Chapter

13

Relevant Costs for Decision Making

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Distinguish between relevant and irrelevant costs in decisions.
2. Prepare an analysis showing whether to keep or replace old equipment.
3. Prepare an analysis showing whether a product line or other organizational segment should be dropped or retained.
4. Prepare a well-organized make or buy analysis.

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

5. Prepare an analysis showing whether a special order should be accepted.
6. Determine the most profitable use of a constrained resource.
7. Prepare an analysis showing whether joint products should be sold at the split-off point or processed further.

Cost Concepts for Decision Making

A **relevant cost** is a cost that differs between alternatives.

Identifying Relevant Costs

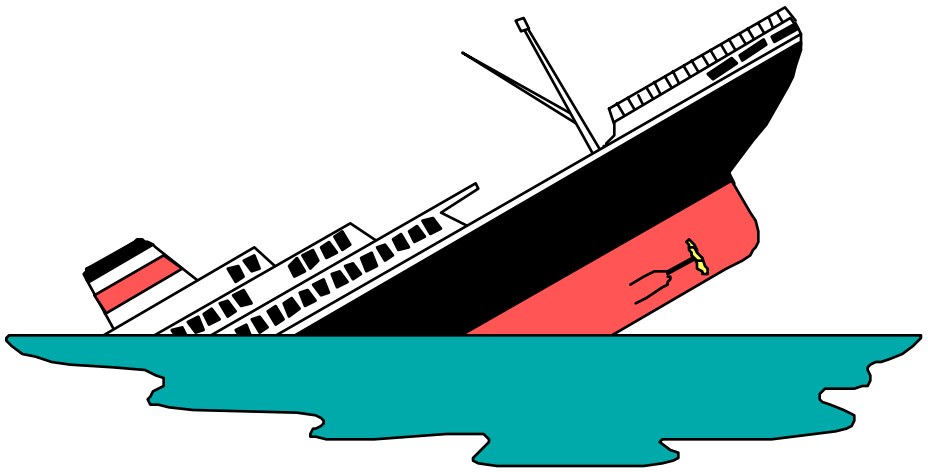
Costs that can be eliminated (in whole or in part) by choosing one alternative over another are avoidable costs. Avoidable costs are relevant costs.

Unavoidable costs are never relevant and include:

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

Identifying Relevant Costs

Sunk cost -- a cost that has already been incurred and that cannot be avoided regardless of what a manager decides to do.



