Advanced Cost Assignment

- Towards decision-making relevance

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III. Cost Allocation: Joint Products and Byproducts

Agenda:
Learning Objectives for this session

17.1 Identify the split off point in a joint-cost situation and distinguish joint products from byproducts

17.2 Explain why joint costs are allocated to individual products

17.3 Allocate joint costs using four methods

17.4 Identify situations where the sales value at splitoff method is preferred when allocating joint costs

17.5 Explain why joint costs are irrelevant in a sell-or-process further decision

17.6 Account for byproducts using two methods

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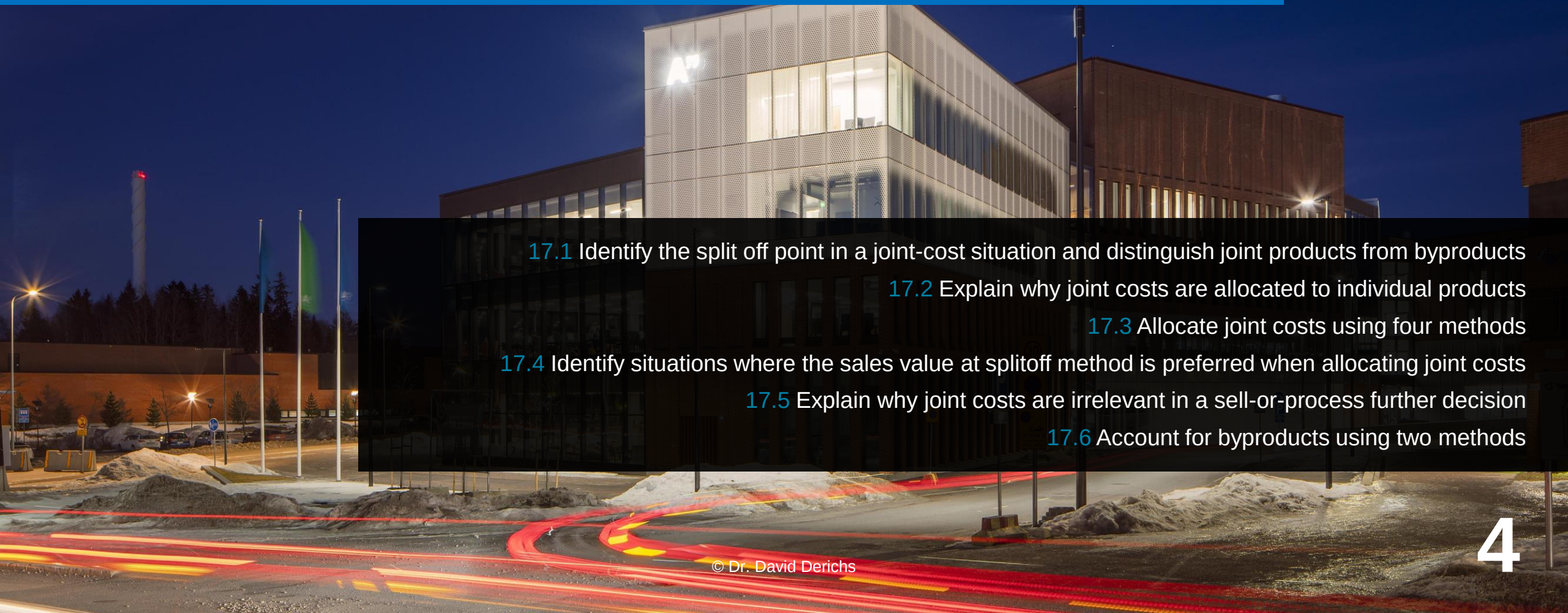
III. Cost Allocation: Joint Products and Byproducts



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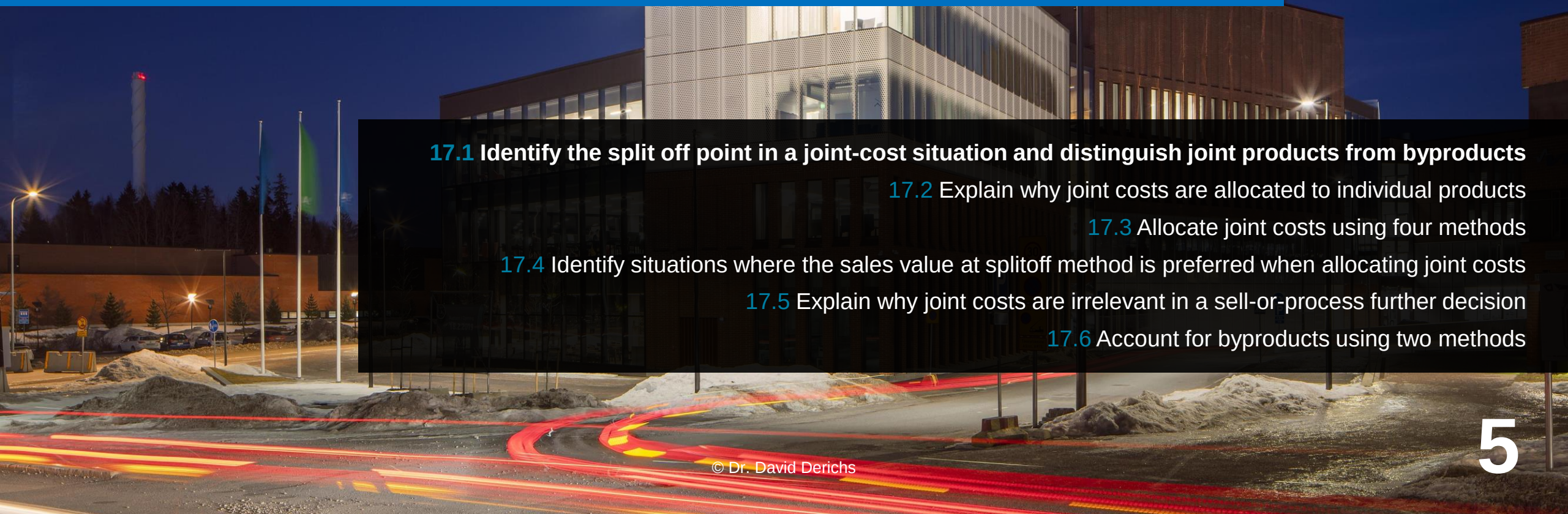

