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Project group:

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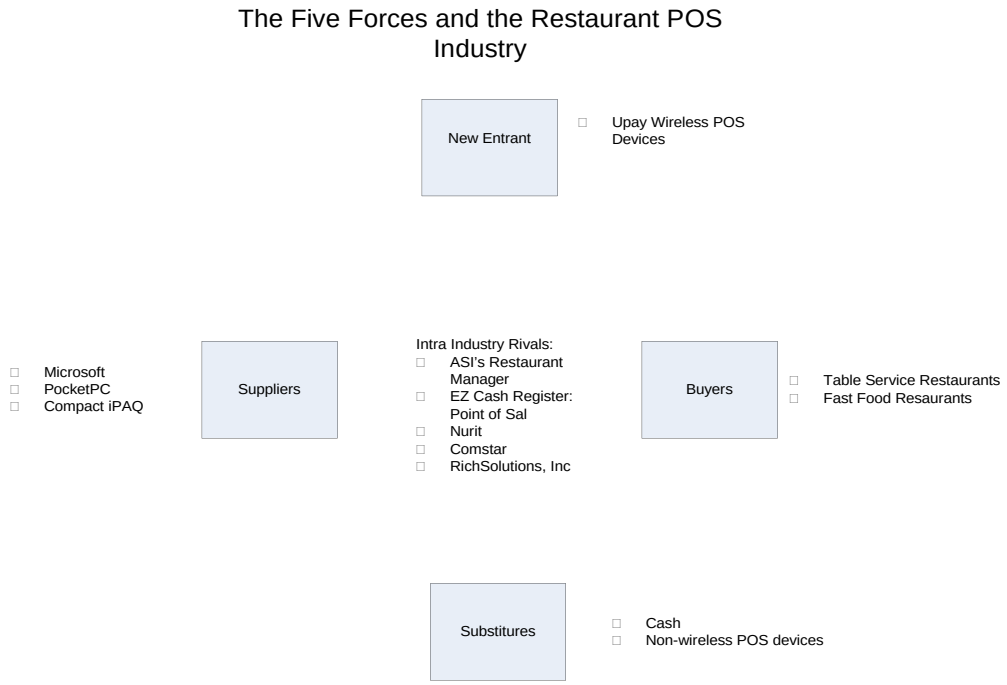
Project platforms:

- Upay Handheld – This product can be used by the waitress in table-service restaurants to place the customers order from their table. And, being wireless and POS enabled, the waitress can slide the customers payment card anywhere in the restaurant, saving everyone valuable time.

Technology Strategy

Our technology strategy is to use existing technology for PC and handheld computers, wireless communication, and POS technology to design superior integrated food order and payment devices, being first to market with innovative designs that meet customer needs.

Market Analysis



- There are already other wireless POS products available, but not widely used in the market.
- Market size is estimated to be $731 million in 2005

We have analyzed two markets, the POS industry and the food service industry. We researched the POS industry in order to find out who our competitors are and what types of product they are currently producing. And second, we examined the restaurant industry to determine the size of our customers market.

According to our research the POS industry is thriving, with revenues in 2003 that totaled over $2.1 billion worldwide. And although growth in the U.S. market for POS is relatively slow, we believe that increasing growth in the restaurant industry, combined with fierce competition will drive the need for increased IT investment in restaurants. A Porter model representing this industry is appended at the end of this document.

In our analysis, we also found that many of our competitors have already developed similar products to the ones we are considering. Therefore, we will have to be a rapid-cycle competitor in order to keep up with the competition. This has also led us to think about which of the three products we should develop first and what type of restaurants we want to target.
During our analysis of the restaurant industry, we found that fast food restaurants maintain the lion's share of the $440 billion dollar market. And as a result, we have chosen to develop the product that will best fit their needs—the Upay food order and payment device.

Product Platform

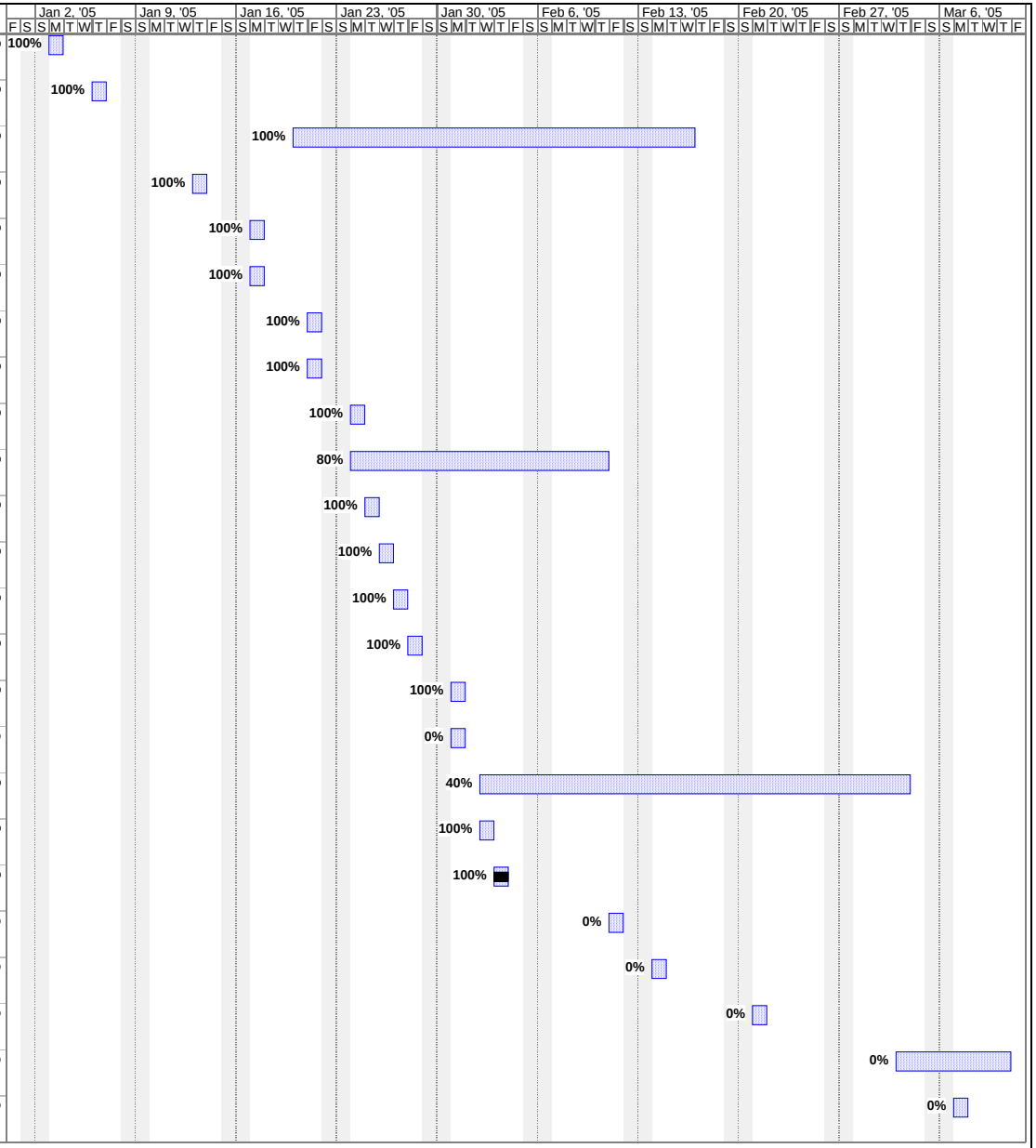
The Upay food order and payment device will have the following primary features:

- Touch screen
- Easy to use interface
- POS enabled
- Wireless network connection

The Upay will allow restaurants to cut expenses by having fewer cashiers, and service more customers quickly and efficiently.

Project Schedule

ID	Task Name	Work	% Work Complete
1	Form Teams	0 hrs	100%
2	Brainstorm	0 hrs	100%
3	Phase I	0 hrs	100%
4	Prepare Project Proposal	0 hrs	100%
5	Develop our company strategy	0 hrs	100%
6	Develop our overall supply chain strategy	0 hrs	100%
7	Similate Beer Game	0 hrs	100%
8	Estimate Demand Data	0 hrs	100%
9	Develop demand forecasting software for our product	0 hrs	100%
10	Phase II	0 hrs	80%
11	Inventory management	0 hrs	100%
12	Create conceptual SC	0 hrs	100%
13	Model SC Drivers(fac., trans, inv.)	0 hrs	100%
14	Create Cycle Inv. Module	0 hrs	100%
15	Integrate DF module w/ CI module	0 hrs	100%
16	Use Integrated model to investigate scenarios	0 hrs	0%
17	Phase III	0 hrs	40%
18	Create product availability and Safety inv. Modules	0 hrs	100%
19	Create a transportaion module	0 hrs	100%
20	Link the prod. Aval. & trans. Modules to other modules	0 hrs	0%
21	Simulate SC w/ modules and investigate senarios	0 hrs	0%
22	Develop proper SC management guidelines & User manual for software module	0 hrs	0%
23	Phase IV	0 hrs	0%
24	Closure	0 hrs	0%



Project: ProjectSchedule
Date: Wed 4/13/05

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

UPAY

New Product Development- The majority of parts for our wireless POS will be outsourced. The unit itself will be outsourced to Palm to assure quality and precision for hand writing styles. Also our systems will be outsourced but we will put them together at the end to assure the product is customized for our customers needs. We will serve as a manufacturer, and in order to cut overhead costs we will outsource the processes which we think can be done more efficiently outside of the company. In house production mostly deals with software and databases along with assembly.

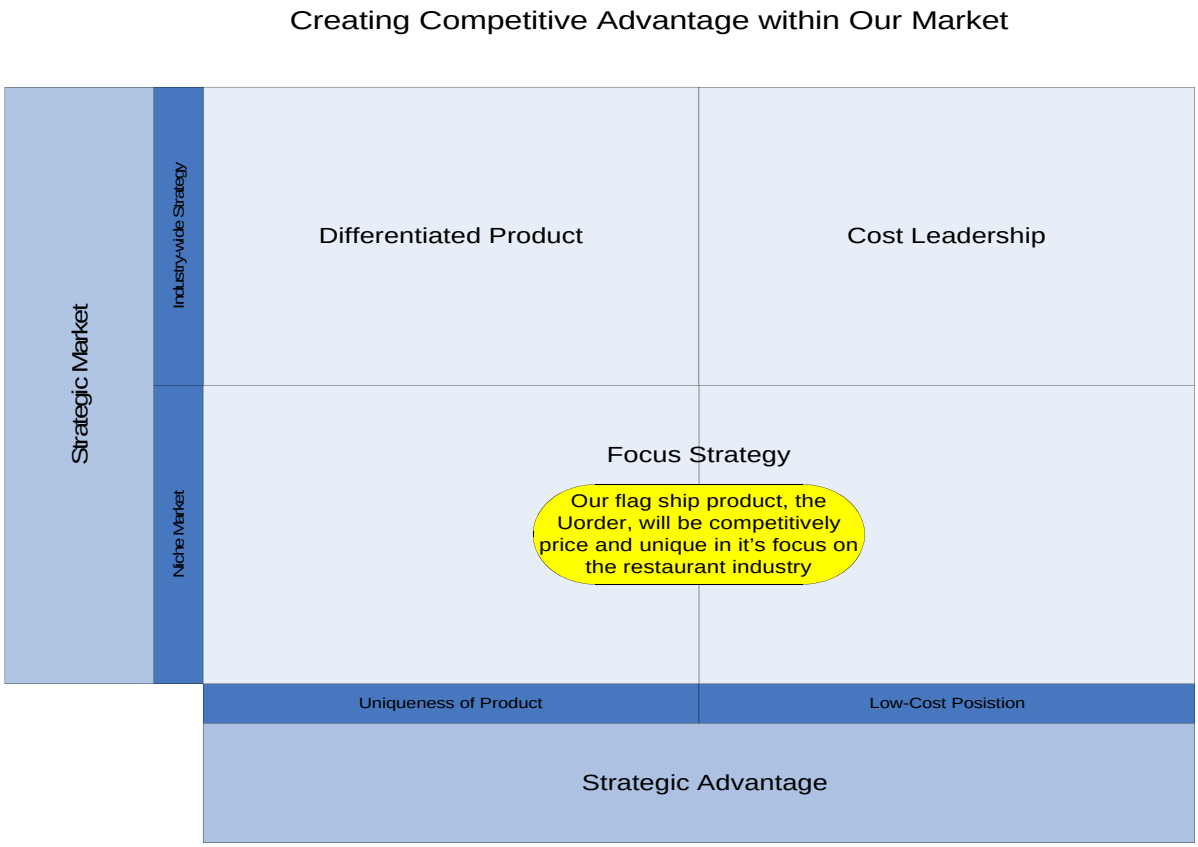
Marketing and Sales- Our product is targeted for the restaurant industry. The marketing strategy that we intend on using is through demonstrations, workshops, as well as advertising. The approach for advertising will be in mass media, for example magazines, newspapers, and television. Another approach we could take is by sending out flyers to all larger restaurants that may need to incorporate this new system into their restaurant. The pricing for this product should be reasonable, meaning that our system is an investment but over the course of 5 years it pays itself off.