Identifying Relevant Costs

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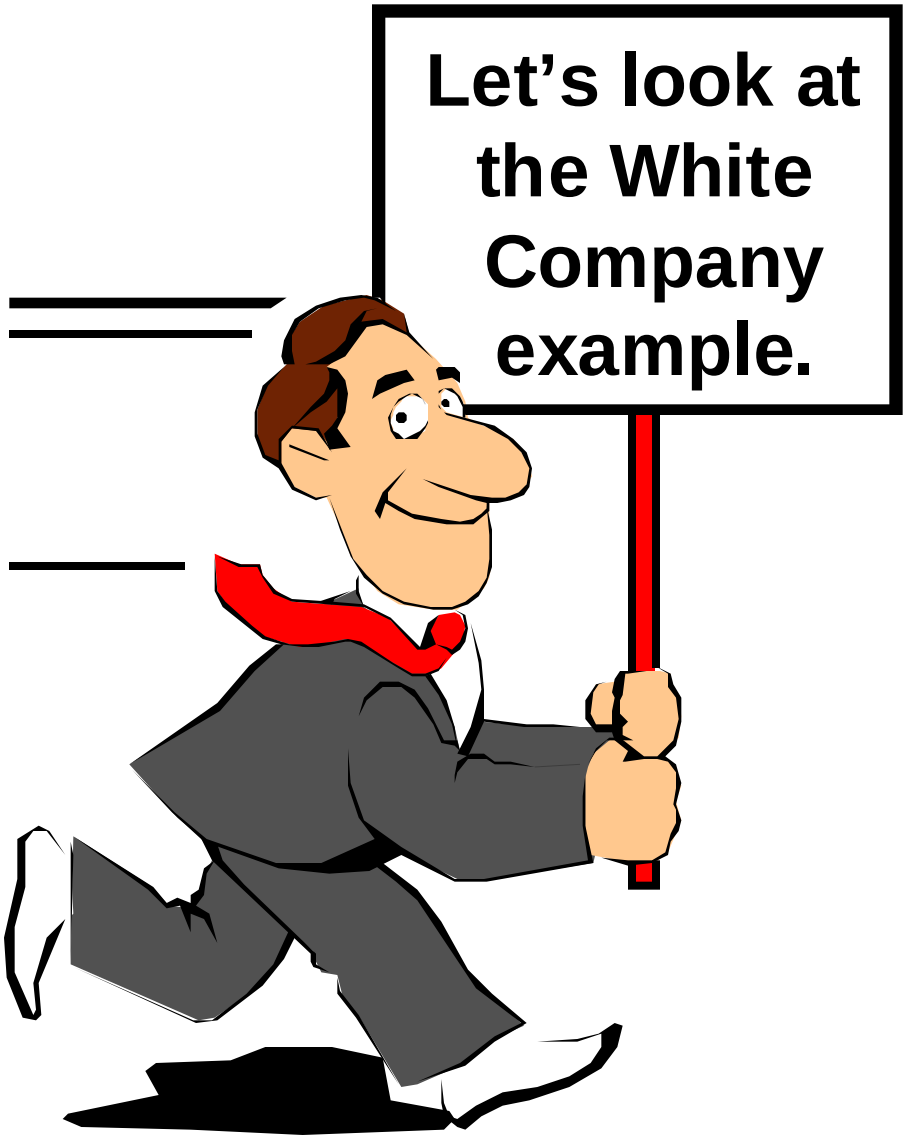
Identifying Relevant Costs

Sunk Costs are not Relevant Costs



Sunk Costs are not Relevant Costs

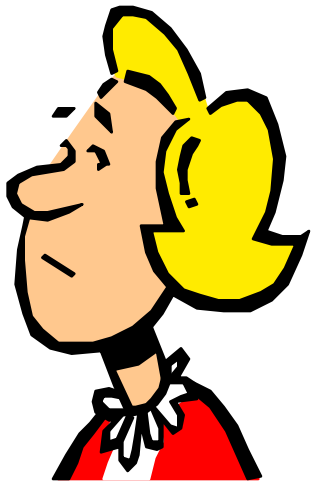
A manager at White Co. wants to replace an old machine with a new, more efficient machine.

New machine:	
List price	$ 90,000
Annual variable expenses	80,000
Expected life in years	5
Old machine:	
Original cost	$ 72,000
Remaining book value	60,000
Disposal value now	15,000
Annual variable expenses	100,000
Remaining life in years	5

Sunk Costs are not Relevant Costs

- White's sales are $200,000 per year.
- Fixed expenses, other than amortization, are $70,000 per year.

Should the manager purchase the new machine?



Incorrect Analysis

The manager recommends that the company not purchase the new machine since disposal of the old machine would result in a loss:

Remaining book value	**$ 60,000**
Disposal value	**(15,000)**
Loss from disposal	**$ 45,000**

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000		
Variable expenses	(500,000)		
Other fixed expenses			
Amortization - new			
Amortization - old			
Disposal of old machine			
Total net income			

$200,000 per year × 5 years

$100,000 per year × 5 years

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000		
Variable expenses	(500,000)		
Other fixed expenses	(350,000)		
Amortization - new			
Amortization - old			
Disposal of old machine			
Total net income			

$70,000 per year × 5 years

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000		
Variable expenses	(500,000)		
Other fixed expenses	(350,000)		
Amortization - new			
Amortization - old	(60,000)		
Disposal of old machine			
Total net income	$ 90,000		

The remaining book value of the old machine.

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000	$1,000,000	$ -
Variable expenses	(500,000)	(400,000)	100,000
Other fixed expenses	(350,000)		
Amortization - new			
Amortization - old	(60,000)		
Disposal of old machine			
Total net income	$ 90,000		

$80,000 per year × 5 years

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000	$1,000,000	$ -
Variable expenses	(500,000)	(400,000)	100,000
Other fixed expenses	(350,000)	(350,000)	-
Amortization - new		(90,000)	(90,000)
Amortization - old	(60,000)		
Disposal of old machine			
Total net income	$ 90,000		

The total cost will be amortized over the five year period.