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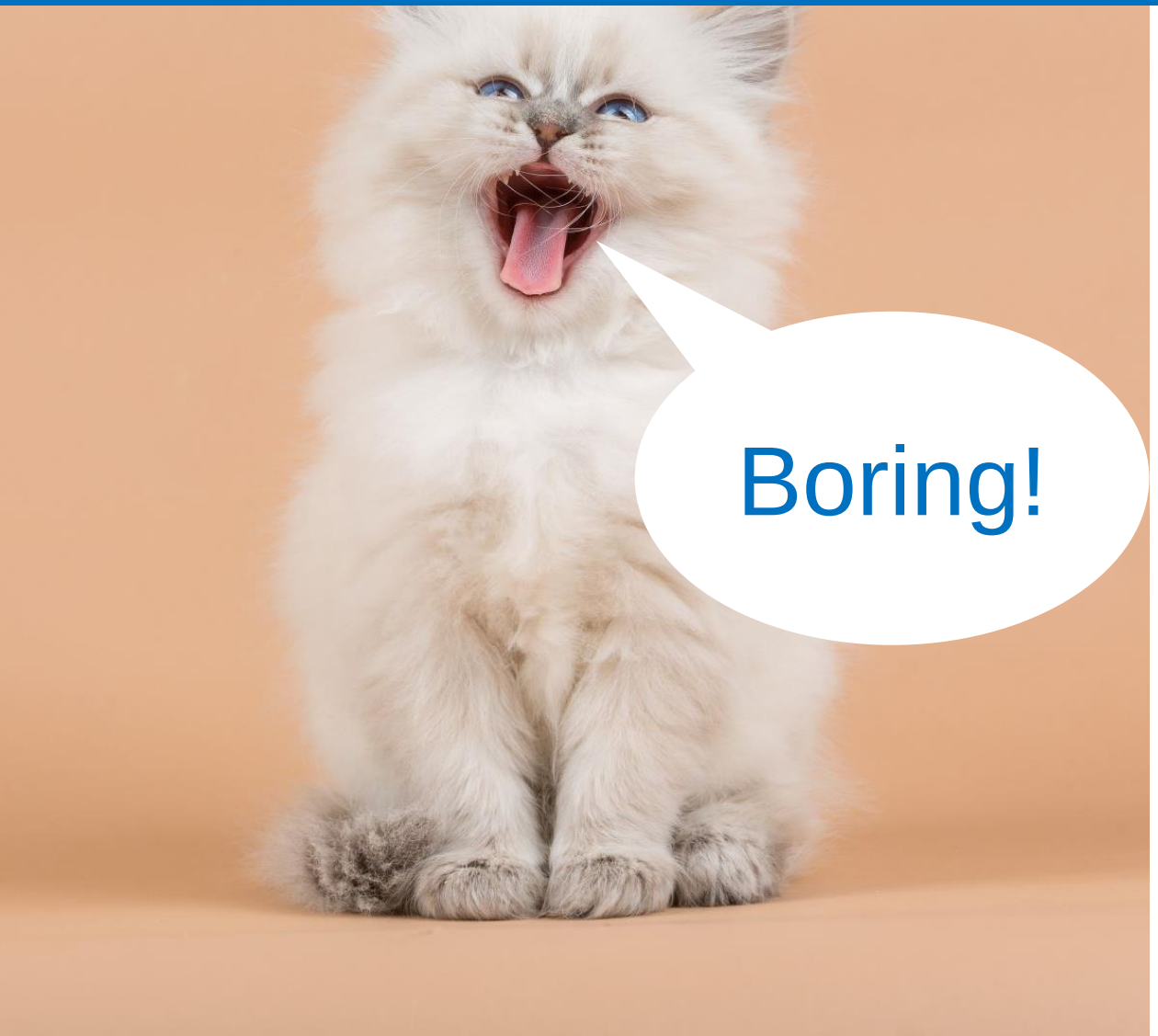
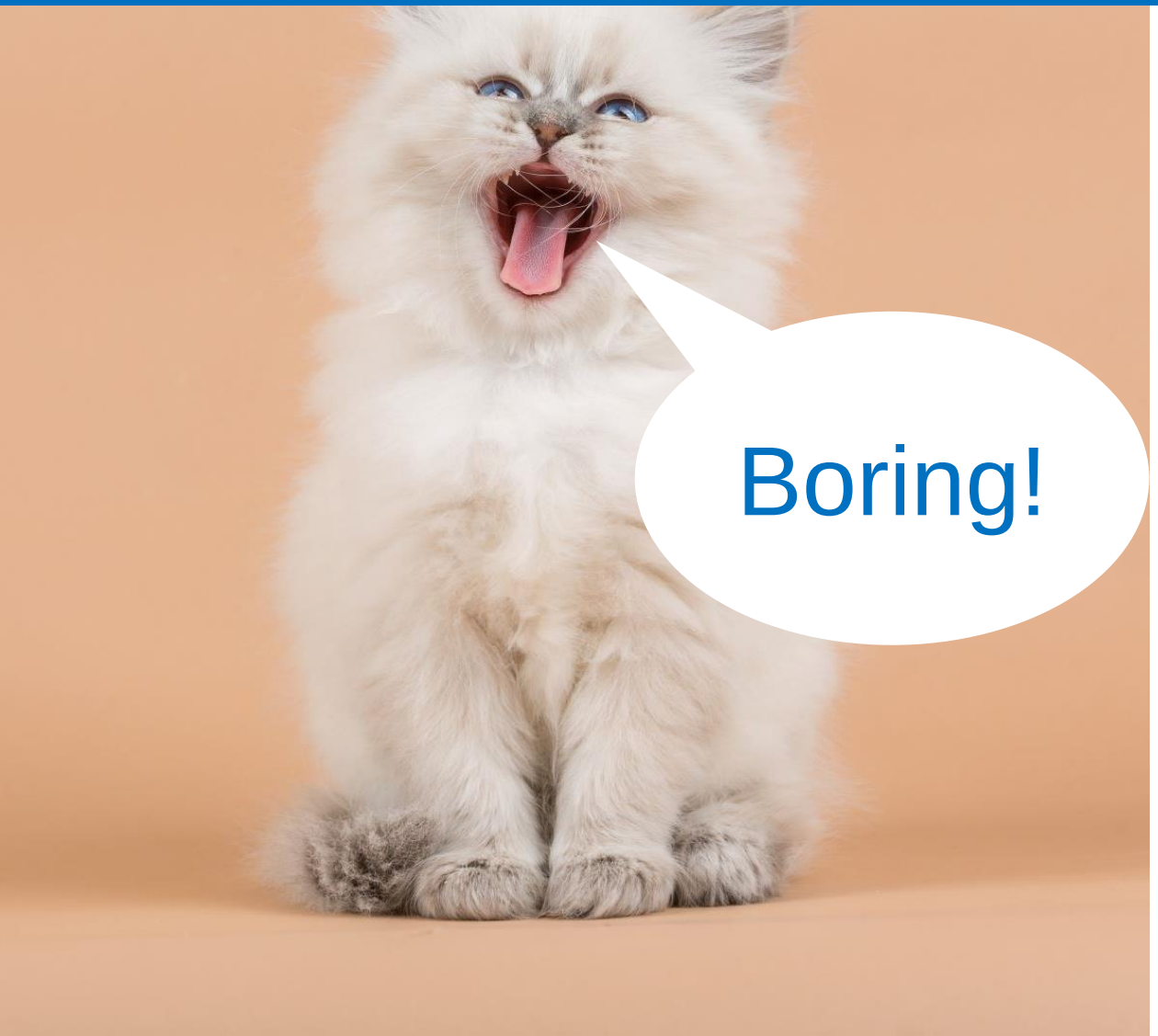
Joint Cost Terminology (1 of 3)