Operations- The methodology that UPAY has is a product focus. This is because we will do many different functions in producing a single type of product, our product being a wireless POS system. With this we have extensive expertise on our product making us very knowledgeable about our product.

Distribution- The route we plan to follow is by cutting out all retailers. The way to order these systems is solely through the Internet. To maximize our profits we want to cut out our retailers also by being online we don't have to worry about retail stores and where to position them.

Service- All of our systems will come with a 6 month warranty to assure that all the bugs are out of the system. The hardware that is sold will carry a 6-month warranty while the software will hold an 18-month warranty. An optional support plan will be available for purchase, and with this service we will send out a technician in your area to fix your system, as opposed to trouble shooting with tech support and if nothing is resolved, then the system much be packaged up and shipped back for repairs.

Creating Competitive Advantage

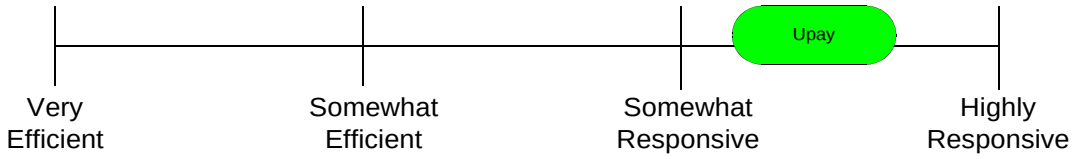


Our choice of position within this framework should allow us to gain market share buy selling at a low price, while entering a niche market with a product that is uniquely designed for the restaurant industry.

Supply Chain Strategy

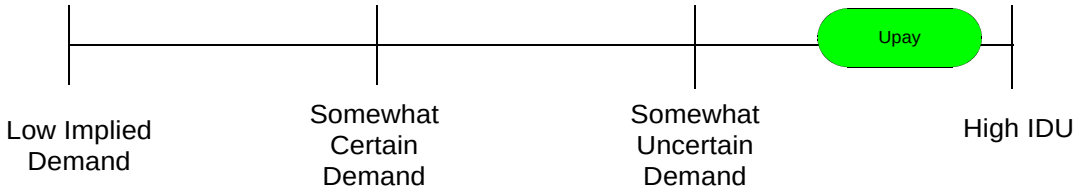
In this step, we align our competitive strategy from above with our supply chain strategy. In order to do this we illustrate the Responsiveness spectrum as well as the IDU spectrum. Then, by combining these two elements, we determine our zone of strategic fit. This is illustrated on the following page:

Responsiveness Spectrum

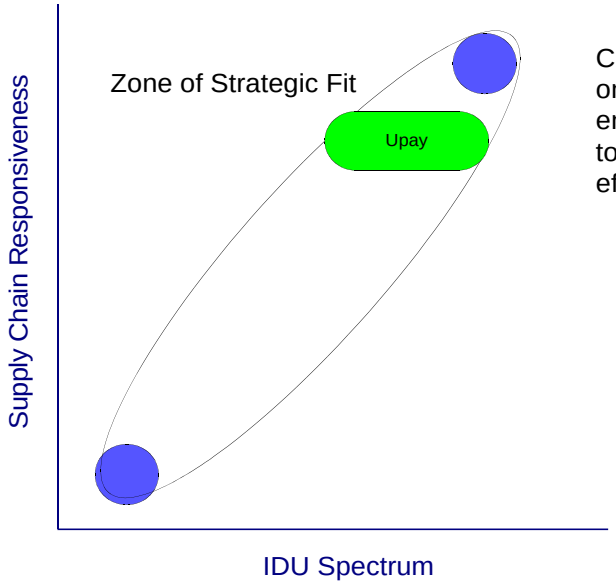


For our company U PAY we are on the far right side of the spectrum. The market we are in is a niche market, making this product very specific and specialized. On the down side of this it makes our product very inefficient meaning that the product we have isn't narrow and a well defined product.

IDU Spectrum



For U PAY it sits very high on the IDU spectrum because it is a brand new product and is like no other on the market. Our product has a high implied demand uncertainty meaning that we will not know how successful the product will be until it hits the market. It is not always bad to have a high IDU, sometimes it could be good, if the customer wants it then it will succeed.



Currently, since U PAY is both responsive and high on the IDU spectrum, we find ourselves at higher end of the Zone of Strategic Fit. However, we hope to use information systems to make our product both efficient and responsive.

Phase II

Aligning Supply Chain Drivers

Facilities: Upay can gain economies of scale by manufacturing or storing its handhelds in a single location; this centralization increases efficiency. At the same time, it reduces responsiveness, but, due to the small size of the units, low shipping costs, and integrated information with our suppliers, we hope to overcome the responsiveness hurdle.

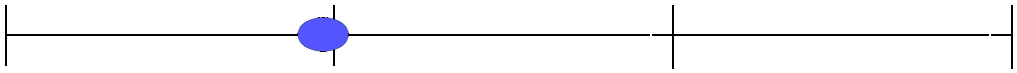
Inventory: In order to be efficient, Upay will try to keep its inventory levels low through centralized stocking. This will support our strategy of being a low-cost producer.

Transportation: We will look to receive our parts for the Upay handheld by trucking companies in order to stay aligned with our low-cost strategy. However, after our products have been assembled and are ready for the customer, we will utilize companies such as FedEx, DHL, and UPS in order to be responsive to our customers.

Information: UPay will integrate its sales information with its suppliers in order to reduce the bullwhip effect in our supply chain, and make the supply chain more efficient.

Supply Chain Drivers

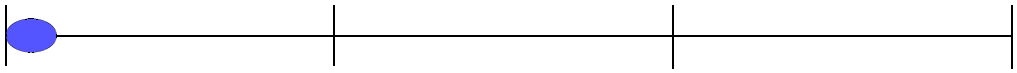
D1: INVENTORY



Efficient Responsive

Inventory Strategy: Inventory should be more efficient than responsive due to continuous technology advances and decreasing costs. On the other hand, to buffer the demand uncertainty, inventory needs to maintain a somewhat responsive level.

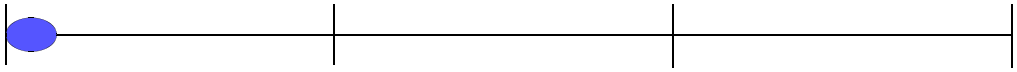
D2: TRANSPORTATION



Efficient Responsive

Transportation Strategy: Shipping will be slow and efficient. Transportation should be outsourced as well.

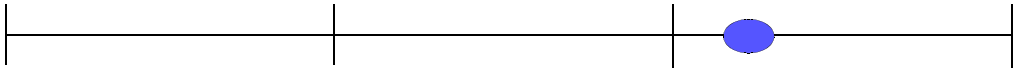
D3: FACILITIES



Efficient Responsive

Facilities Strategy: Centralized location with low capacity in order to be as efficient as possible.