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000	$1,000,000	$ -
Variable expenses	(500,000)	(400,000)	100,000
Other fixed expenses	(350,000)	(350,000)	-
Amortization - new		(90,000)	(90,000)
Amortization - old	(60,000)	(60,000)	-
Disposal of old machine		15,000	15,000
Total net income	$ 90,000	$ 115,000	$ 25,000

The remaining book value of the old machine is a sunk cost and is not relevant to the decision.

Correct Analysis

Look at the comparative cost and revenue for the next five years.

For Five Years	Keep Old Machine	Purchase New Machine	Difference
Sales	$1,000,000	$1,000,000	$ -
Variable expenses	(500,000)	(400,000)	100,000
Other fixed expenses	(350,000)	(350,000)	-
Amortization - new		(90,000)	(90,000)
Amortization - old	(60,000)	(60,000)	-
Disposal of old machine		15,000	15,000
Total net income	$ 90,000	$ 115,000	$ 25,000

Would you recommend purchasing the new machine even though we will show a $45,000 loss on the old machine?

Correct Analysis

Correct Analysis

Relevant Cost Analysis	
Savings in variable expenses provided by the new machine ($20,000 × 5 yrs.)	$ 100,000
Net effect	

$100,000 - $80,000 = $20,000 variable cost savings

Correct Analysis

Relevant Cost Analysis	
Savings in variable expenses provided by the new machine ($20,000 × 5 yrs.)	$ 100,000
Cost of the new machine	(90,000)
Disposal value of old machine	15,000
Net effect	$ 25,000

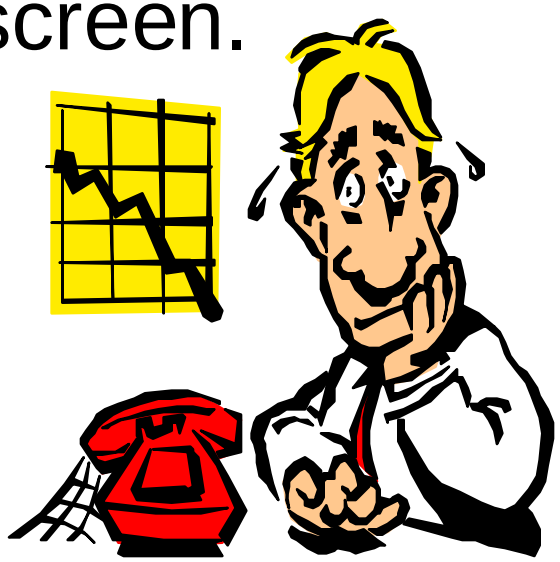
Adding/Dropping Segments

One of the most important decisions managers make is whether to add or drop a business segment such as a product or a store.

Let's see how relevant costs should be used in this decision.

Adding/Dropping Segments

Due to the declining popularity of digital watches, Lovell Company's digital watch line has not reported a profit for several years. An income statement for last year is shown on the next screen.



Adding/Dropping Segments

Segment Income Statement
Digital Watches

Sales		$ 500,000
Less: variable expenses		
Variable mfg. costs	$ 120,000	
Variable shipping costs	5,000	
Commissions	75,000	200,000
Contribution margin		$ 300,000
Less: fixed expenses		
General factory overhead	$ 60,000	
Salary of line manager	90,000	
Amortization of equipment	50,000	
Advertising - direct	100,000	
Rent - factory space	70,000	
General admin. expenses	30,000	400,000
Net loss		$ (100,000)

Adding/Dropping Segments

Segment Income Statement
Digital Watches

		000
		000
		000
General factory overhead	$ 60,000	
Salary of line manager	90,000	
Amortization of equipment	50,000	
Advertising - direct	100,000	
Rent - factory space	70,000	
General admin. expenses	30,000	400,000
Net loss		$ (100,000)

If the digital watch line is dropped, the fixed general factory overhead and general administrative expenses will be allocated to other product lines because they are not avoidable.