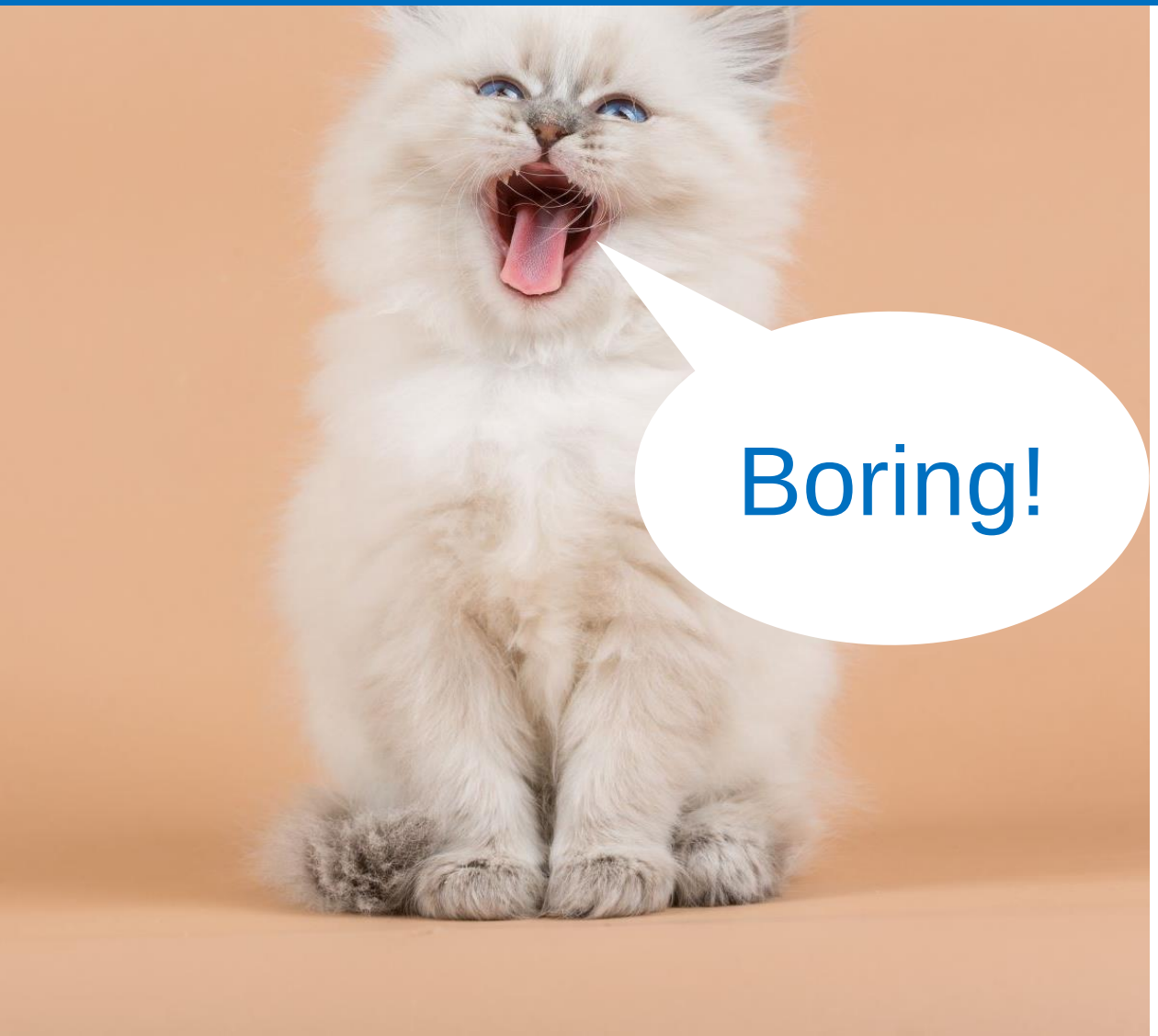
- **Joint costs**—the costs of a production process that yields multiple products simultaneously
- **Split off point**—the juncture in a joint production process when two or more products become separately identifiable
- **Separable costs**—all costs (manufacturing, marketing, distribution, and so on) incurred beyond the split off point that are assignable to each of the specific products identified at the split off point

Joint Cost Terminology (2 of 3)



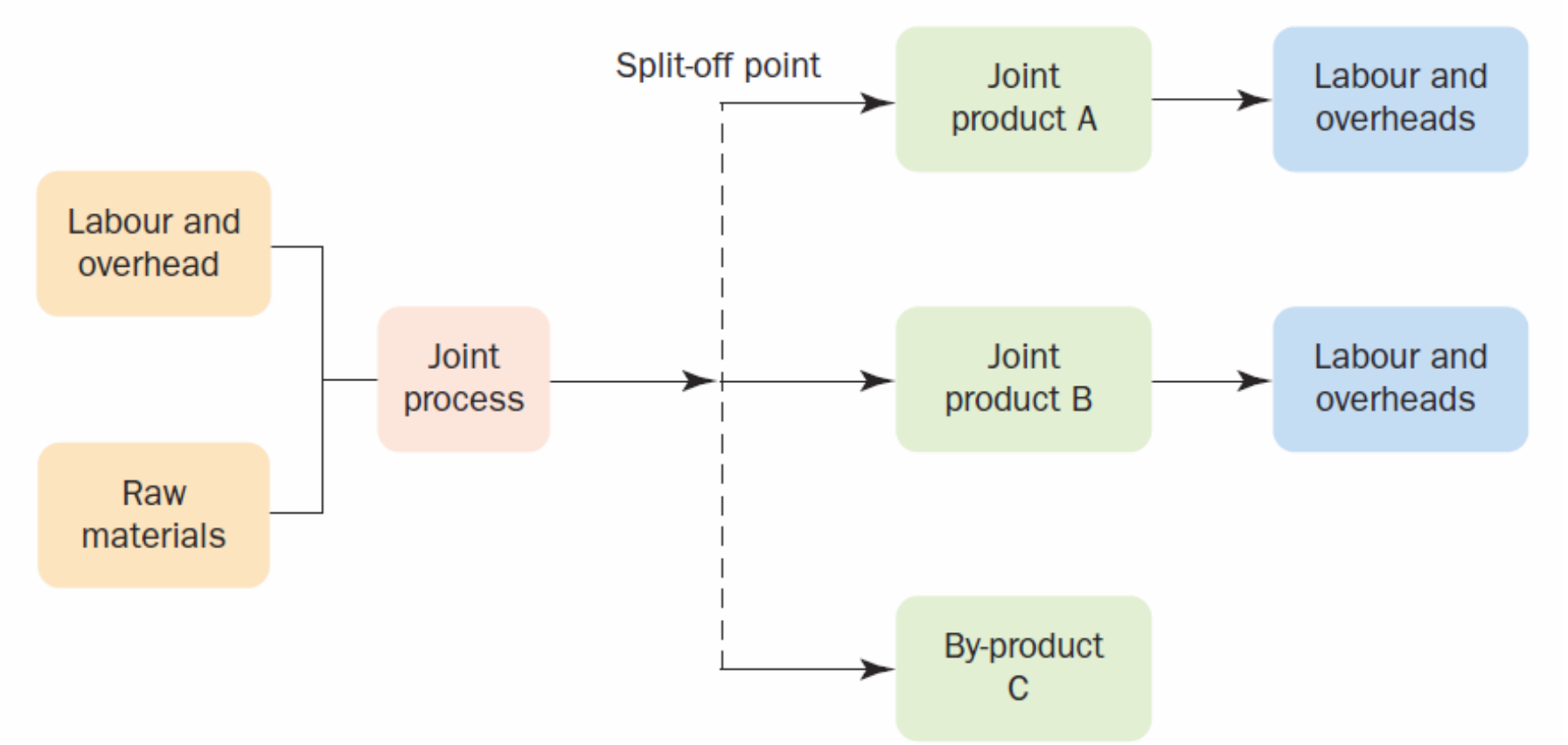
- Categories of joint process outputs
  1. **Outputs with a positive sales value**
  2. **Outputs with a zero sales value**
- Product—any output with a positive sales value, or an output that enables a firm to avoid incurring costs
  - Sales value can be high or low.