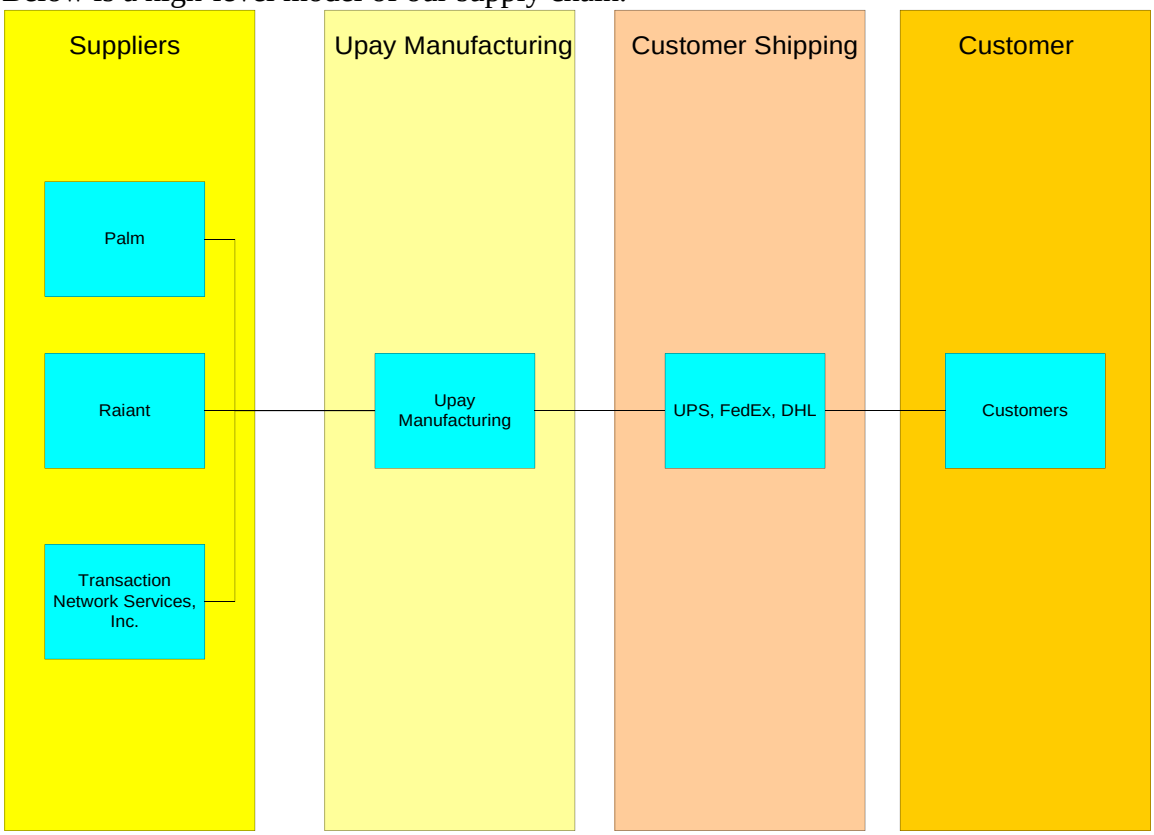
D4: INFORMATION



Efficient Responsive

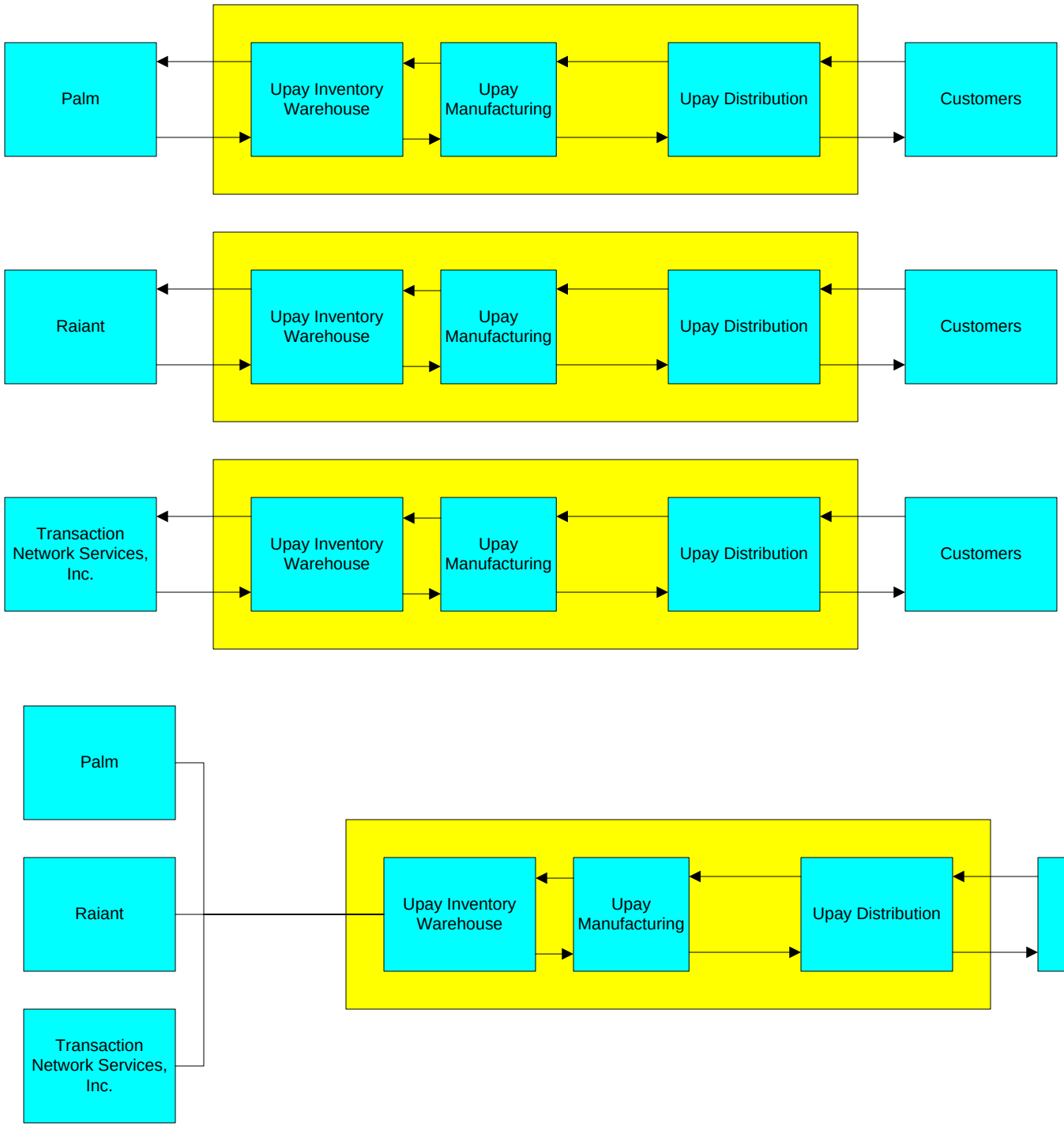
Upay Supply Chain Model

Below is a high-level model of our supply chain.



As can be seen in our model, we have three primary suppliers for the UPay device. First is Palm. Palm provides us with the handheld unit. Next is Radiant, who is providing the Card reader. And finally, we have TNS who will be providing the application for the POS system, which runs on top of Palm's OS.

Each of the parts needed for the UPay handheld have a one-to-one ratio, meaning that for every unit we get from Palm, we need one unit from Radiant and one from TNS. This will simplify our supply chain decision as they pertain to receiving multiple products because the lot size for each product will be the same.


Palm
Upay Inventory Warehouse
Upay Manufacturing
Upay Distribution
Customers
Raiant
Upay Inventory Warehouse
Upay Manufacturing
Upay Distribution
Customers
Transaction Network Services, Inc.
Upay Inventory Warehouse
Upay Manufacturing
Upay Distribution
Customers
Palm
Raiant
Transaction Network Services, Inc.
Upay Inventory Warehouse
Upay Manufacturing
Upay Distribution
Customers

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Supplier Order	1																															
UpayWarehouse Order	2																															
In-Transit Order	4																															
In-Transit Inventory	3																															
Distributor Order	3																															
In-Transit Order	4																															
In-Transit Inventory	3																															
Retailer Order	1																															
Customer Order	4	1	2	4	3	5	5	3	5	5	2	1	5	1	3	1	2	2	1	2	4	2	3	2	1	4	2	1	5	5	5	5

Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Supplier Order	5																															
Manufacturer Order	3																															
In-Transit Order	5																															
In-Transit Inventory	1																															
Distributor Order	2																															
In-Transit Order	3																															
In-Transit Inventory	5																															
Retailer Order	5																															
Customer Order	4	5	4	3	1	4	3	4	2	5	5	4	4	5	2	2	3	1	5	1	5	2	5	1	5	4	5	1	5	2	1	2

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
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69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
1	3	1	1	5	4	4	4	1	5	3	3	4	2	1	2	4	1	4	2	2	3	4	2	3	5	5	1	4	2	3	5

69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
5	1	2	3	5	3	4	1	4	1	3	3	2	2	4	2	5	2	3	4	5	5	3	4	5	3	2	4	3	3	5	1

Upay Wireless POS Device

		Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10	Period 11	Period 12	Period 13	Period 14	Period 15	Period 16	Period 17	Period 18	Period 19	Period 20	Period 21	Period 22	Period 23	Period 24
Supplier	Raw Material Order	1	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	20	19	0	0	0	0	0	0
	Raw Materials Used	0	1	3	8	14	19	23	28	36	43	46	49	63	94	131	158	175	195	214	214	214	214	214	214
Warehouse	Order in	2	4	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0	0	0	0	0	0	0
	Order out	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	20	19	0	0	0	0	0	0	0
	Ship out	0	1	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	19	0	0	0	0	0	0
	Inventory	0	1	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	20	20	20	20	20	20	20
	In-transit Order	4	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0	0	0	0	0	0	0	0
	In-transit Inventory	3	0	1	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	19	0	0	0	0	0
Manufacturing	Order in	3	4	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0	0	0	0	0	0	0
	Order out	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0	0	0	0	0	0	0	0	0
	Ship out	0	3	0	1	2	5	6	5	4	5	8	7	3	3	14	16	0	0	0	0	0	0	0	0
	Inventory	0	3	0	1	2	5	6	5	4	5	8	7	3	3	14	31	52	79	96	115	115	115	115	115
	In-transit Order	4	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0	0	0	0	0	0	0	0
	In-transit Inventory	3	0	3	0	1	2	5	6	5	4	5	8	7	3	3	14	16	0	0	0	0	0	0	0
Distribution	Order in	1	4	1	2	4	3	5	5	3	5	5	2	1	5	1	3	1	2	2	1	2	4	2	3
	Order out	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0	0	0	0	0	0	0	0	0
	Ship out	0	3	0	3	0	1	2	5	6	5	4	5	7	5	1	3	1	2	2	1	2	4	2	3
	Inventory	0	3	0	3	0	1	2	5	6	5	4	5	8	8	6	8	19	34	32	30	29	27	23	21
Customer	Customer Order	4	1	2	4	3	5	5	3	5	5	2	1	5	1	3	1	2	2	1	2	4	2	3	2
	Customer Beer	0	0	3	0	3	0	1	2	5	6	5	4	5	7	5	1	3	1	2	2	1	2	4	2

Period 25	Period 26	Period 27	Period 28	Period 29	Period 30	Period 31	Period 32	Period 33	Period 34	Period 35	Period 36	Period 37	Period 38	Period 39	Period 40	Period 41	Period 42	Period 43	Period 44	Period 45	Period 46	Period 47	Period 48	Period 49	Period 50	Period 51	Period 52
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1	4	2	1	5	5	5	5	5	2	2	5	5	4	4	2	2	1	2	2	4	4	1	5	3	3	1	5
3	2	1	4	2	1	5	3	0	0	0	2	7	12	10	4	4	2	2	1	2	2	4	4	1	5	3	3

Period 53	Period 54	Period 55	Period 56	Period 57	Period 58	Period 59	Period 60	Period 61	Period 62	Period 63	Period 64	Period 65	Period 66	Period 67	Period 68	Period 69	Period 70	Period 71	Period 72	Period 73	Period 74	Period 75	Period 76	Period 77	Period 78	Period 79	Period 80
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43	43	43	41	34	24	13	0	0	0	0	7	8	12	12	15	24	24	24	20	15	7	0	0	0	2	8	1
0	2	7	10	11	13	7	1	0	0	0	0	0	0	0	0	0	4	5	8	9	6	6	2	0	3	4	9
0	0	0	2	7	10	11	13	0	0	0	0	7	1	0	0	0	0	0	4	5	8	7	0	0	0	2	8
5	5	3	1	4	1	4	1	4	5	4	4	4	2	3	4	4	1	3	1	1	5	4	4	4	1	5	3
2	7	10	11	13	7	1	0	0	0	0	0	0	0	0	0	0	4	5	8	9	6	6	2	0	3	4	9	10
3	0	0	0	2	7	10	2	4	5	4	4	4	2	3	4	0	0	0	0	4	5	8	6	1	0	0	2
3	0	0	0	2	7	10	11	22	18	13	9	5	8	7	4	0	0	0	0	4	5	8	7	1	0	0	2
5	3	1	4	1	4	1	4	5	4	4	4	2	3	4	4	1	3	1	1	5	4	4	4	1	5	3	3
1	3	0	0	0	2	7	10	2	4	5	4	4	4	2	3	4	0	0	0	0	4	5	8	6	1	0	0

Period 81	Period 82	Period 83	Period 84	Period 85	Period 86	Period 87	Period 88	Period 89	Period 90	Period 91	Period 92	Period 93	Period 94	Period 95	Period 96	Period 97	Period 98	Period 99	Period 100
30	10	0	3	21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279	309	319	319	322	343	361	361	361	361	361	361	361	361	361	361	361	361	361	361
9	12	21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	3	21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	22	18	0	3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	30	18	0	3	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21
12	21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	29	22	18	0	3	18	0	0	0	0	0	0	0	0	0	0	0	0	0
9	10	5	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	13	23	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	13	29	28	38	28	31	49	49	49	49	49	49	49	49	49	49	49	49	49
10	5	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
1	0	13	23	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	4	2	1	2	4	1	4	2	2	3	4	2	3	5	5	1	4	2	3
5	8	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
8	1	0	11	2	4	1	4	2	2	3	4	2	3	5	5	1	4	1	0
8	1	0	13	25	31	37	36	32	30	28	25	21	19	16	11	6	5	1	0
4	2	1	2	4	1	4	2	2	3	4	2	3	5	5	1	4	2	3	5
2	8	1	0	11	2	4	1	4	2	2	3	4	2	3	5	5	1	4	1