Adding/Dropping Segments

Segment Income Statement
Digital Watches

Sales		$ 500,000
Less: variable expenses		
Less: fixed expenses		200,000
		$ 300,000
General factory overhead	$ 60,000	
Salary of line manager	90,000	
Amortization of equipment		
Advertising - direct		
Rent - factory space		
General admin. expenses	30,000	400,000
Net loss		$ (100,000)

The equipment used to manufacture digital watches has no resale value or alternative use.

Should Lovell retain or drop the digital watch segment?

A Contribution Margin Approach

DECISION RULE

Lovell should drop the digital watch segment only if its fixed cost savings *exceed* lost contribution margin.

Let's look at this solution.

A Contribution Margin Approach

Contribution Margin Solution

Contribution margin lost if digital watches are dropped		$ (300,000)
Less fixed costs that can be avoided		
Salary of the line manager	$ 90,000	
Advertising - direct	100,000	
Rent - factory space	70,000	260,000
Net disadvantage		$ (40,000)

Remember, amortization on equipment with no resale value is not relevant to the decision since it is a sunk cost and is not avoidable.

Comparative Income Approach

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

Let's look at this second approach.

Comparative Income Approach
Solution

	Keep Digital Watches	Drop Digital Watches	Difference
Sales	$ 500,000	$ -	$ (500,000)
Less variable expenses:		-	
Mfg. expenses	120,000	-	120,000
Freight out	5,000	-	5,000
Commissions	75,000	-	75,000
Total variable expenses	200,000	-	200,000
Contribution margin	300,000	-	(300,000)
Less fixed expenses:			
General factory overhead	60,000	60,000	-
Salary of line manager	90,000	-	90,000
Amortization	50,000	50,000	-
Advertising - direct	100,000	-	100,000
Rent - factory space	70,000	-	70,000
General admin. expenses	30,000	30,000	-
Total fixed expenses	400,000	140,000	260,000
Net loss	$(100,000)	$(140,000)	$ (40,000)

Beware of Allocated Fixed Costs

Beware of Allocated Fixed Costs

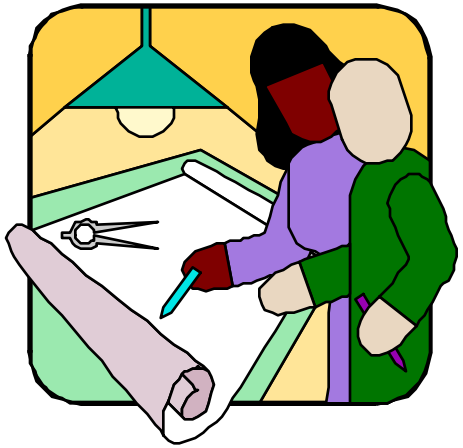
Part of the answer lies in the way we allocate common fixed costs to our products.

Beware of Allocated Fixed Costs

The 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.

Let’s look at the Essex Company example.



The Make or Buy Decision

- Essex manufactures part 4A that is currently used in one of its products.
- The unit cost to make this part is:

Direct materials	$ 9
Direct labour	5
Variable overhead	1
Amortization of special equip.	3
Supervisor's salary	2
General factory overhead	10
Total cost per unit	$ 30

The Make or Buy Decision

- The special equipment used to manufacture part 4A has no resale value.
- General factory overhead is allocated on the basis of direct labour hours.
- The $30 total unit cost is based on 20,000 parts produced each year.
- An outside supplier has offered to provide the 20,000 parts at a cost of $25 per part.

Should we accept the supplier's offer?

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	$ 25		$ 500,000
Direct materials	$ 9	180,000	
Direct labour	5	100,000	
Variable overhead	1	20,000	
Amortization of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	$ 30	$ 340,000	$ 500,000

20,000 × $9 per unit = $180,000

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	$ 25		$ 500,000
Direct materials	$ 9	180,000	
Direct labour	5	100,000	
Variable overhead	1	20,000	
Amortization of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	$ 30	$ 340,000	$ 500,000

The special equipment has no resale value and is a sunk cost.