Joint Cost Terminology (3 of 3)



- **Main product**—output of a joint production process that yields one product with a high sales value compared to the sales values of the other outputs
- **Joint products**—outputs of a joint production process that yields two or more products with a high sales value compared to the sales values of any other outputs
- **Byproducts**—outputs of a joint production process that have low sales values compared to the sales values of the other outputs

Visualizing joint and by-products



Source: Datar/Rajan (2021)

Come up with products that have a split of point!

Examples of Joint Cost Situations

Example: Gold / Uranium mining

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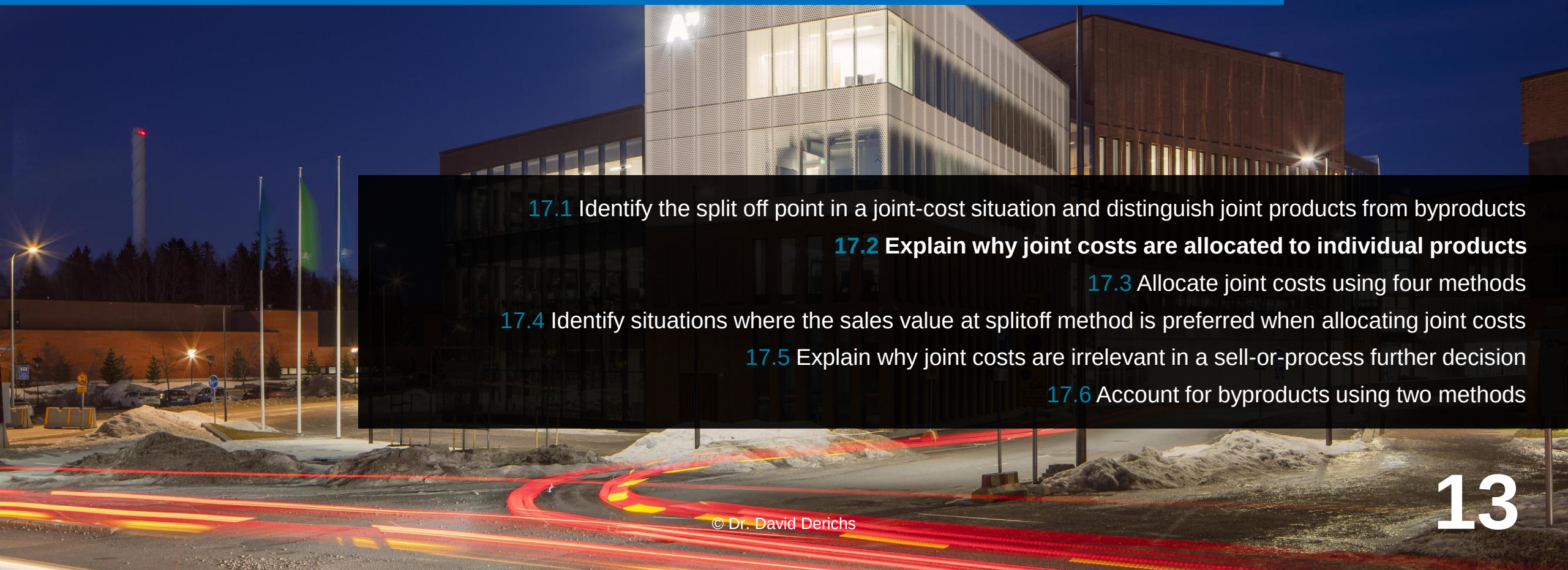
17.2 Explain why joint costs are allocated to individual products



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Allocating Joint Costs

Before a manager is able to allocate joint costs, they must first look at the context for doing so. Joint costs must be allocated to individual products or services for **several purposes**:

- Computation of inventoriable costs and cost of goods sold for **financial accounting and tax reporting**
- **Reimbursing companies** that have some, but not all, of their products or services reimbursed under cost-plus contracts
- **Regulating the rates or prices** of one or more of the jointly produced products or services
- **Litigation or insurance settlement** situations

Source: Datar/Rajan (2021)
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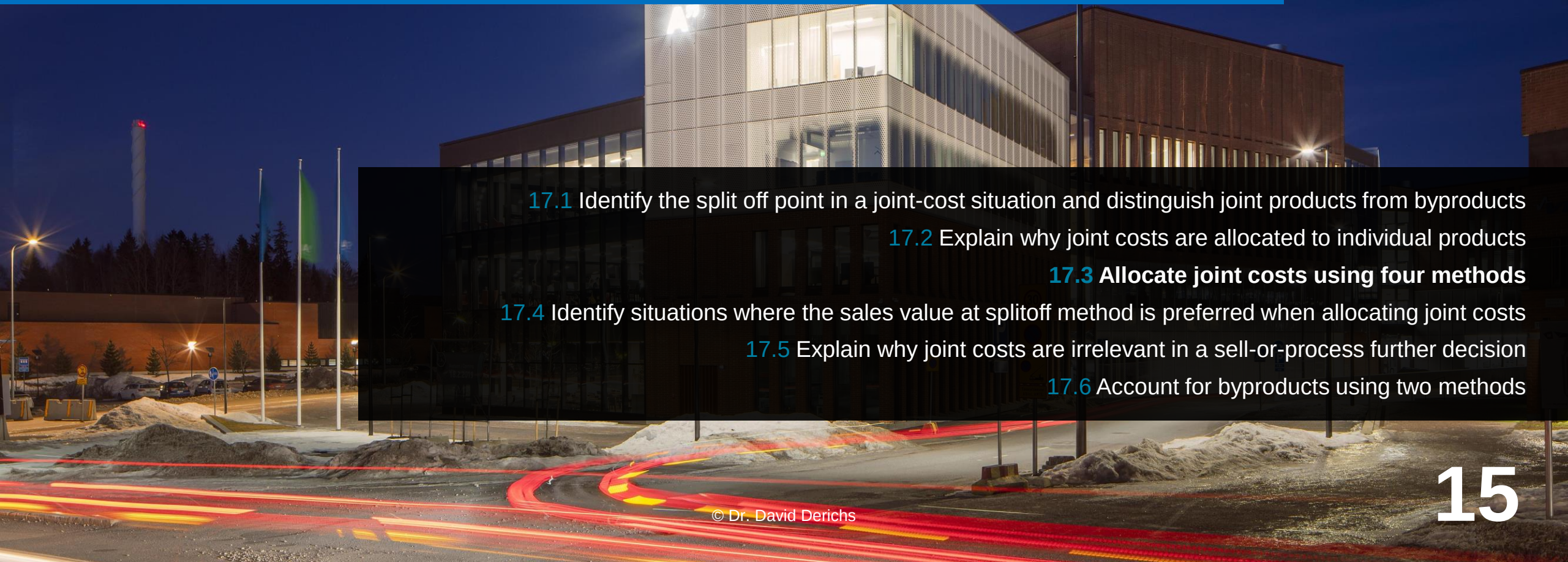
17.3 Allocate joint costs using four methods