Warehouse	Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Current Period Demand	2	4	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0
	Gross Demand	2	6	8	10	10	10	12	12	11	10	17	34	51	58	54	47	36	19
	Amount Shipped	0	1	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	19
	Ending Inventory	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Backlog	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	20	19	0
	Order Placed	2	5	6	5	4	5	8	7	3	3	14	31	37	27	17	20	19	0

Manufacturer	Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Current Period Demand	3	4	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0
	Gross Demand	3	7	5	7	9	9	10	12	18	25	28	28	30	33	30	16	0	0
	Amount Shipped	0	3	0	1	2	5	6	5	4	5	8	7	3	3	14	16	0	0
	Ending Inventory	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	52	79
	Backlog	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0	0	0
	Order Placed	3	4	5	6	7	4	4	7	14	20	20	21	27	30	16	0	0	0

Distribution	Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Current Period Demand	1	4	1	2	4	3	5	5	3	5	5	2	1	5	1	3	1	2
	Gross Demand	1	5	3	5	6	9	13	16	14	13	13	11	7	5	1	3	1	2
	Amount Shipped	0	3	0	3	0	1	2	5	6	5	4	5	7	5	1	3	1	2
	Ending Inventory	0	0	0	0	0	0	0	0	0	0	0	0	1	3	5	5	18	32
	Backlog	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0	0	0
	Order Placed	1	2	3	2	6	8	11	11	8	8	9	6	0	0	0	0	0	0

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	17	17	12	5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	17	17	12	5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	17	17	12	5	0
96	115	115	115	115	115	115	115	115	115	115	115	115	115	113	106	94	77	60	48	43	43
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
2	1	2	4	2	3	2	1	4	2	1	5	5	5	5	5	2	2	5	5	4	4
2	1	2	4	2	3	2	1	4	2	1	5	5	7	12	17	19	19	17	10	4	4
2	1	2	4	2	3	2	1	4	2	1	5	3	0	0	0	2	7	12	10	4	4
30	29	27	23	21	18	16	15	11	9	8	3	0	0	0	0	0	0	0	7	20	28
0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	17	17	12	5	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	17	17	12	5	0	0	0

41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
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43	43	43	43	43	43	43	43	43	43	43	43	43	43	41	34	24	13	0	0	0	0
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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
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2	2	1	2	2	4	4	1	5	3	3	1	5	7	10	11	15	14	11	2	4	5
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31	29	28	26	24	20	16	15	10	7	4	3	0	0	0	0	0	0	0	9	18	13
0	0	0	0	0	0	0	0	0	0	0	0	2	7	10	11	13	7	1	0	0	0
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63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
8	8	8	1	0	0	0	0	0	0	0	0	0	2	8	14	16	14	9	12	21	18
8	8	11	12	9	0	0	0	0	0	0	0	0	2	8	14	29	43	39	22	21	21
8	5	0	3	9	0	0	0	0	0	0	0	0	2	8	1	0	13	29	22	18	0
5	0	0	0	2	11	11	11	11	11	11	11	11	9	1	0	0	0	0	8	0	0
0	3	11	9	0	0	0	0	0	0	0	0	0	0	0	13	29	30	10	0	3	21
0	3	11	9	0	0	0	0	0	0	0	0	0	0	0	13	29	30	10	0	3	21

63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
0	0	0	0	0	0	0	0	4	5	8	9	6	6	2	0	3	4	9	10	5	8
8	8	1	0	0	0	0	0	4	5	8	9	8	14	16	16	17	13	21	31	23	8
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0	0	7	12	12	15	24	24	20	15	7	0	0	0	0	0	0	0	0	0	6	20
8	1	0	0	0	0	0	0	0	0	0	2	8	14	16	14	9	12	21	18	0	0
8	1	0	0	0	0	0	0	0	0	0	2	8	14	16	14	9	12	21	18	0	0

63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
4	4	4	2	3	4	4	1	3	1	1	5	4	4	4	1	5	3	3	4	2	1
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9	5	1	6	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
0	0	0	0	0	0	4	5	8	9	6	6	2	0	3	4	9	10	5	8	10	0
0	0	0	0	0	0	4	5	8	9	6	6	2	0	3	4	9	10	5	8	10	0

85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	28	31	49	49	49	49	49	49	49	49	49	49	49	49	49
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
2	4	1	4	2	2	3	4	2	3	5	5	1	4	2	3
2	4	1	4	2	2	3	4	2	3	5	5	1	4	2	4
2	4	1	4	2	2	3	4	2	3	5	5	1	4	1	0
23	27	36	32	30	28	25	21	19	16	11	6	5	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
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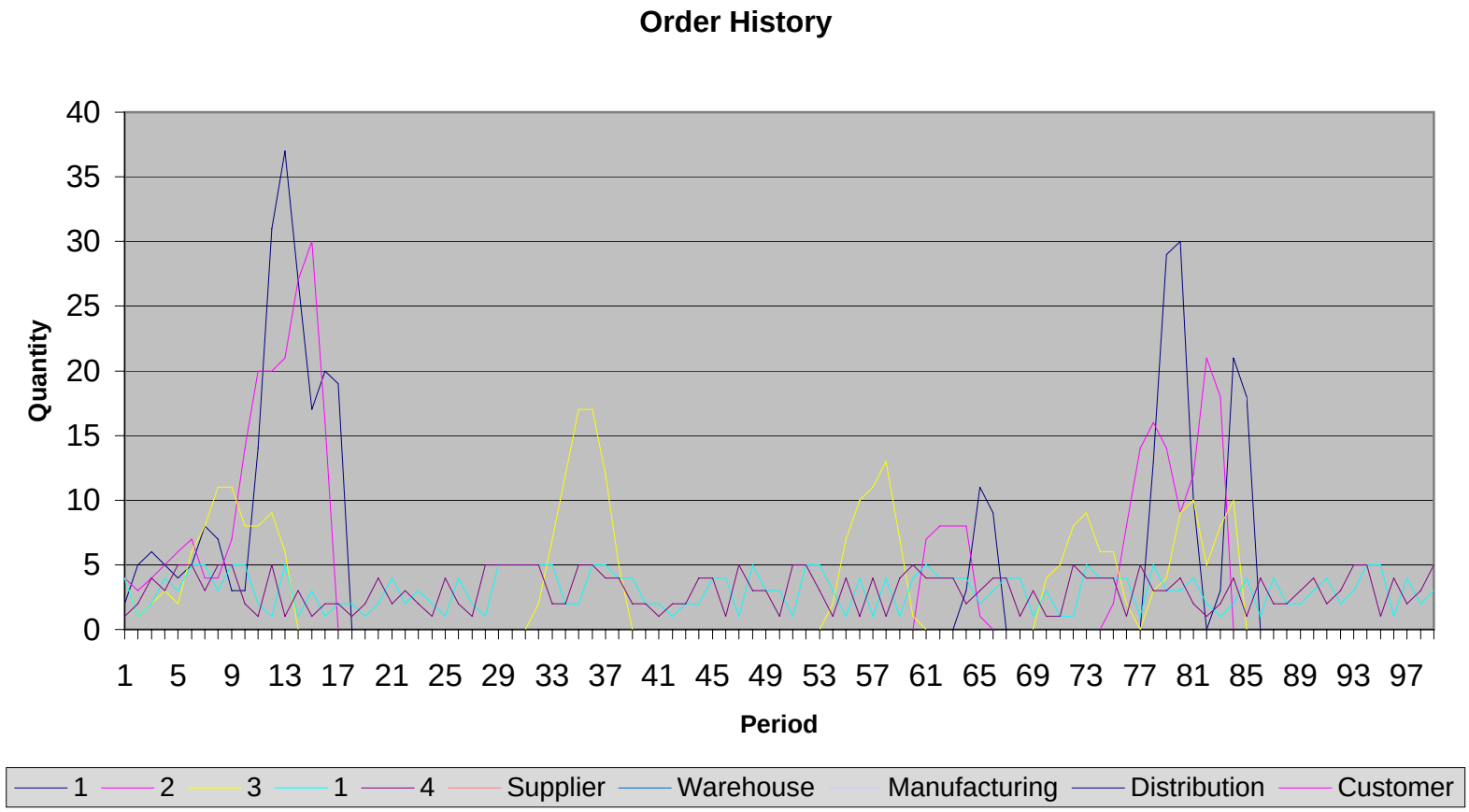
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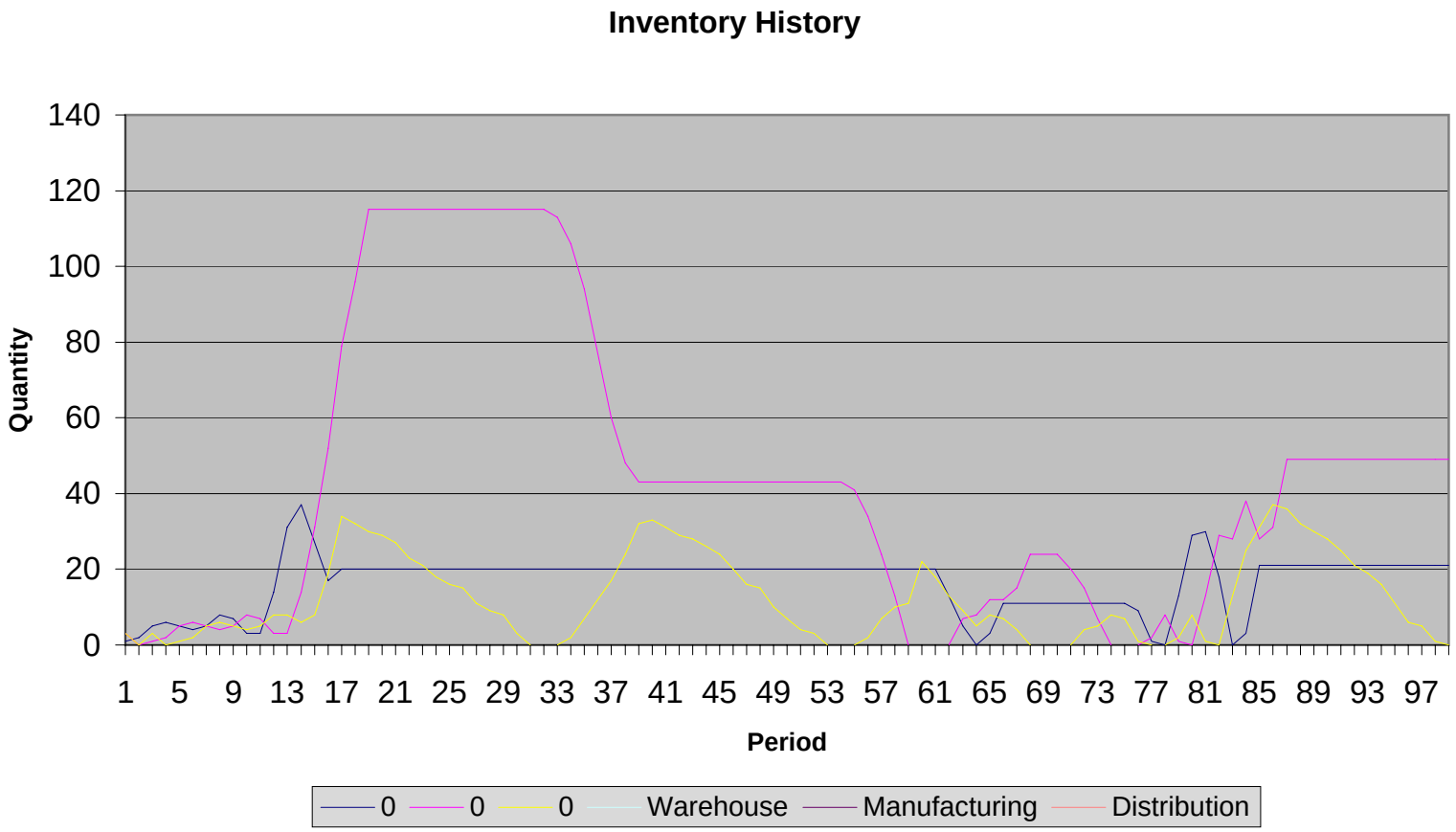
35
30
25
20
15
10
5
0
1
5
9
13
17
21
25
29
33
37
41
45
49
53
57
61
65
69
73
77
81
85
89
93
97
Period
1
2
3
1
4
Supplier
Warehouse
Manufacturing
Distribution
Customer