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	$ 25		$ 500,000
Direct materials	$ 9	180,000	
Direct labour	5	100,000	
Variable overhead	1	20,000	
Amortization of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	$ 30	$ 340,000	$ 500,000

Not avoidable and is irrelevant. If the product is dropped, it will be reallocated to other products.

The Make or Buy Decision

	Cost Per Unit	Cost of 20,000 Units	
		Make	Buy
Outside purchase price	$ 25		$ 500,000
Direct materials	$ 9	180,000	
Direct labour	5	100,000	
Variable overhead	1	20,000	
Amortization of equip.	3	-	
Supervisor's salary	2	40,000	
General factory overhead	10	-	
Total cost	$ 30	$ 340,000	$ 500,000

Should we make or buy part 4A?

The Make or Buy Decision

DECISION RULE

In deciding whether to accept the outside supplier's offer, Essex isolated the relevant costs of making the part by eliminating:

- The sunk costs.
- The future costs that will not differ between making or buying the parts.

The Matter of Opportunity Cost

The economic benefits that are foregone as a result of pursuing some course of action. Opportunity costs are not actual dollar outlays and are not recorded in the accounts of an organization.

Special Orders

- Jet, Inc. receives a one-time order that is not considered part of its normal ongoing business.
- Jet, Inc. makes a single product with a unit variable cost of $8. Normal selling price is $20 per unit.
- A foreign distributor offers to purchase 3,000 units for $10 per unit.
- Annual capacity is 10,000 units, and annual fixed costs total $48,000, but Jet, Inc. is currently producing and selling only 5,000 units.

Should Jet accept the offer?

Special Orders

Jet, Inc.
Contribution Income Statement

Revenue (5,000 × $20)		$100,000
Variable costs:		
Direct materials	$20,000	
Direct labour	5,000	
Manufacturing overhead	10,000	
Marketing costs	5,000	
Total variable costs		40,000
Contribution margin		60,000
Fixed costs:		
Manufacturing overhead	$28,000	
Marketing costs	20,000	
Total fixed costs		48,000
Net income		$ 12,000

Special Orders

If Jet accepts the offer, net income will increase by $6,000.

Increase in revenue (3,000 × $10)	$30,000
Increase in costs (3,000 × $8 variable cost)	24,000
Increase in net income	$ 6,000

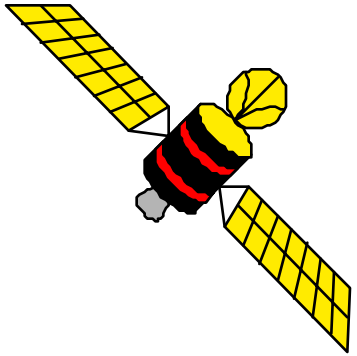
We can reach the same results more quickly like this:

Special order contribution margin = $10 – $8 = $2
Change in income = $2 × 3,000 units = $6,000.

Utilization of a Constrained Resource

- Firms often face the problem of deciding how to best utilize a constrained resource.
- Usually, fixed costs are not affected by this particular decision, so management can focus on maximizing total contribution margin.

Let's look at the Ensign Company example.



Utilization of a Constrained Resource

Ensign Company produces two products and selected data is shown below:

	Product 1	Product 2
Selling price per unit	$ 60	$ 50
Less variable expenses per unit	36	35
Contribution margin per unit	$ 24	$ 15
Current demand per week (units)	2,000	2,200
Contribution margin ratio	40%	30%
Processing time required on machine A1 per unit	1.00 min.	0.50 min.

Utilization of a Constrained Resource

- Machine A1 is the constrained resource. There is excess capacity on all other machines. Machine A1 is being used at 100% of its capacity, and has a capacity of 2,400 minutes per week.

Should Ensign focus its efforts on Product 1 or 2?

Utilization of a Constrained Resource

Let's calculate the contribution margin per unit of the constrained resource, machine A1.

		Product 1			Product 2	
Contribution margin per unit		$ 24			$ 15	
Time required to produce one unit	÷	1.00	min.	÷	0.50	min.
Contribution margin per minute		$ 24	min.		$ 30	min.

