AGENDA: DIFFERENTIAL ANALYSIS: THE KEY TO DECISION MAKING

A. Identification of relevant costs and benefits.

B. Drop or retain a segment.

C. Make or buy decision.

D. Utilization of constrained resources.

E. Special order.

F. Joint products.

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RELEVANT COSTS AND BENEFITS

Every decision involves choosing from among at least two alternatives.

A relevant cost or benefit is a cost or benefit that differs, in total, between the alternatives. Any cost or benefit that does not differ between the alternatives is irrelevant and can be ignored. Relevant costs and benefits are also known as differential costs and benefits.

Avoidable costs are those costs that can be eliminated in whole or in part by choosing one alternative over another. Avoidable costs are relevant costs.

Two broad categories of costs are never relevant in decisions:

1. Sunk costs.
2. Future costs that do not differ between alternatives.

To make decisions:

1. Focus on identifying relevant costs and benefits.
2. Ignore everything else including sunk costs and future costs that do not differ between alternatives.

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DROP OR RETAIN A SEGMENT

EXAMPLE: Due to the declining popularity of digital watches, Sweiz Company's digital watch line has not reported a profit for several years. An income statement for last year follows:

Segment Income Statement—Digital Watches

Sales		$ 500,000
Variable expenses:		
Variable manufacturing costs	$120,000	
Variable shipping costs	5,000	
Commissions	75,000	200,000
Contribution margin		300,000
Fixed expenses:		
General factory overhead*	60,000	
Salary of product line manager	90,000	
Depreciation of equipment**	50,000	
Product line advertising	100,000	
Rent—factory space***	70,000	
General administrative expense*	30,000	400,000
Net operating loss		$(100,000)

* Allocated common costs that would be redistributed to other product lines if digital watches were dropped.

** This equipment has no resale value and does not wear out through use.

*** The digital watches are manufactured in their own facility.

Should the company retain or drop the digital watch line?

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DROP OR RETAIN A SEGMENT (continued)

Approach #1:

If by dropping digital watches the company is able to avoid more in fixed costs than it loses in contribution margin, then it will be better off if the product line is eliminated.

The solution would be:

Contribution margin lost if digital watches are dropped.....		$(300,000)
Less fixed costs that can be avoided:		
Salary of the product line manager.....	$ 90,000	
Product line advertising	100,000	
Rent—factory space	70,000	260,000
Net disadvantage of dropping the line.....		$(40,000)

The digital watch line should not be dropped. If it is dropped, the company will be $40,000 worse off each year. Note the following points:

- Depreciation on the old equipment is not relevant to the decision. It relates to a sunk cost.
- General factory overhead and general administrative expense are allocated common costs that would not be avoided if the digital watch line were dropped. These costs would be reallocated to other product lines.

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DROP OR RETAIN A SEGMENT (continued)

Approach #2:

The solution can also be obtained by preparing comparative income statements showing results with and without the digital watch line.

	Keep Digital Watches	*Drop Digital Watches*	*Difference: Increase or (Decrease)*
Sales	$ 500,000	$ 0	$(500,000)
Variable expenses:			
Variable manufacturing expense	120,000	0	120,000
Variable shipping costs	5,000	0	5,000
Commissions	75,000	0	75,000
Total variable expenses	200,000	0	200,000
Contribution margin	300,000	0	(300,000)
Fixed expenses:			
General factory overhead	60,000	60,000	0
Salary of product line manager	90,000	0	90,000
Depreciation	50,000	50,000	0
Product line advertising	100,000	0	100,000
Rent—factory space	70,000	0	70,000
General administrative expense	30,000	30,000	0
Total fixed expenses	400,000	140,000	260,000
Net operating loss	$(100,000)	$(140,000)	$ (40,000)

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MAKE OR BUY DECISION

A decision concerning whether an item should be produced internally or purchased from an outside supplier is called a "make or buy" decision.

EXAMPLE: Essex Company is presently making a part that is used in one of its products. The unit product cost is:

Direct materials.....	$ 9
Direct labor.....	5
Variable manufacturing overhead.....	1
Depreciation of special equipment*.....	3
Supervisor's salary	2
General factory overhead**.....	10
Total unit product cost	$30

* The special equipment has no resale value.