Inventory History
140
120
100
80
60
40
20
0
Quantity
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65 69 73 77 81 85 89 93 97
Period
0
0
0
Warehouse
Manufacturing
Distribution

To create new data, click on new data button in Data Sheet

All initial orders are random between 1-5

All initial In-transit Inventories are random between 1-5

All customer orders are random between 1-5

Orders placed are equal to backlog (downfall of the system)

I need to include cost evaluation

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.941158487
R Square	0.885779298
Adjusted R Square	0.877620677
Standard Error	3093.806176
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1039189957	1039189957	108.5697248	5.60064E-08
Residual	14	134002913.2	9571636.655		
Total	15	1173192871			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3444.920221	1924.050736	1.790451861	0.095022607	-681.7581726	7571.598614	-681.7581726	7571.598614
X Variable 1	1748.268015	167.7851975	10.41967969	5.60064E-08	1388.404558	2108.131472	1388.404558	2108.131472

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.933409628
R Square	0.871253533
Adjusted R Square	0.864100951
Standard Error	3784.836059
Observations	20

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1744921453	1744921453	121.8096616	1.91718E-09
Residual	18	257849711.9	14324984		
Total	19	2002771165			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	5466.284211	1758.175406	3.109066475	0.006057948	1772.494756	9160.073665	1772.494756	9160.073665
X Variable 1	1619.858647	146.7696471	11.03674144	1.91718E-09	1311.507061	1928.210233	1311.507061	1928.210233

	BP-Demand	de-season
1	12,250	
2	11,500	
3	13,200	13,005
4	14,321	13,657
5	13,750	14,520
6	15,210	14,673
7	16,400	14,519
8	12,340	14,774
9	14,500	15,073
10	16,500	16,418
11	17,500	18,750
12	22,000	21,188
13	23,500	24,688
14	27,000	28,625
15	35,000	31,719
16	36,000	34,363
17	34,250	36,063
18	37,400	36,797
19	38,200	
20	38,675	

	BP-Demand	de-season	seasonal factor			
					L	3444.92
1	12,250	5,193	2.36	1.2347588	T	1748.268
2	11,500	6,941	1.66	1.1149831		
3	13,200	8,690	1.52	1.1116296		
4	14,321	10,438	1.37	1.0266895		
5	13,750	12,186	1.13			
6	15,210	13,935	1.09			
7	16,400	15,683	1.05			
8	12,340	17,431	0.71			
9	14,500	19,179	0.76			
10	16,500	20,928	0.79			
11	17,500	22,676	0.77			
12	22,000	24,424	0.90			
13	23,500	26,172	0.90			
14	27,000	27,921	0.97			
15	35,000	29,669	1.18			
16	36,000	31,417	1.15			
17	34,250	33,165	1.03			
18	37,400	34,914	1.07			
19	38,200	36,662	1.04			
20	38,675	38,410	1.01			

Period *t*	Demand D_t	Deseasonalized Demand D_t	Deseasonalized Demand D_t	Seasonal Factor	Seasonal Factor (avg)	Forecast	Error E_t	Absolute Error A_t	Squared Error MSE_t	MAD_t	% Error	$MAPE_t$	TS_t
1	12,250		5,193	2.36	1.23475879	6,412	5,838	5,838	34,078,335	5,837.67	47.65	47.65	1.00
2	11,500		6,941	1.66	1.11498307	7,740	3,760	3,760	24,109,448	4,799.03	32.70	40.18	2.00
3	13,200	13,005	8,690	1.52	1.11162965	9,660	3,540	3,540	20,250,743	4,379.43	26.82	35.72	3.00
4	14,321	13,657	10,438	1.37	1.02668955	10,717	3,604	3,604	18,436,023	4,185.68	25.17	33.09	4.00
5	13,750	14,520	12,186	1.13		15,047	-1,297	1,297	15,085,308	3,607.96	9.43	28.36	4.28
6	15,210	14,673	13,935	1.09		15,537	-327	327	12,588,886	3,061.10	2.15	23.99	4.94
7	16,400	14,519	15,683	1.05		17,433	-1,033	1,033	10,943,051	2,771.43	6.30	21.46	5.08
8	12,340	14,774	17,431	0.71		17,896	-5,556	5,556	13,434,216	3,119.54	45.03	24.41	2.73
9	14,500	15,073	19,179	0.76		23,682	-9,182	9,182	21,308,898	3,793.13	63.32	28.73	-0.17
10	16,500	16,418	20,928	0.79		23,334	-6,834	6,834	23,848,255	4,097.21	41.42	30.00	-1.83
11	17,500	18,750	22,676	0.77		25,207	-7,707	7,707	27,080,271	4,425.39	44.04	31.28	-3.43
12	22,000	21,188	24,424	0.90		25,076	-3,076	3,076	25,612,066	4,312.94	13.98	29.83	-4.24
13	23,500	24,688	26,172	0.90		32,317	-8,817	8,817	29,621,334	4,659.38	37.52	30.43	-5.81
14	27,000	28,625	27,921	0.97		31,131	-4,131	4,131	28,724,510	4,621.64	15.30	29.35	-6.75
15	35,000	31,719	29,669	1.18		32,981	2,019	2,019	27,081,334	4,448.14	5.77	27.77	-6.56
16	36,000	34,363	31,417	1.15		32,256	3,744	3,744	26,264,978	4,404.15	10.40	26.69	-5.78
17	34,250	36,063	33,165	1.03		40,951	-6,701	6,701	27,361,642	4,539.28	19.57	26.27	-7.08
18	37,400	36,797	34,914	1.07		38,928	-1,528	1,528	25,971,301	4,372.00	4.09	25.04	-7.70
19	38,200		36,662	1.04		40,755	-2,555	2,555	24,947,858	4,276.34	6.69	24.07	-8.47
20	38,675		38,410	1.01		39,435	-760	760	23,729,378	4,100.55	1.97	22.97	-9.02
21						**49,586**							
22						**46,725**							
23						**48,528**							
24						**46,615**							

L	3444.92
T	1748.268

Moving Average

Period t	Demand D_t	Level L_t	Forecast F_t	Error E_t	Absolute Error A_t	Squared Error MSE_t	MAD_t	% Error	$MAPE_t$	TS_t
1	12,250									
2	11,500									
3	13,200									
4	14,321	12,818								
5	13,750	13,193	12,818	-932	932.25	869,090	932	7	7	-1.00
6	15,210	14,120	13,193	-2,017	2017.25	2,469,194	1,475	13	10	-2.00
7	16,400	14,920	14,120	-2,280	2279.75	3,378,549	1,743	14	11	-3.00
8	12,340	14,425	14,920	2,580	2580.25	4,198,334	1,952	21	14	-1.36
9	14,500	14,613	14,425	-75	75	3,359,793	1,577	1	11	-1.73
10	16,500	14,935	14,613	-1,888	1887.5	3,393,603	1,629	11	11	-2.83
11	17,500	15,210	14,935	-2,565	2565	3,848,692	1,762	15	12	-4.07
12	22,000	17,625	15,210	-6,790	6790	9,130,618	2,391	31	14	-5.84
13	23,500	19,875	17,625	-5,875	5875	11,951,174	2,778	25	15	-7.14
14	27,000	22,500	19,875	-7,125	7125	15,832,619	3,213	26	16	-8.39
15	35,000	26,875	22,500	-12,500	12500	28,597,836	4,057	36	18	-9.73
16	36,000	30,375	26,875	-9,125	9125	33,153,485	4,479	25	19	-10.85
17	34,250	33,063	30,375	-3,875	3875	31,758,265	4,433	11	18	-11.84
18	37,400	35,663	33,063	-4,338	4337.5	30,833,668	4,426	12	18	-12.83
19	38,200	36,463	35,663	-2,538	2537.5	29,207,350	4,300	7	17	-13.80
20	38,675	37,131	36,463	-2,213	2212.5	27,687,838	4,170	6	16	-14.76
21			***37,131***							
22			***37,131***							
23			***37,131***							
24			***37,131***							

SES

Period t	Demand D_t	Level L_t	Forecast F_t	Error E_t	Absolute Error A_t	Squared Error MSE_t	MAD_t	% Error	$MAPE_t$	TS_t
0		22,475								
1	12,250	21,452	22,475	10,225	10,225	104,546,535	10,225	83	83	1.00
2	11,500	20,457	21,452	9,952	9,952	101,797,604	10,089	87	85	2.00
3	13,200	19,731	20,457	7,257	7,257	85,420,178	9,145	55	75	3.00
4	14,321	19,190	19,731	5,410	5,410	71,383,184	8,211	38	66	4.00
5	13,750	18,646	19,190	5,440	5,440	63,026,010	7,657	40	60	5.00
6	15,210	18,303	18,646	3,436	3,436	54,489,710	6,954	23	54	6.00
7	16,400	18,112	18,303	1,903	1,903	47,222,634	6,232	12	48	7.00
8	12,340	17,535	18,112	5,772	5,772	45,484,892	6,175	47	48	8.00
9	14,500	17,232	17,535	3,035	3,035	41,454,598	5,826	21	45	9.00
10	16,500	17,158	17,232	732	732	37,362,670	5,316	4	41	10.00
11	17,500	17,193	17,158	-342	342	33,976,666	4,864	2	37	10.86
12	22,000	17,673	17,193	-4,807	4,807	33,071,172	4,859	22	36	9.88
13	23,500	18,256	17,673	-5,827	5,827	33,138,741	4,934	25	35	8.55
14	27,000	19,130	18,256	-8,744	8,744	36,232,896	5,206	32	35	6.42
15	35,000	20,717	19,130	-15,870	15,870	50,606,914	5,917	45	36	2.97
16	36,000	22,246	20,717	-15,283	15,283	62,041,368	6,502	42	36	0.35
17	34,250	23,446	22,246	-12,004	12,004	66,868,606	6,826	35	36	-1.42
18	37,400	24,841	23,446	-13,954	13,954	73,971,002	7,222	37	36	-3.28
19	38,200	26,177	24,841	-13,359	13,359	79,469,904	7,545	35	36	-4.91
20	38,675	27,427	26,177	-12,498	12,498	83,305,997	7,792	32	36	-6.36
21			***27,427***							
22			***27,427***							
23			***27,427***							
24			***27,427***							