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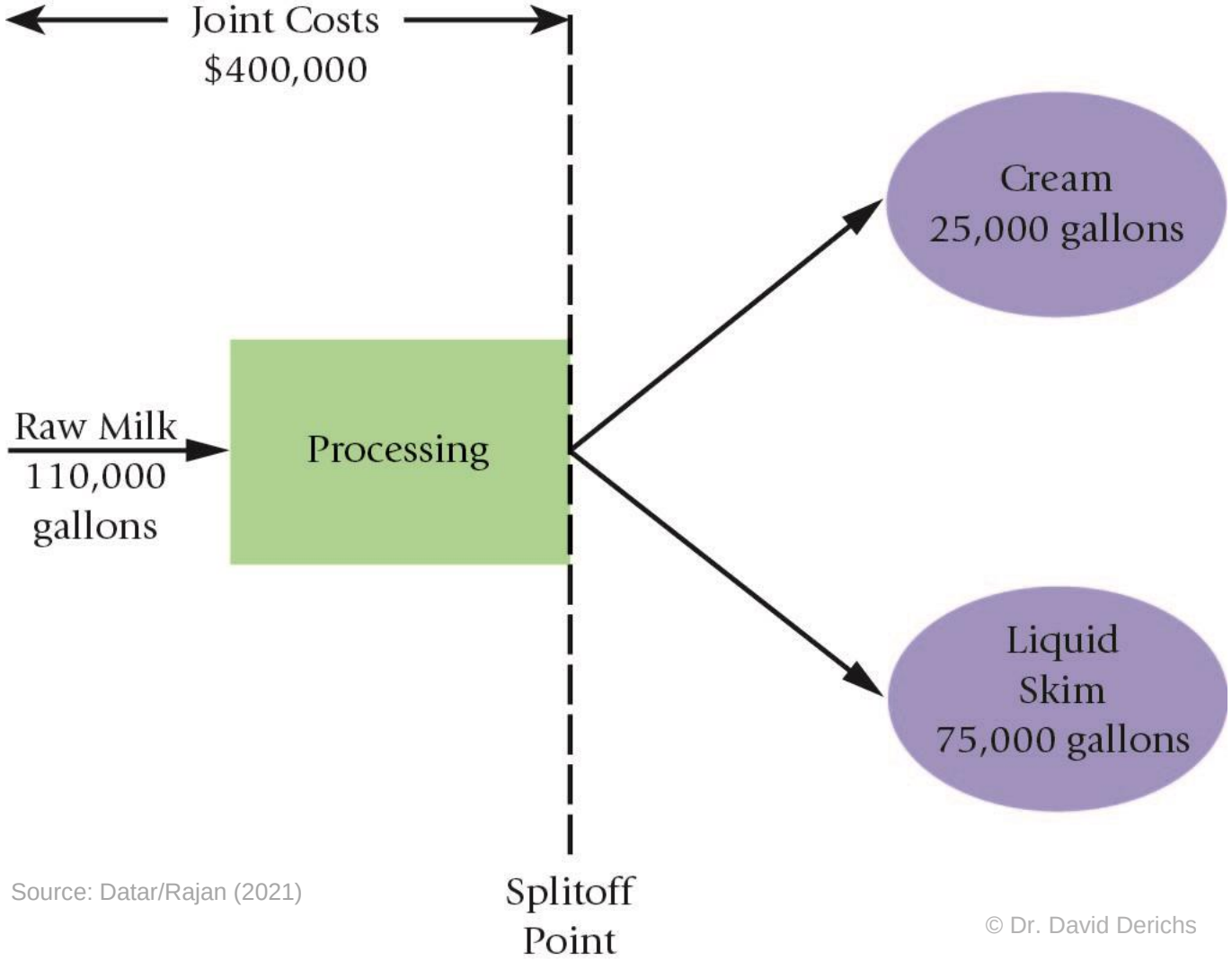
Joint Cost Illustration Overview



Source: Datar/Rajan (2021)

Two Approaches to Allocating Joint Costs

1. **Market-based**—allocate using market-derived data (dollars)
   a. Sales value at splitoff method
   b. Net realizable value (NRV) method
   c. Constant gross-margin percentage NRV method
2. **Physical measures**—allocate using tangible attributes of the products, such as weight, quantity, or volume of the joint products

Joint Cost Example Data

	A	B	C
1		Joint Costs	
2	Joint costs (costs of 110,000 gallons raw milk and processing to splitoff point)	$400,000	
3			
4		Cream	Liquid Skim
5	Beginning inventory (gallons)	0	0
6	Production (gallons)	25,000	75,000
7	Sales (gallons)	20,000	30,000
8	Ending inventory (gallons)	5,000	45,000
9	Selling price per gallon	$ 8	$ 4

Source: Datar/Rajan (2021)
Managerial Accounting

1.a. Sales Value at Split Off Method

Source: Datar/Rajan (2021)

- The sales value at split off method allocates joint costs to joint products produced during the accounting period on the **basis of the relative total sales value at the split off point**.
- This method uses the **sales value of the entire production of the accounting period**, not just the quantity sold.
- The sales value at split off method **follows the benefits-received criterion** of cost allocation.