** Common costs allocated on the basis of direct labor-hours.

The costs above are based on 20,000 parts produced each year. An outside supplier has offered to provide the 20,000 parts for only $25 per part. Should this offer be accepted?

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MAKE OR BUY DECISION (continued)

The solution to Essex Company's make or buy decision follows:

	Total Differential Costs of 20,000 units	
	Make	*Buy*
Outside purchase price		$500,000
Direct materials	$180,000	
Direct labor	100,000	
Variable manufacturing overhead	20,000	
Depreciation of equipment (not relevant)		
Supervisor's salary	40,000	
General factory overhead (not relevant)		
Total cost	$340,000	$500,000

This solution assumes that none of the general factory overhead costs will be saved if the parts are purchased from the outside; these costs would be reallocated to other items made by the company.

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SPECIAL ORDERS

A special order is a one-time order that does not affect the company's normal sales.

EXAMPLE: Jamestown Candleworks has just received a request from the Williamsburg Foundation for 800 candles to be used in a special event for major donors. The candles will be used as the only illumination in the reception room and will be given out as gifts to the donors as they leave. The candles will be imprinted with the Williamsburg Foundation logo. This sale will have no effect on the company's normal sales to retail outlets. The normal selling price of a candle of about the size and weight of the special candles is $3.95 and its unit product cost is $2.30, as shown below:

Direct materials.....	$1.35
Direct labor.....	0.15
Manufacturing overhead.....	0.80
Unit product cost	$2.30

The variable portion of the manufacturing overhead is $0.05 per candle; the other $0.75 represents fixed manufacturing costs that would not be affected by this special order.

Jamestown Candleworks would have to order a special candle mold in which the Williamsburg Foundation logo is inscribed. Such a mold would cost $800. In addition, the Williamsburg Foundation wants a special wick containing gold-like thread that would add $0.20 to the cost of each candle.

Because of the large size of the order and the charitable nature of the work, the Williamsburg Foundation has asked to pay only $2.95 each for this candle.

If accepted, what effect would this order have on the company's net operating income?

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SPECIAL ORDERS

Only the incremental costs and benefits are relevant. The existing fixed manufacturing overhead costs would not be affected by the order and are irrelevant.

	Per Unit	*Total for 800 Candles*
Incremental revenue	$2.95	$2,360
Incremental costs:		
Variable costs:		
Direct materials	1.35	1,080
Direct labor	0.15	120
Variable manufacturing overhead	0.05	40
Special wick	0.20	160
Total variable cost	$1.75	1,400
Fixed cost:		
Special mold		800
Total incremental cost		2,200
Incremental net operating income		$ 160

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UTILIZATION OF CONSTRAINED RESOURCES

- Anything that prevents an organization from getting more of what it wants (for example, profits) is a constraint.
  - A particular machine may not have enough capacity to satisfy current demand.
  - Supplies of a critical part may not be sufficient to satisfy current demand.
- When the constraint is a machine or a work center, it is called a bottleneck.
- When capacity is not sufficient to satisfy demand, something must be cut back. Which products should be cut back and by how much?
  - Fixed costs are not usually affected by the decision of which products should be emphasized in the short run. All of the machines and other fixed assets are in place—it is just a question of how they should be used.
  - When fixed costs are unaffected by the choice of which product to emphasize, maximizing the total contribution margin will maximize total profits.
  - The total contribution margin is maximized by emphasizing the products with the greatest contribution margin per unit of the constrained resource.

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UTILIZATION OF CONSTRAINED RESOURCES (continued)

EXAMPLE: Ensign Company makes two products, X and Y. The current constraint is Machine N34. Selected data on the products follow:

	X	*Y*
Selling price per unit.....	$60	$50
Variable expenses per unit.....	36	35
Contribution margin.....	$24	$15
Contribution margin ratio.....	40%	30%
Current demand per week (units)...	2,000	2,200
Processing time required on Machine N34 per unit.....	1.0 minute	0.5 minute

Machine N34 is available for 2,400 minutes per week, which is not enough capacity to satisfy demand for both product X and product Y. Should the company focus its efforts on product X or product Y?