Holt's Method

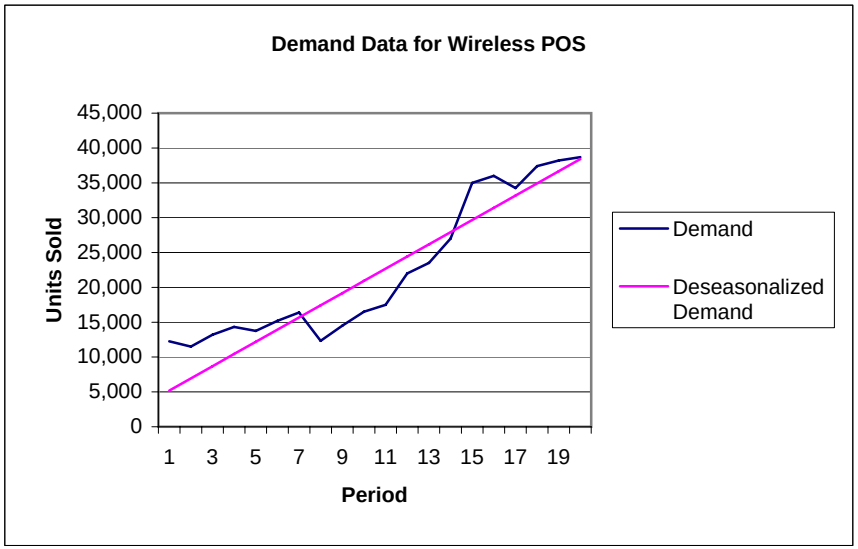
Period t	Demand D_t	Level L_t	Trend T_t	Forecast F_t	Error E_t	Absolute Error A_t	Squared Error MSE_t	MAD_t	% Error	$MAPE_t$	TS_t
0		5,466	1,620								
1	12,250	7,603	1,723	7,086	-5,164	5,164	26,665,421	5,164	42	42	-1.00
2	11,500	9,543	1,767	9,326	-2,174	2,174	15,696,578	3,669	19	31	-2.00
3	13,200	11,499	1,804	11,310	-1,890	1,890	11,655,438	3,076	14	25	-3.00
4	14,321	13,405	1,825	13,303	-1,018	1,018	9,000,569	2,562	7	21	-4.00
5	13,750	15,082	1,795	15,230	1,480	1,480	7,638,384	2,345	11	19	-3.74
6	15,210	16,710	1,762	16,877	1,667	1,667	6,828,445	2,232	11	17	-3.18
7	16,400	18,265	1,720	18,472	2,072	2,072	6,466,332	2,209	13	17	-2.28
8	12,340	19,221	1,568	19,985	7,645	7,645	12,964,387	2,889	62	22	0.91
9	14,500	20,159	1,442	20,788	6,288	6,288	15,917,508	3,267	43	25	2.73
10	16,500	21,091	1,340	21,601	5,101	5,101	16,927,971	3,450	31	25	4.06
11	17,500	21,938	1,241	22,431	4,931	4,931	17,599,303	3,585	28	26	5.28
12	22,000	23,061	1,218	23,179	1,179	1,179	16,248,492	3,384	5	24	5.94
13	23,500	24,201	1,202	24,278	778	778	15,045,222	3,184	3	22	6.56
14	27,000	25,562	1,234	25,403	-1,597	1,597	14,152,838	3,070	6	21	6.29
15	35,000	27,617	1,398	26,796	-8,204	8,204	17,696,141	3,413	23	21	3.25
16	36,000	29,713	1,538	29,015	-6,985	6,985	19,639,911	3,636	19	21	1.13
17	34,250	31,551	1,598	31,251	-2,999	2,999	19,013,757	3,598	9	20	0.31
18	37,400	33,574	1,683	33,148	-4,252	4,252	18,961,676	3,635	11	20	-0.86
19	38,200	35,551	1,742	35,256	-2,944	2,944	18,419,783	3,598	8	19	-1.69
20	38,675	37,430	1,769	37,292	-1,383	1,383	17,594,402	3,488	4	19	-2.14
21				***39,200***							
22				***40,969***							
23				***42,738***							
24				***44,507***							

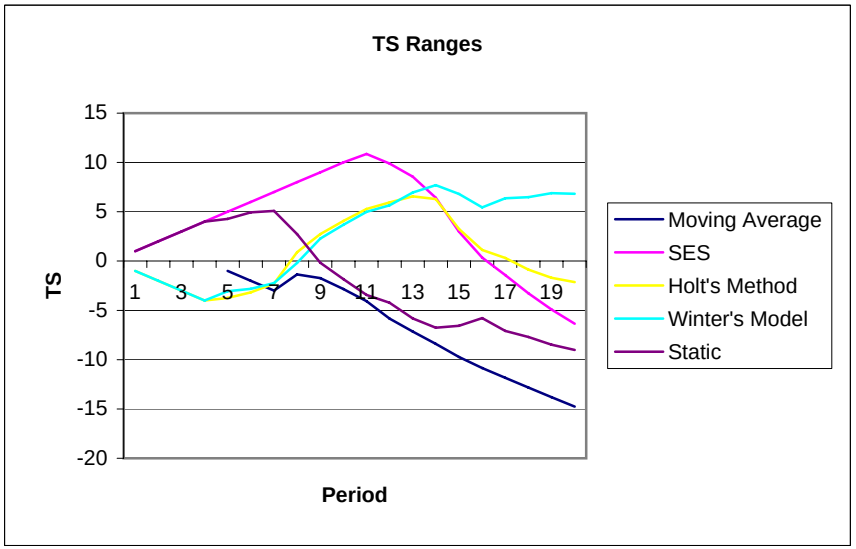
Winter's Model

Period t	Demand D_t	Level L_t	Trend T_t	Seasonal Factor S_t	Forecast F_t	Error E_t	Absolute Error A_t	Squared Error MSE_t	MAD_t	% Error	$MAPE_t$	TS_t
0		3,445	1,748									
1	12,250	5,430	1,772	1.23	6,412	-5,838	5,838	34,078,335	5,838	48	47.65	-1.00
2	11,500	7,357	1,787	1.11	8,030	-3,470	3,470	23,061,239	4,654	30	38.92	-2.00
3	13,200	9,281	1,801	1.11	10,165	-3,035	3,035	18,443,780	4,114	23	33.61	-3.00
4	14,321	11,226	1,815	1.03	11,378	-2,943	2,943	15,998,186	3,821	21	30.34	-4.00
5	13,750	12,903	1,802	1.34	17,434	3,684	3,684	15,513,604	3,794	27	29.63	-3.06
6	15,210	14,625	1,794	1.16	17,055	1,845	1,845	13,495,109	3,469	12	26.72	-2.81
7	16,400	16,316	1,783	1.14	18,762	2,362	2,362	12,364,175	3,311	14	24.96	-2.23
8	12,340	17,781	1,752	1.05	19,033	6,693	6,693	16,418,047	3,734	54	28.62	-0.19
9	14,500	19,109	1,709	1.31	25,583	11,083	11,083	28,241,942	4,550	76	33.93	2.28
10	16,500	20,496	1,677	1.15	23,896	7,396	7,396	30,887,620	4,835	45	35.02	3.68
11	17,500	21,840	1,644	1.13	25,032	7,532	7,532	33,237,660	5,080	43	35.75	4.98
12	22,000	23,392	1,635	1.02	23,855	1,855	1,855	30,754,735	4,811	8	33.47	5.65
13	23,500	24,712	1,603	1.25	31,400	7,900	7,900	33,190,223	5,049	34	33.48	6.95
14	27,000	26,212	1,593	1.11	29,303	2,303	2,303	31,198,207	4,853	9	31.70	7.70
15	35,000	28,011	1,613	1.10	30,478	-4,522	4,522	30,481,363	4,831	13	30.45	6.80
16	36,000	29,928	1,644	1.01	29,870	-6,130	6,130	30,924,990	4,912	17	29.61	5.44
17	34,250	31,392	1,626	1.22	38,653	4,403	4,403	30,246,347	4,882	13	28.62	6.37
18	37,400	33,059	1,630	1.11	36,491	-909	909	28,611,937	4,661	2	27.17	6.48
19	38,200	34,673	1,628	1.11	38,557	357	357	27,112,741	4,435	1	25.79	6.89
20	38,675	36,367	1,635	1.03	37,309	-1,366	1,366	25,850,468	4,281	4	24.68	6.82
21				***1.21***	***46,020***							
22				***1.11***	***42,099***							
23				***1.11***	***42,203***							
24				***1.03***	***39,193***							

Comparative Analysis

Forecasting Method	MAD	MAPE	TS Range
MA	4,170	16.3%	-14.76 to -1.00
SES	7,792	35.9%	-6.36 to 10.86
Holt's	3,488	18.5%	-4.00 to 6.56
Winter's	4,281	24.7%	-4.00 to 6.95
Static	4,101	23.0%	-9.02 to 5.08





Inventory - continuous review

	Supplier		
	A	**B**	**C**
Optimum Lot Size	2,332	3,762	83,131
Cycle Inventory	1,166	1,881	41,565
Order Frequency	72	44	2
safety stock	509	416	294
ROP	10,154	6,846	3,509
Average Inventory	1,675	2,297	41,859
Average Flow Time	0.5211	0.7143	13.0200
Annual Ordering Cost	$116,606	$75,237	$2,078
Annual Holding Cost	$16,718,000	$6,687,200	$8,359
Annual Material Cost	$83,590,000	$33,436,000	$41,795

Total Cost (final product)	$140,675,276

Transportation

	A		B		C	
Mode	**Truck/LTL**	**Truck/LT**	**Truck/LTL**	**Truck/LT**	**Truck/LTL**	**Truck/LT**
Lot Size	2,332	10,000	3,762	15,000	83,131	100,000
Transportation cost	$2,149	$3,200	$2,281	$3,200	$1,231	$3,200
Transportation cost/unit	$0.92	$0.32	$0.61	$0.21	$0.01	$0.03
Safety Inventory	509	509	509	509	509	509
Transportation cost	$154,059.30	$53,497.60	$101,366.29	$35,665.07	$2,476.22	$5,349.76
Safety Inv. Costs/day	$139.49	$139.49	$55.79	$55.79	$0.07	$0.07
Cycle Inv	1,166	5,000	1,881	7,500	41,565	50,000
Cycle Inv cost/day	$319.47	$1,369.86	$206.13	$821.92	$5.69	$6.85
Total Cost/day	**$881**	$1,656	**$540**	$975	**$13**	$22

Inputs - Costs, Capacities, Demands

	Demand Region				**Fixed**	
Supply City	West	Midwest	South	East	**Cost**	**Capacity**
Boston	$752	$722	$722	$702	$6,000,000	55,000
Miami	$737	$737	$702	$722	$5,500,000	55,000
Chicago	$722	$702	$722	$737	$5,600,000	55,000
Santa Cruz	$702	$722	$737	$752	$6,100,000	55,000
Demand	57,100	39,000	25,000	46,080		

Decision Variables

	Demand Region				Plants
Supply City	West	Midwest	South	East	(1=open)
Boston	0	0	0	2180	1
Miami	0	22094	9292	23615	1
Chicago	17487	13770	11966	11778	1
Santa Cruz	39613	3137	3743	8508	1

Constraints

Supply City	*Excess Capacity*			
Boston	52,820			
Miami	0			
Chicago	0			
Sanat Cruz	0			
Unmet Demand	West	Midwest	South	East
	0	0	0	0

Objective Function

Total Cost =	$143,442,685

	TC
Boston	$7,530,612
Miami	$45,360,952
Chicago	$45,216,653
Santa Cruz	$45,334,468

Inputs - Demand, costs, prices

	Supplier		
	A	**B**	**C**
Average weekly demand, Dw	3,215	3,215	3,215
Std. Dev of weekly demand, σ_D	350	350	350
Holding Cost, h	20%	20%	20%
Unit Cost, C	500	200	0.25
Shipping Cost, S	1,627	1,693	1,033
Supplier Lead time (weeks), L	3	2	1
Unit Price (final product), P	1100		
Salvage Value (final product)	600		
Optimized Product Availability (CSL)	79.95%		
Cost of Understocking, Cu	399.75		
Cost of Overstocking, Co	100.25		
Total Annual Demand	167,180		