1.a. Sales Value at Split Off Example

	A	B	C	D
1	**PANEL A: Allocation of Joint Costs Using Sales Value at Splitoff Method**	**Cream**	**Liquid Skim**	**Total**
2	Sales value of total production at splitoff point			
3	(25,000 gallons × $8 per gallon; 75,000 gallons × $4 per gallon)	$200,000	$300,000	$500,000
4	Weighting ($200,000 ÷ $500,000; $300,000 ÷ 500,000)	0.40	0.60	
5	Joint costs allocated (0.40 × $400,000; 0.60 × $400,000)	$160,000	$240,000	$400,000
6	Joint production cost per gallon			
7	($160,000 ÷ 25,000 gallons; $240,000 ÷ 75,000 gallons)	$ 6.40	$ 3.20	
8				
9	**PANEL B: Product-Line Income Statement Using Sales Value at Splitoff Method for May 2017**	**Cream**	**Liquid Skim**	**Total**
10	Revenues (20,000 gallons × $8 per gallon; 30,000 gallons × $4 per gallon)	$160,000	$120,000	$280,000
11	Cost of goods sold (joint costs):			
12	Production costs (0.40 × $400,000; 0.60 × $400,000)	160,000	240,000	400,000
13	Deduct ending inventory (5,000 gallons × $6.40 per gallon; 45,000 gallons × $3.20 per gallon)	32,000	144,000	176,000
14	Cost of goods sold (joint costs)	128,000	96,000	224,000
15	Gross margin	$ 32,000	$ 24,000	$ 56,000
16	Gross margin percentage ($32,000 ÷ $160,000; $24,000 ÷ $120,000; $56,000 ÷ $280,000)	20%	20%	20%

Source: Datar/Rajan (2021)
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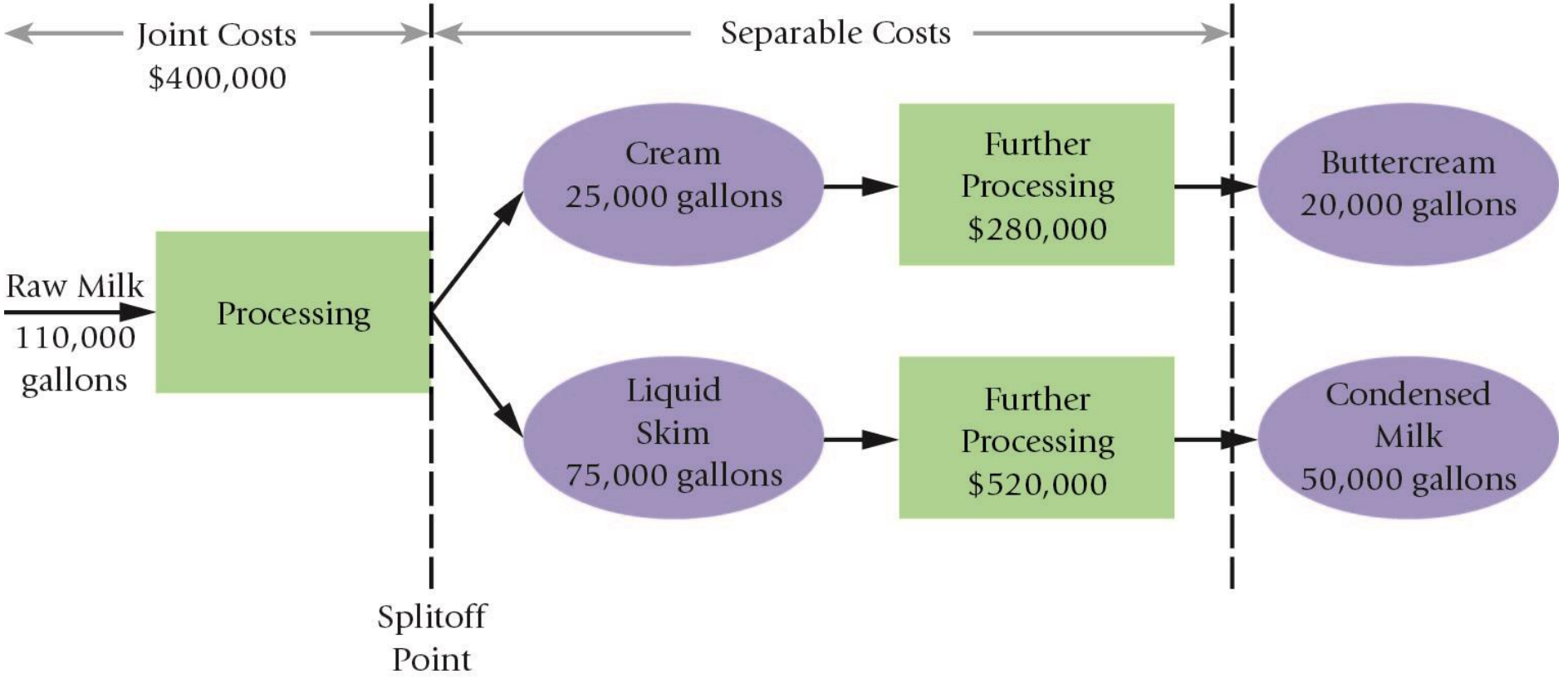
Exercise Time – E1 Question 1.a)

1.b. Net Realizable Value Method (NRV)

Source: Datar/Rajan (2021)

- Allocates joint costs to joint products produced during the accounting period **on the basis of relative NRV**.
- **NRV = Final Sales Value – Separable Costs.**
- In many cases, **products are processed beyond the split off point** to bring them to a marketable form or to increase their value above their selling price at the split off point.

1.b. Net Realizable Value Method Overview



Source: Datar/Rajan (2021)
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1.b. Net Realizable Value Method Example (1 of 2)

	A	B	C	D	E
1		Joint Costs		Buttercream	Condensed Milk
2	Joint costs (costs of 110,000 gallons raw milk and processing to splitoff point)	$400,000			
3	Separable cost of processing 25,000 gallons cream into 20,000 gallons buttercream			$280,000	
4	Separable cost of processing 75,000 gallons liquid skim into 50,000 gallons condensed milk				$520,000
5					
6		Cream	Liquid Skim	Buttercream	Condensed Milk
7	Beginning inventory (gallons)	0	0	0	0
8	Production (gallons)	25,000	75,000	20,000	50,000
9	Transfer for further processing (gallons)	25,000	75,000		
10	Sales (gallons)			12,000	45,000
11	Ending inventory (gallons)	0	0	8,000	5,000
12	Selling price per gallon	$ 8	$ 4	$ 25	$ 22

Source: Datar/Rajan (2021)
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1.b. Net Realizable Value Method Example (2 of 2)

	A	B	C	D
1	**PANEL A: Allocation of Joint Costs Using Net Realizable Value Method**	**Buttercream**	**Condensed Milk**	**Total**
2	Final sales value of total production during accounting period			
3	(20,000 gallons × $25 per gallon; 50,000 gallons × $22 per gallon)	$500,000	$1,100,000	$1,600,000
4	Deduct separable costs	280,000	520,000	800,000
5	Net realizable value at splitoff point	$220,000	$ 580,000	$ 800,000
6	Weighting ($220,000 ÷ $800,000; $580,000 ÷ $800,000)	0.275	0.725	
7	Joint costs allocated (0.275 × $400,000; 0.725 × $400,000)	$110,000	$ 290,000	$ 400,000
8	Production cost per gallon			
9	([$110,000 + $280,000] ÷ 20,000 gallons; [$290,000 + $520,000] ÷ 50,000 gallons)	$ 19.50	$ 16.20	
10				
11	**PANEL B: Product-Line Income Statement Using Net Realizable Value Method for May 2017**	**Buttercream**	**Condensed Milk**	**Total**
12	Revenues (12,000 gallons × $25 per gallon; 45,000 gallons × $22 per gallon)	$300,000	$ 990,000	$1,290,000
13	Cost of goods sold:			
14	Joint costs (0.275 × $400,000; 0.725 × $400,000)	110,000	290,000	400,000
15	Separable costs	280,000	520,000	800,000
16	Production costs	390,000	810,000	1,200,000
17	Deduct ending inventory (8,000 gallons × $19.50 per gallon; 5,000 gallons × $16.20 per gallon)	156,000	81,000	237,000
18	Cost of goods sold	234,000	729,000	963,000
19	Gross margin	$ 66,000	$ 261,000	$ 327,000
20	Gross margin percentage ($66,000 ÷ $300,000; $261,000 ÷ $990,000; $327,000 ÷ $1,290,000)	22.0%	26.4%	25.3%