Product 2 should be emphasized. Provides more valuable use of the constrained resource machine A1, yielding a contribution margin of $30 per minute as opposed to $24 for Product 1.

Utilization of a Constrained Resource

Let's calculate the contribution margin per unit of the scarce resource, machine A1.

		Product 1			Product 2	
Contribution margin per unit		$ 24			$ 15	
Time required to produce one unit	÷	1.00	min.	÷	0.50	min.
Contribution margin per minute		$ 24	min.		$ 30	min.

If there are no other considerations, the best plan would be to produce to meet current demand for Product 2 and then use remaining capacity to make Product 1.

Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Recource (Machine A1)

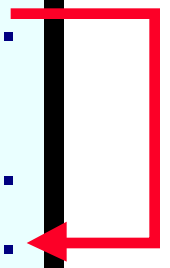
Weekly demand for Product 2		2,200	units
Time required per unit	×	0.50	min.
Total time required to make Product 2		1,100	min.

Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Recource (Machine A1)

Weekly demand for Product 2		2,200	units
Time required per unit	×	0.50	min.
Total time required to make Product 2		1,100	min.
Total time available		2,400	min.
Time used to make Product 2		1,100	min.
Time available for Product 1		1,300	min.



Utilization of a Constrained Resource

Let's see how this plan would work.

Alloting Our Constrained Recource (Machine A1)

Weekly demand for Product 2		2,200	units
Time required per unit	×	0.50	min.
Total time required to make Product 2		1,100	min.
Total time available		2,400	min.
Time used to make Product 2		1,100	min.
Time available for Product 1		1,300	min.
Time required per unit	÷	1.00	min.
Production of Product 1		1,300	units

Utilization of a Constrained Resource

According to the plan, we will produce 2,200 units of Product 2 and 1,300 of Product 1. Our contribution margin looks like this.

	Product 1	Product 2
Production and sales (units)	1,300	2,200
Contribution margin per unit	$ 24	$ 15
Total contribution margin	$ 31,200	$ 33,000

The total contribution margin for Ensign is $64,200.

Managing Constraints

Produce only what can be sold.

At the bottleneck itself:

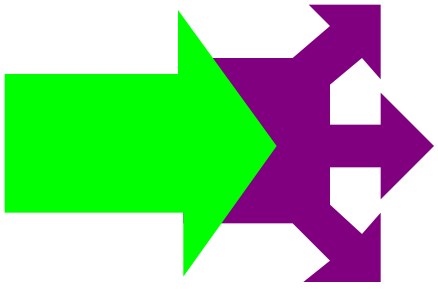
- **Improve the process**
- **Add overtime or another shift**
- **Hire new workers or acquire more machines**
- **Subcontract production**

Eliminate waste.