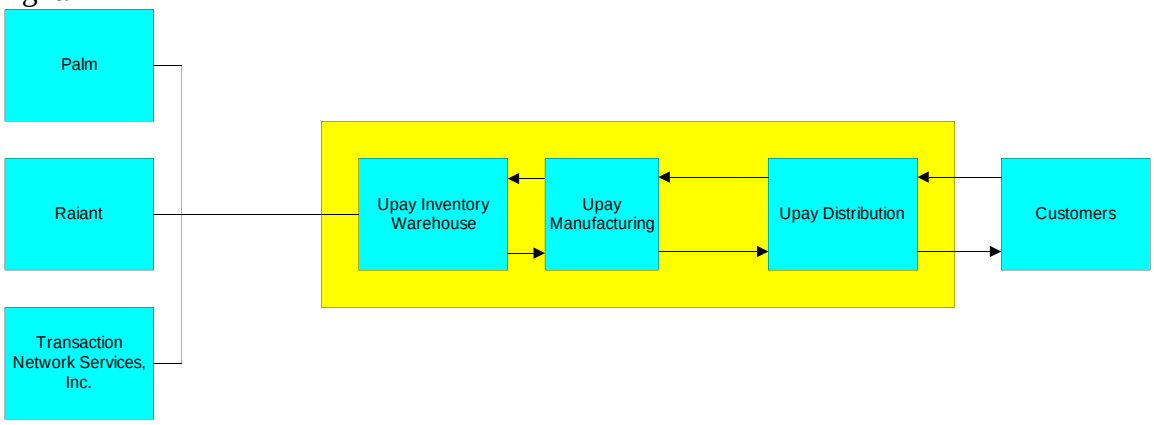
The Beer Game
(Tailored to the Upay Supply Chain)

What is the objective of the Beer Game?

The Beer Game is a useful tool to illustrate what happens when there is a lack of coordination within a supply chain. A lack of coordination occurs for two reasons: different stages of the supply chain have different objectives and/or information moving between stages gets delayed and distorted. The effect of either of these results in something called the bullwhip effect. The bullwhip effect causes serious fluctuations in orders as you move up the supply chain from the retailer all the way to the supplier. The bullwhip effect distorts demand information within the supply chain, with different stages having a very different estimate of what demand looks like. These varying estimates are a result of basing forecasting on orders instead of customer demand.

Example of the Beer game based on the Upay supply chain

The following diagram represents the structure of the Upay supply chain with suppliers on the left, Upay's internal supply chain incased in yellow, and the customer on the far right:



The following data for the Upay version of the Beer Game is generated using an Excel macro that was created by John Young and modified by Brandon Thomason to simulate the Upay supply chain. The data is generated by placing orders randomly with, values 1-5, at each step of the supply chain. This mimics the effect of basing production on orders instead of customer demand. Following the data are two graphs, order history and inventory history, which visually represent the bullwhip effect.

Analysis of Beer Game Data

We can see from the charts labeled Order History and Inventory History that the quantities ordered and the inventory held by each stage of the supply chain varies widely. We can also clearly see the bullwhip effect on the Order History chart, where the quantities ordered become more and more distorted as they move further away from the customer order. This is first observed in periods 10-17 and then repeats itself again in periods 78-86.

There are also large discrepancies in the inventory held at each location, with manufacturing clearly overstocking for the majority of the periods being examined, but also reaching stockout levels at three different times over the course of 100 periods. This stockout phenomenon occurs with warehousing as well, but is predominant in the distribution stage, occurring 6 times, with each time covering several periods.

What can we learn from the Upay version of the Beer Game?

- Gain understanding of how the bullwhip could affect the performance of our supply chain.
    - **Manufacturing cost**: As a result of the bullwhip effect, Upay would have to build excess capacity or hold excess inventory in order to satisfy a stream of orders that are more variable than customer demand, which would in turn increase the manufacturing cost per unit produced.
    - **Inventory cost**: To handle the increased variability in demand, Upay would have to carry a higher level of inventory that would be required in the absence of the bullwhip effect. As a result, inventory costs in the supply chain increase. The high levels of inventory also increase the warehousing space required and thus the warehousing cost incurred.
    - **Replenishment lead time**: The bullwhip effect would increase replenishment lead times in the Upay supply chain because the scheduling at our supplier plants would become more difficult than if there was a level demand.
    - **Transportation cost**: As a result of the bullwhip effect, transportation requirements fluctuate significantly over time. This raises transportation cost because surplus transportation capacity needed to be maintained to cover high-demand periods.
    - **Labor cost for shipping and receiving**: Labor requirements for shipping at Upay and its suppliers fluctuate with orders. A similar fluctuation will occur for the labor requirements for receiving at our distributor facility. Therefore, the various stages in the supply chain have to carry excess labor capacity or vary labor capacity in response to the fluctuation in orders. Either option increases total labor cost.
    - **Level of product availability**: As we have seen in the Beer Game simulation, there are quite a few stockouts that occur for all three internal stages of the Upay supply chain. This results in a loss of sales for the supply chain.

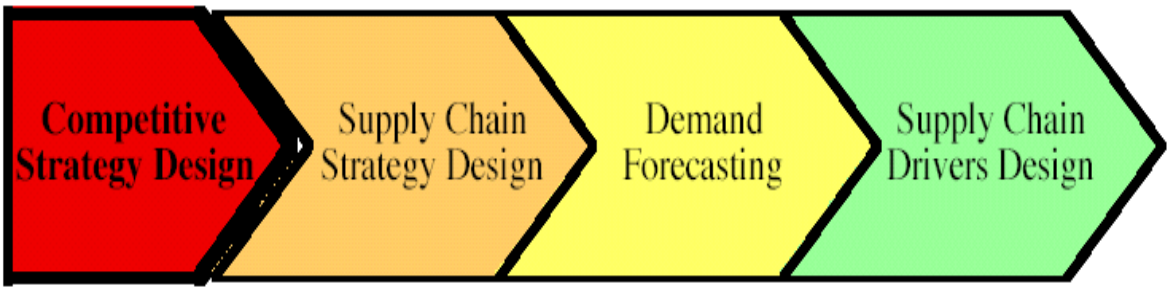
- **Relationships across the supply chain**: The bullwhip effect negatively impacts performance at every stage and this hurts the relationship between different stages of the supply chain. There is a tendency to assign blame to other stages of the supply chain because each stage feels it is doing the best it can.

What are we doing to correct the bullwhip effect within our supply chain?

- **Over coming obstacles**: In order to overcome incentive obstacles in the Upay supply chain, we will not base any performance incentives on local stages of the supply chain. Information about customer demand will be shared with our suppliers so that they can better evaluate their demand forecast. We will also strive to order lot sizes that are in line with our customer demand in order to prevent order magnification upstream in the supply chain.
- **Achieving coordination**:
  - Aligning Incentives across functions: All facility, transportation, and inventory decisions will be evaluated based on their impact on profitability, not total costs, or even worse, just local costs.
  - Using Sell-Through Incentives: In an effort to reduce forward buying and the resulting fluctuation in orders, sales staff will be encouraged focus on sell-through mentality, instead of a sell-in mentality.
  - Implementing Collaborative Forecasting and Planning: Upay will share its forecast data with its suppliers so that they can better forecast and plan their own production schedule, and in turn, better meet our needs.
  - Single Stage Control of Replenishment: Because we sell directly to the customer, single control of replenishment is automatic because we do not have intermediary outside of our own supply chain network separating us from the customer.
- **Partnerships and trust**: By sharing customer demand data and creating effective contracts between Upay and our suppliers, we intend to accentuate the mutual benefits that our relationship with our suppliers offers to all of us.

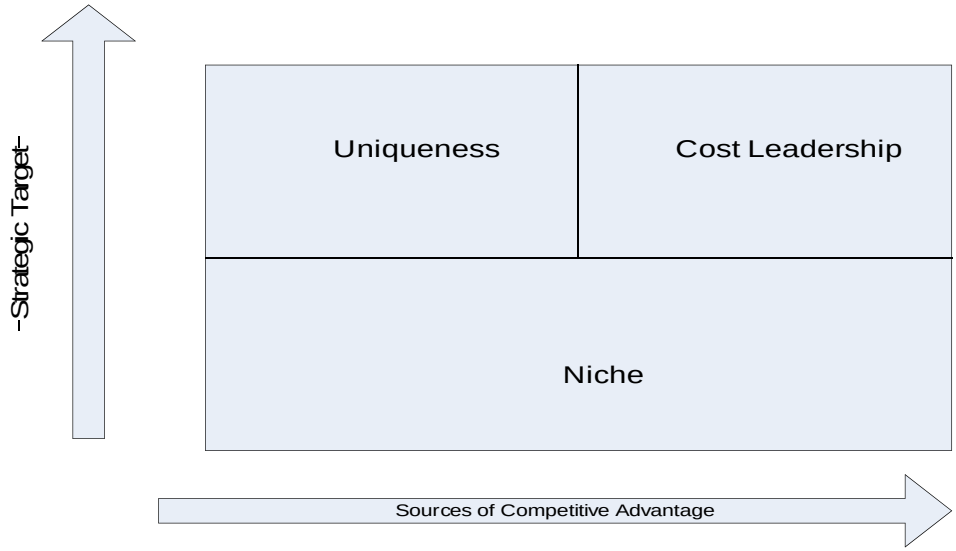
UPAY Manual

When developing the supply chain system there are four stages that must be followed. By looking at the diagram below it can be shown that each stage represents a small piece of the overall supply chain. Each stage in the end will effect how workers within the chain work with each other and how effective the software package is to keep a high value and maximize profits, all this while decreasing costs.



Competitive Strategy Design- This stage of the supply chain deals with outlining the process in which your firm researches the industry that it is in. Through research the major players, your competitor's market shares, and their sources of competitive advantage. What needs to be done here is the mistakes that have been done not be repeated again in this industry and also to learn about your competitors better to compete with them.