Source: Datar/Rajan (2021)

Exercise Time – E1 Question 1.c)

1.c. Constant Gross Margin Percentage NRV Method: Three Steps

The constant gross margin percentage NRV method can be broken down into three steps:

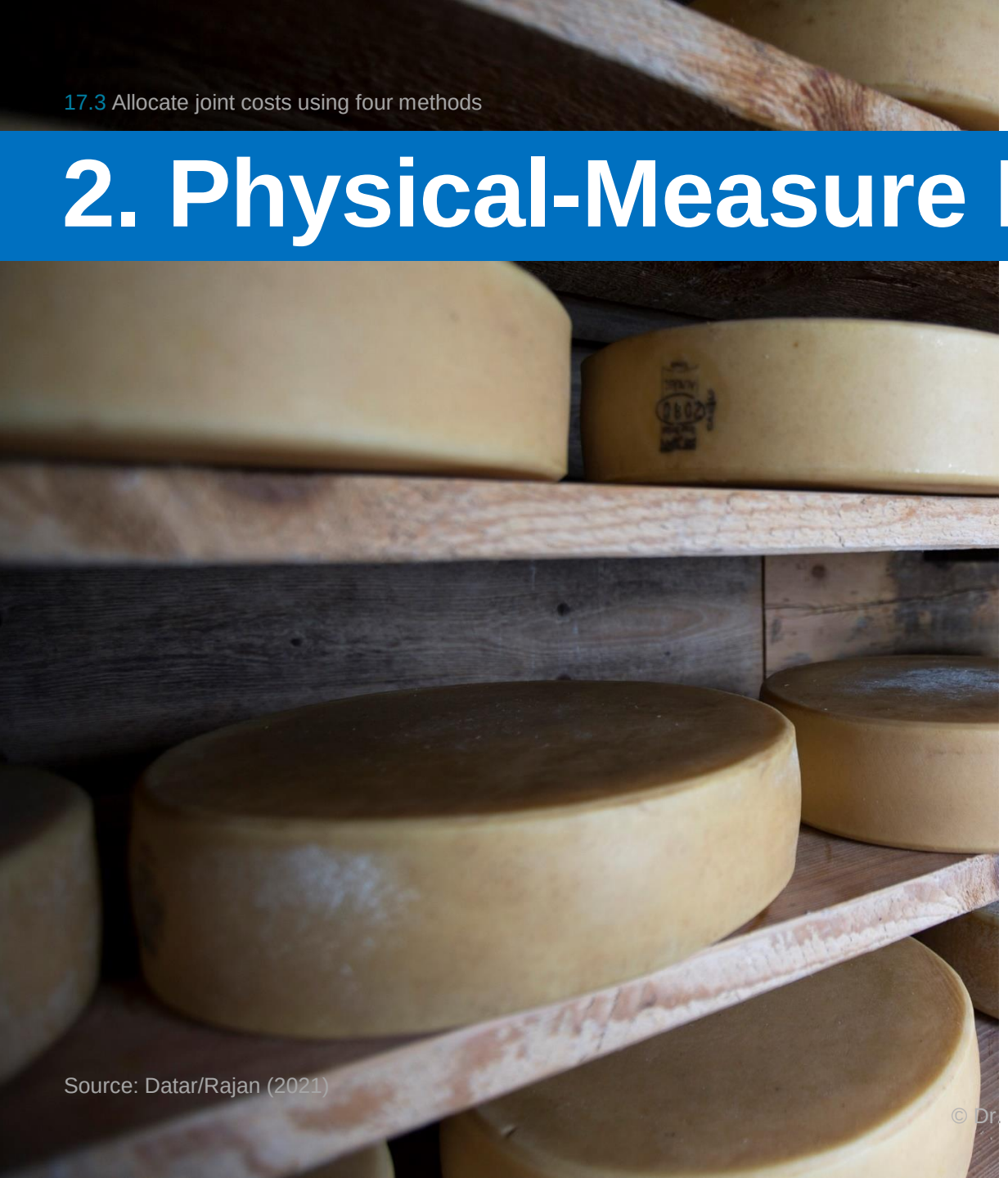
1. **Compute the overall gross margin percentage.**
2. **Compute the total production costs for each product.**
3. **Compute the allocated joint costs.**

1.c. Constant Gross Margin NRV Method Example

	A	B	C	D
1	**PANEL A: Allocation of Joint Costs Using Constant Gross-Margin Percentage NRV Method**			
2	**Step 1:**			
3	Final sales value of total production during accounting period: (20,000 gallons × $25 per gallon) + (50,000 gallons × $22 per gallon)	$1,600,000		
4	Deduct joint and separable costs ($400,000 + $280,000 + $520,000)	1,200,000		
5	Gross margin	$ 400,000		
6	Gross margin percentage ($400,000 ÷ $1,600,000)	25%		
7		**Buttercream**	**Condensed Milk**	**Total**
8	**Step 2:**			
9	Final sales value of total production during accounting period: (20,000 gallons × $25 per gallon; 50,000 gallons × $22 per gallon)	$ 500,000	$1,100,000	$1,600,000
10	Deduct gross margin, using overall gross-margin percentage (25% × $500,000; 25% × $1,100,000)	125,000	275,000	400,000
11	Total production costs	375,000	825,000	1,200,000
12	**Step 3:**			
13	Deduct separable costs	280,000	520,000	800,000
14	Joint costs allocated	$ 95,000	$ 305,000	$ 400,000
15				
16	**PANEL B: Product-Line Income Statement Using Constant Gross-Margin Percentage NRV Method for May 2017**	**Buttercream**	**Condensed Milk**	**Total**
17	Revenues (12,000 gallons × $25 per gallon; 45,000 gallons × $22 per gallon)	$ 300,000	$ 990,000	$1,290,000
18	Cost of goods sold:			
19	Joint costs (from Panel A)	95,000	305,000	400,000
20	Separable costs	280,000	520,000	800,000
21	Production costs	375,000	825,000	1,200,000
22	Deduct ending inventory			
23	(8,000 gallons × $18.75 per gallon[a]; 5,000 gallons × $16.50 per gallon[b])	150,000	82,500	232,500
24	Cost of goods sold	225,000	742,500	967,500
25	Gross margin	$ 75,000	$ 247,500	$ 322,500
26	Gross margin percentage ($75,000 ÷ $300,000; $247,500 ÷ $990,000; $322,500 ÷ $1,290,000)	25%	25%	25%
27				
28	[a]Total production costs of buttercream ÷ Total production of buttercream = $375,000 ÷ 20,000 gallons = $18.75 per gallon.			
29	[b]Total production costs of condensed milk ÷ Total production of condensed milk = $825,000 ÷ 50,000 gallons = $16.50 per gallon.			