CONTRIBUTION MARGIN PER UNIT OF THE CONSTRAINED RESOURCE

	X	*Y*
Contribution margin per unit (a).....	$24	$15
Constrained resource required to produce one unit (b).....	1.0 minute	0.5 minute
Contribution margin per unit of the constrained resource (a)÷ (b).....	$24 per minute	$30 per minute

- Product Y should be emphasized because it has the larger contribution margin per unit of the constrained resource. A minute of processing time on Machine N34 can be used to make 1 unit of Product X, with a contribution margin of $24, or 2 units of Product Y, with a combined contribution margin of $30.

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UTILIZATION OF CONSTRAINED RESOURCES (continued)

- In the absence of other considerations (such as satisfying an important customer), the best plan would be to produce to meet current demand for Product Y and then use any remaining capacity to make Product X.

ALLOTING THE CONSTRAINED RESOURCE

Total time available on Machine N34 (a)	2,400	minutes
Planned production and sales of Product Y.....	2,200	units
Time required to process one unit	× 0.5	minute
Total time required to make Product Y (b)	1,100	minutes
Time available to process Product X (a) – (b).....	1,300	minutes
Time required to process one unit	÷ 1	minute per unit
Planned production and sales of Product X.....	1,300	units

RESULTS OF FOLLOWING THE ABOVE PLAN

	X	*Y*	*Total*
Planned production and sales (units)	1,300	2,200	
Contribution margin per unit	× $24	× $15	
Total contribution margin.....	$31,200	$33,000	$64,200

THE VALUE OF OBTAINING MORE OF THE CONSTRAINING RESOURCE

Ensign should be willing to pay up to $24 per minute for additional N34 machining capacity. This is because additional machine capacity would be used to produce more units of Product X. Product X earns $24 of contribution margin per minute of machine time.

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UTILIZATION OF CONSTRAINED RESOURCES (continued)

MANAGING CONSTRAINTS

Processing more units actually demanded by customers through the bottleneck is the key to increased profits:

- Produce only what can be sold.
- Pay workers overtime to keep the bottleneck running after normal working hours.
- Shift workers from non-bottleneck areas to the bottleneck.
- Hire more workers or acquire more machines for the bottleneck.
- Subcontract some of the production that would use the bottleneck.
- Focus business process improvement efforts on the bottleneck.
- Reduce defects.

The potential payoff to effectively managing the constraint can be enormous.

EXAMPLE: Suppose the available time on Machine N34 can be increased by paying the machine's operator to work overtime. Would this be worthwhile?

ANSWER: Because the additional time would be used to make more of Product X, each minute of overtime is worth $24 to the company and hence each hour is worth $1,440 (60 minutes × $24 per minute)!

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JOINT PRODUCT COSTS

- Some companies make a number of end products from a single raw material input. Such end products are known as joint products.
  - The split-off point is the point in the manufacturing process at which the joint products can be recognized as separate products.
  - The term joint cost is used to describe costs that are incurred up to the split-off point.
- It is profitable to continue processing a joint product after the split-off point if the incremental revenue from further processing exceeds the incremental processing costs.
- In practice, joint costs incurred up to the split-off point are almost always allocated to the joint products. Extreme caution should be exercised in interpreting these allocated joint costs. They are *not* relevant in decisions concerning whether joint products should be processed further because they are incurred whether or not there is further processing.

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JOINT PRODUCT COSTS (continued)

EXAMPLE: NW Sawmill buys logs and then runs them through a saw that produces unfinished lumber and scrap (i.e., sawdust, chips, and bark). The unfinished lumber can be sold "as is" or processed further into finished lumber. The scrap can also be sold "as is" to gardening supply wholesalers or processed further into prestologs. Data concerning these joint products appear below:

	Per Log	
	Lumber	*Scraps*
Sales value at the split-off point.....	$140	$5
Sales value after further processing.....	$270	$20
Allocated joint costs*.....	$176	$24
Cost of further processing.....	$50	$4

*Allocated on the basis of weight.

Analysis of Sell or Process Further

	Per Log	
	Lumber	*Scraps*
Sales value after further processing.....	$270	$20
Sales value at the split-off point.....	140	5
Incremental revenue	130	15
Cost of further processing.....	50	4
Profit from further processing	$ 80	$11

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