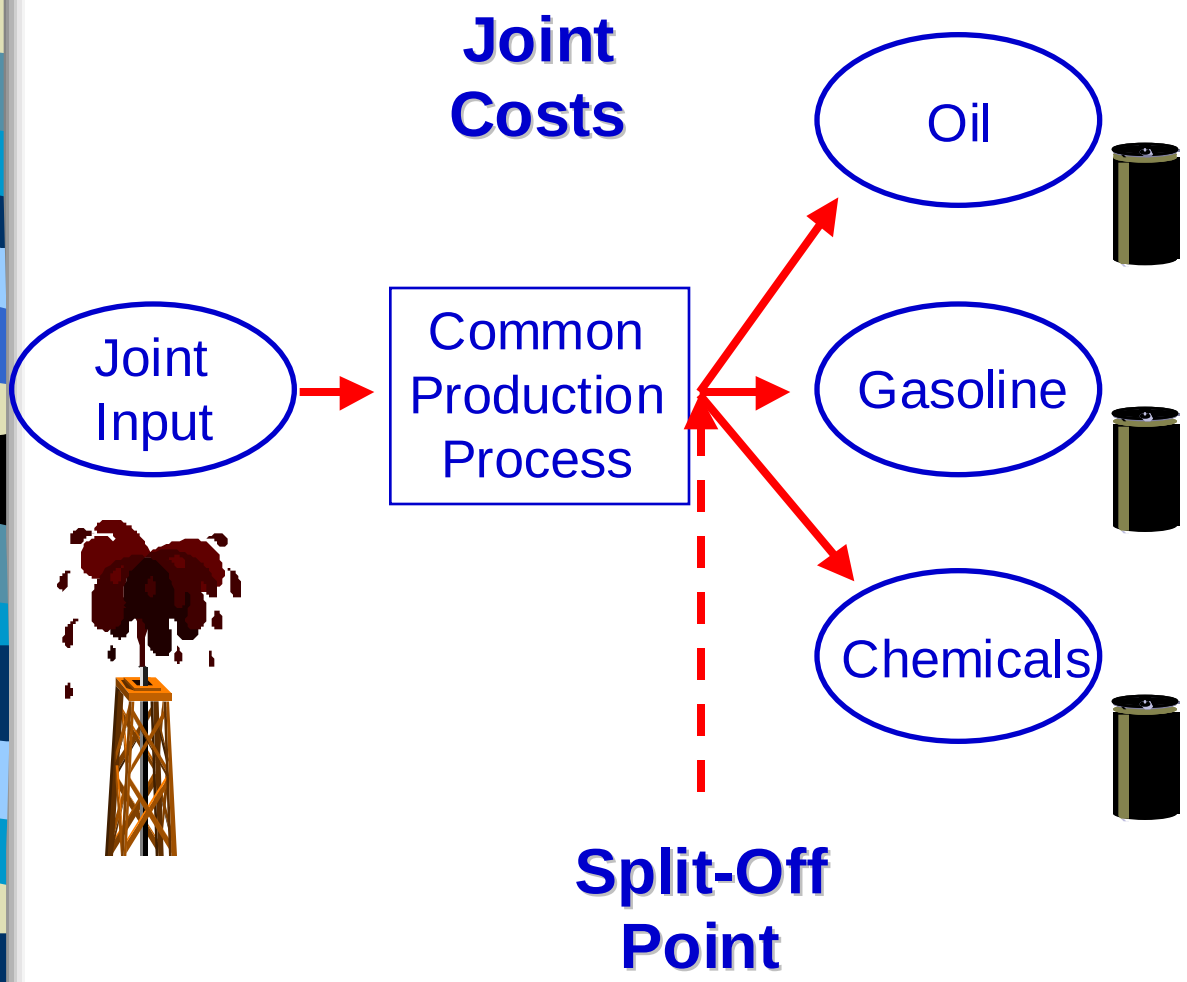
Streamline production process.