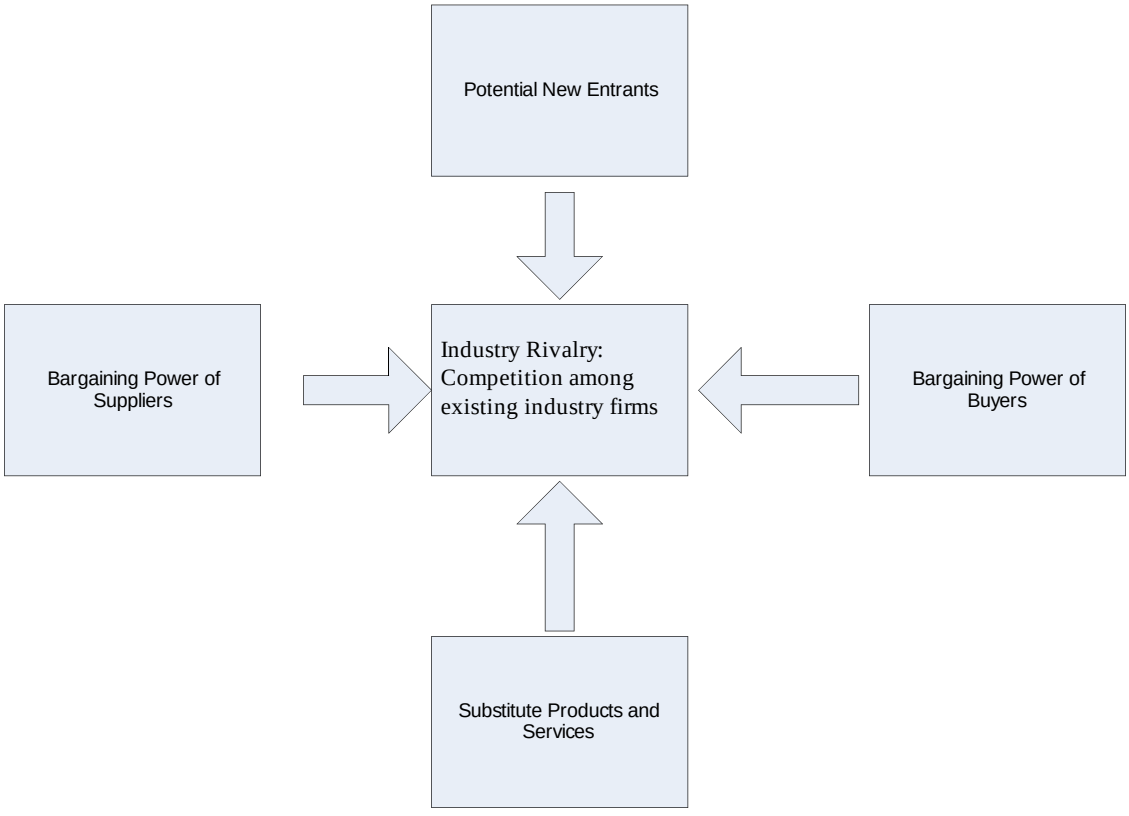
Also defining what kind of company you want to be. A certain image must be portrayed about your company either it be providing unique products, low cost products, or are you a niche market company. In each case it is important to know where you stand because with the knowledge of where your company stands against the rest of the competitors in the same industry.



Getting to know your competition is very important when competing in a certain industry. Understanding the landscape of the industry that you plan on competing in will let you choose a strategy that best fits the overall goals of the firm. The analysis that you perform will not directly be a part of your supply chain system, but it will help in future stages as the design becomes more complex. The Porter Competitive model is a very good way to get a view of what the industry that you are competing in. There are five main categories in this model which include: Bargaining power of buyers, bargaining power of suppliers, new entrants, substitutes, and inner industry rivalry.

Bargaining power of buyers comes from the customers of the products and services within the industry. Identifying customers is most often easy but sometimes more difficult that one would first think. Is a company truly a customer or an intermediary? A major consideration if the customer has significant power, why this power exists and what benefits this accrues to them.

Bargaining power of suppliers- This refers to the key providers of products and services that contribute to the competitive posture of companies within the industry. It is important to assess any power implications, the question needs to be asked if the supplier provides a unique or scarce product or service that can not be duplicated from another company? If yes then you know that the suppliers for you industry have a great amount of power.

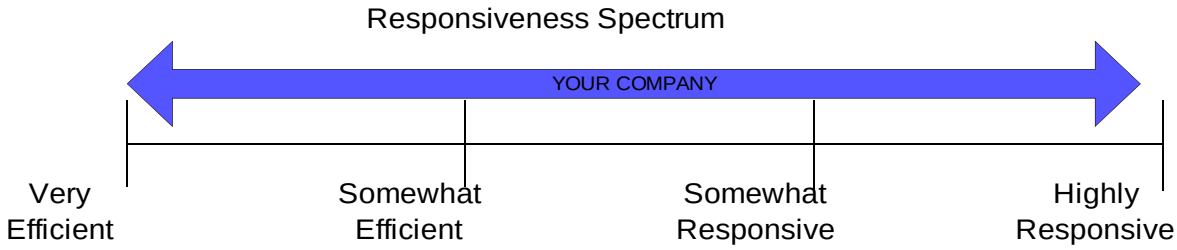


Threat of new entrants represents the likelihood that additional companies will start competing in the industry. These can be new companies, existing companies that change business strategies to enter an industry that is new to them, or existing companies that have not competed in the same geographic or products are but decide to do so. Knowledge of barriers to entry is important in this section. High entry costs or high switching costs for an existing customer to change to the new entrant company as well as barriers to exit are all barriers to entry that a new entrant can expect.

The final force in this model is the threat of substitute products or services that would be viable alternatives to those offered by companies in the industry. Consideration should be given to the substitutes and why buyers would find them attractive.

The Strategic business unit (SBU) within Industry rivalry must understand how the five forces work in the industry and how they affect the company in its particular situation. Assessing the competitive risks is the first step in developing a competitive strategy, which will lead to tactics that will enable the company to realize its goals.

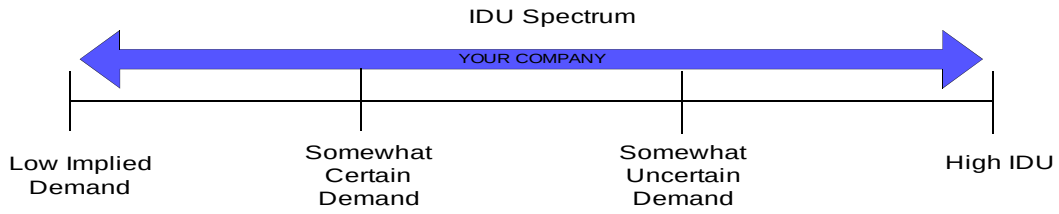
Supply Chain Strategy Design- This stage of the supply chain deals with using the competitive strategy that was developed in the earlier stage. The process that needs to go on in this stage is that the supply chain strategy design needs to align with goals in the competitive strategy. This phase will make you make decisions on how many stages to have in your supply chain, where your company lies on the IDU spectrum, and where you company lies on the responsiveness-efficiency spectrum from each of the four supply chain drivers.



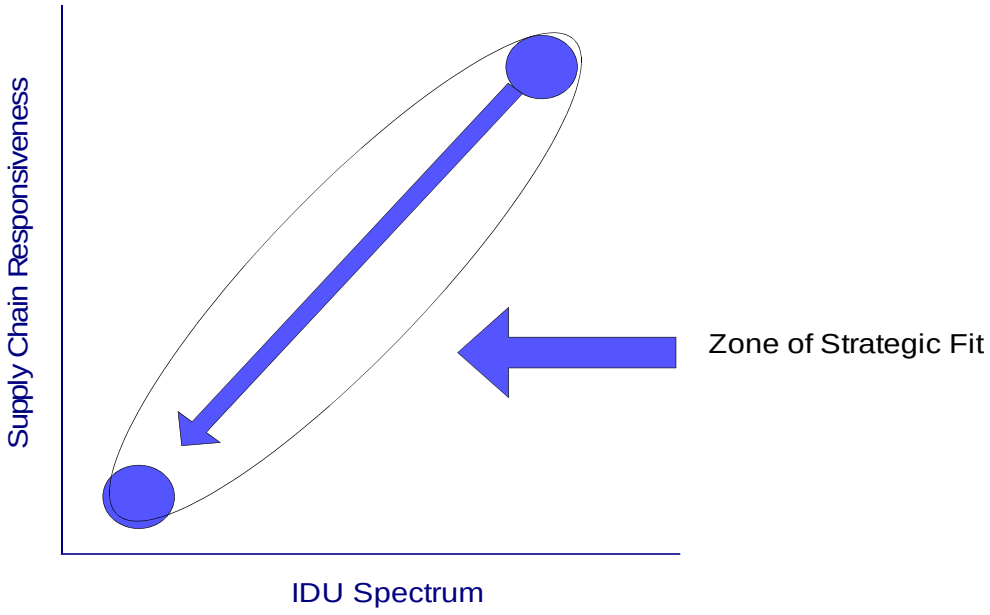
If your company lies on the left hand side of this spectrum then that means that the responsiveness of your company to demand is not high but the efficiency of creating your products are very efficiently. Usually if your company is on the far left then you have narrow well defined products, the further you move to the right the more your company can deal with large changes in demand, need for large product variety and shorter lead times.

On the IDU (Implied Demand Uncertainty) spectrum is used for uncertainty in demand implied by the customers need for the product. Companies that are on the far left hand side seem to be more focused on selling function products where companies on the far right hand side how entirely new products. The way this spectrum can be looked at is a scale of how comfortable the majority of the population is with this product, the left being very comfortable and right being a little skeptical.

All of the four drivers can be used in collaboration with these spectrums.



To align competitive strategy, this can mean satisfying customer needs, and the supply chain strategy (Responsiveness) to maximize value (profitability) of the entire supply chain. Usually new products start with a high IDU and being very responsive. As a product matures it moves closer and closer to low IDU and the company being very efficient.



Demand Forecasting- This stage is about estimating the customer demand based on data that can be obtained from your business partners, marketing firms, or earlier sales data of your product. This forecast information will be the first input into your Supply Chain Management software system. The demand data will be used as a basis for the next stages calculations.

For demand forecasting after some kind of data has been obtained the first thing that should be done is to observe and understand how demand for your product can

change from one time period to the next. There are static and adaptive forecasting methods which include: Deseasonalized Demand, Deseashonalized Demand and Seasonal Factors, for static and for adaptive they include: Moving average, Simple Exponential Smoothing, Trend Corrected Exponential Smoothing (Holt's Model) and Trend and Seasonality Corrected Exponential Smoothing (Winter's Model). Many calculations are necessary to complete this portion of data, equations are provided in the report.

A static method assumes that the estimates of level, trend, and seasonality within the systematic component do not vary as new demand is observed. For these methods two steps are necessary on making estimations on: level, trend and seasonal factors. For seasonal factors we can use an equation which is provided in the context of the report.

In Adaptive Forecasting, the estimates of level, trend, and seasonality are updated after each demand observation. The framework is provided in the most general setting when the systematic component of demand data contains a level, trend, and seasonal factor. The framework can be easily modified for the other two cases, it can also be specialized for the case where the systematic component contains no seasonality or trend.

With these methods after calculation we can examine each one and by looking at certain factors we can decide which method is the best to forecast demand for your company.

Supply Chain Drivers Design- This is a four part phase that will go over each of the supply chain drivers which are: Inventory, Transportation, Facilities and Information Systems. Each one of these drivers represents a separate module in your SCM software package.

The goal of the design of your drivers is to have them take in the appropriate demand data and output the total cost based on specific options you choose. The four drivers you will be concerned are listed below and will work with, manipulate, and output the given information.

- **Inventory**: calculate cycle inventory, safety stock, product availability
- **Transportation**: design the transportation network based on mode, space, and time
- **Facilities**: use linear programming methods for optimization
- **Information System**: develop an integrated system that links forecasting with each of the supply chain drivers.

As you design of these modules try to visualize how they will fit together. Even though you will most likely be developing them separately, it is important to build in flexibility so that when it comes time to integrate all of your pieces. There will be room for adjustments when you align the modules next to each other. Much like in a real puzzle, when two pieces do not fit together, there is not much you can do other try to find the right other piece. When you integrate your software package, you must make your pieces so that they align just right. It is important to think about this now, so that when

the time comes to put everything together, you will have already planned out the integration process.

The information system driver represents the combination of your competitive strategy, supply chain strategy, forecasting method, and the other supply chain drivers. While your other drivers may vary in their efficiency and responsiveness, your information system needs to be the most responsive. This software system is serving the needs of your organization and should therefore be able to provide the most up-to-date information to ensure your decisions reflect what you are receiving from suppliers and what your customers are demanding daily. This should allow for each of the supply chain flows to traverse from supplier to customer in a very timely manner. The goal of this system is encourage sharing of information and to maximize total supply chain profitability. Only with an integrated information system can this be achieved.