | 10,000 | 4,000 | 8,300 | 9,000 | 3,500 | 6,500 | 9,500 | 5,200 |
| Region 2 | 6,450 | 7,100 | 12,500 | 5,100 | 10,100 | 10,400 | 4,500 | 7,900 | 11,300 | 6,280 |
| Region 3 | 7,400 | 9,200 | 15,100 | 5,900 | 12,400 | 13,400 | 5,300 | 9,720 | 14,520 | 7,950 |
| Region 4 | 5,540 | 6,750 | 11,200 | 4,210 | 8,900 | 9,950 | 4,200 | 7,210 | 10,500 | 5,840 |
| Total | 24,390 | 29,050 | 48,800 | 19,210 | 39,700 | 42,750 | 17,500 | 31,330 | 45,820 | 25,270 |

Table 4: Simulation Report

| Actual demand | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
| Region 1 | 5,238 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Region 2 | 6,293 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Region 3 | 7,559 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Region 4 | 5,990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 25,080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

W/H - Plant distance matrix (current month)

| | | To | | | |
|------|---------|-------|-------|-------|-------|
| | | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
| From | Plant 1 | 1,172 | 1,074 | 933 | 1,101 |
| | Plant 2 | 955 | 850 | 730 | 977 |
| | Plant 3 | 1,159 | 976 | 677 | 677 |
| | W/H 1 | 0 | 255 | 671 | 1,214 |
| | W/H 2 | 255 | 0 | 420 | 961 |
| | W/H 3 | 671 | 420 | 0 | 545 |
| | W/H 4 | 1,214 | 961 | 545 | 0 |

Distance from W/H to customers (current month)

| | To | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
|------|------------|-------|-------|-------|-------|
| From | Customer 1 | 354 | 427 | 281 | 331 |
| | Customer 2 | 206 | 100 | 325 | 201 |
| | Customer 3 | 412 | 320 | 99 | 244 |
| | Customer 4 | 250 | 350 | 248 | 166 |

Actual shipment (current month)

| Truck | | To | | | |
|-------|---------|-------|-------|-------|-------|
| | | W/H 1 | W/H 2 | W/H 3 | W/H 4 |
| From | Plant 1 | 1,911 | 1,911 | 1,911 | 1,891 |
| | Plant 2 | 2,052 | 2,073 | 2,073 | 2,073 |
| | Plant 3 | 2,500 | 2,500 | 2,500 | 2,500 |
| | W/H 1 | 0 | 0 | 0 | 0 |
| | W/H 2 | 0 | 0 | 0 | 0 |
| | W/H 3 | 0 | 0 | 0 | 0 |
| | W/H 4 | 0 | 0 | 0 | 0 |

Actual production

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Plant 1 | 4,700 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plant 2 | 4,650 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plant 3 | 5,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 14,350 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Inventory (ending)

| | Initial Inv | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
|---------|-------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Plant 1 | 2,942 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plant 2 | 3,641 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Plant 3 | 8,902 | 3,902 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H 1 | 4,144 | 5,369 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H 2 | 3,865 | 4,056 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H 3 | 8,023 | 6,948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H 4 | 4,059 | 4,533 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 35,576 | 24,846 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Revenue

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Units sold | 25,080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unit value | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Revenue | 351,120 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Cost

| | Month 1 | Month 2 | Month 3 | Month 4 | Month 5 | Month 6 | Month 7 | Month 8 | Month 9 | Month 10 |
|-----------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|
| Production cost | 38,605 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Transportation cost (truck) | 154,514 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H cost (location change) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H cost (fixed) | 28,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W/H cost (variable) | 37,928 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Inventory carrying cost | 72,870 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Cost | 331,917 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | | | | | |
|--------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Profit (Rev - Cost) | 19,203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profitability (Rev/Cost) | 1.058 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

cumulative

| |
|--------|
| 19,203 |
| 1.058 |