Joint Product Costs

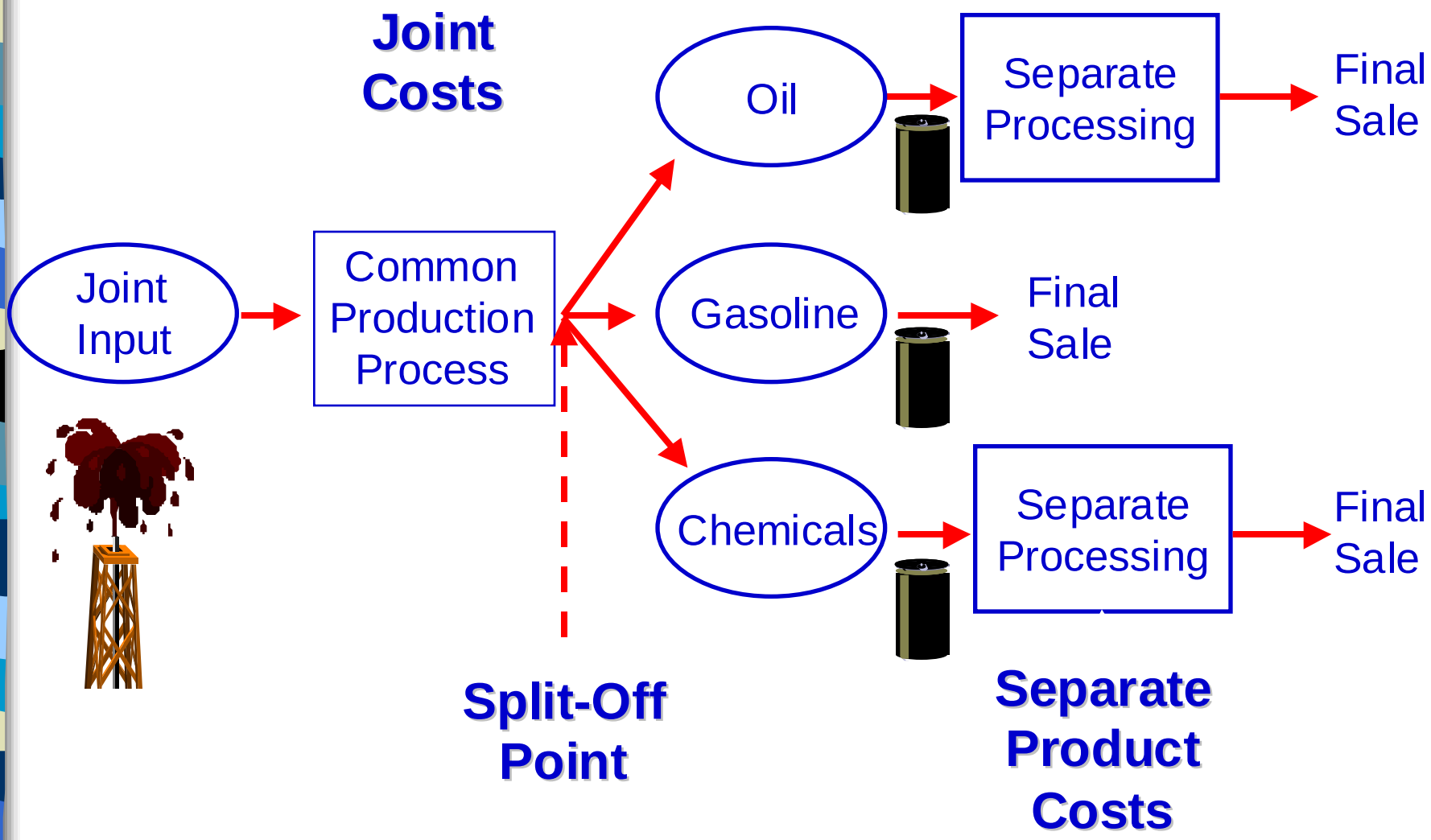
- In some industries, a number of end products are produced from a single raw material input.
- Two or more products produced from a common input are called joint products.
- The point in the manufacturing process where each joint product can be recognized as a separate product is called the split-off point.



Joint Products



Joint Products



The Pitfalls of Allocation

Joint costs are really common costs incurred to simultaneously produce a variety of end products.

Joint costs are often allocated to end products on the basis of the **relative sales value** of each product or on some other basis.

Sell or Process Further

It will always be profitable to continue processing a joint product after the split-off point so long as the incremental revenue exceeds the incremental processing costs incurred after the split-off point.

Let's look at the Sawmill, Inc. example.

Sell or Process Further

- Sawmill, Inc. cuts logs from which unfinished lumber and sawdust are the immediate joint products.
- Unfinished lumber is sold “as is” or can be processed further into finished lumber.
- Sawdust can also be sold “as is” to gardening wholesalers or processed further into “presto-logs.”

Sell or Process Further

Data about Sawmill's joint products includes:

	Per Log	
	Lumber	Sawdust
Sales value at the split-off point	$ 140	$ 40
Sales value after further processing	270	50
Allocated joint product costs	176	24
Cost of further processing	50	20

Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	$ 270	$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10

Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	$ 270	$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10
Cost of further processing	50	20
Profit (loss) from further processing	$ 80	$ (10)

Sell or Process Further

Analysis of Sell or Process Further

	Per Log	
	Lumber	Sawdust
Sales value after further processing	$ 270	$ 50
Sales value at the split-off point	140	40
Incremental revenue	130	10
Cost of further processing	50	20
Profit (loss) from further processing	$ 80	$ (10)

Should we process the lumber further and sell the sawdust "as is"?

End of Chapter 13