Source: Datar/Rajan (2021) Managerial Accounting

2. Physical-Measure Method



The physical-measure method allocates joint costs to joint products produced during the accounting period on the basis of a **comparable physical measure, such as the relative weight, quantity, or volume at the split off point.**

Source: Datar/Rajan (2021)

2. Physical-Measure Method Example

	A	B	C	D
1	**PANEL A: Allocation of Joint Costs Using Physical-Measure Method**	**Cream**	**Liquid Skim**	**Total**
2	Physical measure of total production (gallons)	25,000	75,000	100,000
3	Weighting (25,000 gallons ÷ 100,000 gallons; 75,000 gallons ÷ 100,000 gallons)	0.25	0.75	
4	Joint costs allocated (0.25 × $400,000; 0.75 × $400,000)	$100,000	$300,000	$400,000
5	Joint production cost per gallon ($100,000 ÷ 25,000 gallons; $300,000 ÷ 75,000 gallons)	$ 4.00	$ 4.00	
6				
7	**PANEL B: Product-Line Income Statement Using Physical-Measure Method for May 2017**	**Cream**	**Liquid Skim**	**Total**
8	Revenues (20,000 gallons × $8 per gallon; 30,000 gallons × $4 per gallon)	$160,000	$120,000	$280,000
9	Cost of goods sold (joint costs):			
10	Production costs (0.25 × $400,000; 0.75 × $400,000)	100,000	300,000	400,000
11	Deduct ending inventory (5,000 gallons × $4 per gallon; 45,000 gallons × $4 per gallon)	20,000	180,000	200,000
12	Cost of goods sold (joint costs)	80,000	120,000	200,000
13	Gross margin	$ 80,000	$ 0	$ 80,000
14	Gross margin percentage ($80,000 ÷ $160,000; $0 ÷ $120,000; $80,000 ÷ $280,000)	50%	0%	28.6%

Source: Datar/Rajan (2021)
Managerial Accounting

Exercise Time – E1 Question 1.b) and 2.

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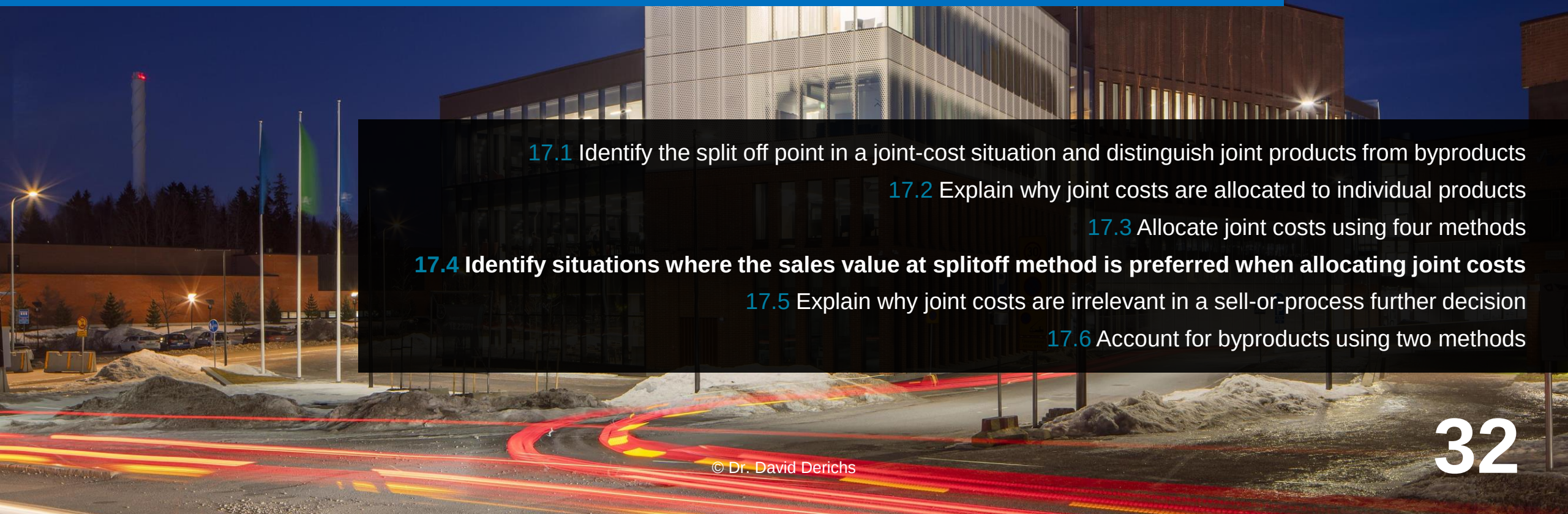
17.4 Identify situations where the sales value at splitoff method is preferred when allocating joint costs



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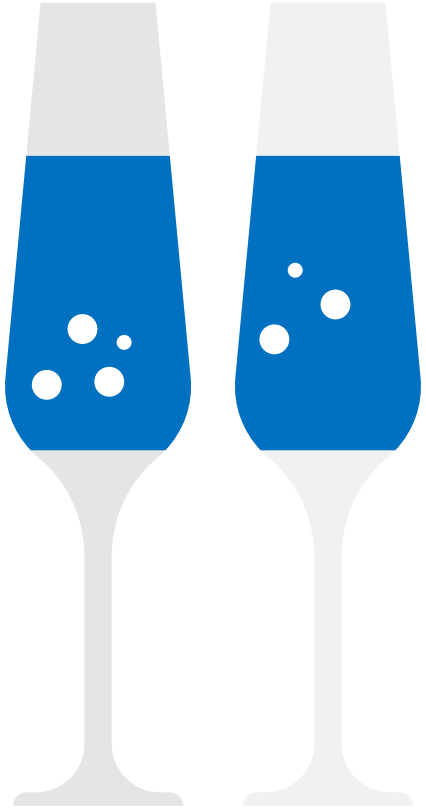
Choosing an Allocation Method

- If **selling price at split off is available**, the **sales value at split off method is preferred** even if further processing is done. Reasons include the following:
  - **Best measure of benefits received**
  - **Independent of further processing decisions**
  - **Common allocation basis (revenue)**
  - **Simplicity**
- If **selling prices are not available**, the **NRV method is the best alternative**.



However, some firms choose not to allocate joint costs at all.

Source: Datar/Rajan (2021)
Managerial Accounting

Methods compared

Method	*Advantages*	*Disadvantages*
Physical measurement	Simple to operate where there is a common unit of measurement	Can distort profit reporting and inventory valuation Can be difficult to find a common unit of measurement
Sales value at split-off point	Provides more realistic inventory valuations	Assumes that sales value determines prior costs Assumes that a sales value at split-off point can be determined
Net realizable value	Takes further processing costs into account Simple to apply if there is only one split-off point	Can be difficult to calculate for a complex process with many split-off points
Constant gross profit percentage	Appropriate only if a constant gross profit for each joint product is a logical assumption	Only appropriate if a constant gross profit for each product makes sense

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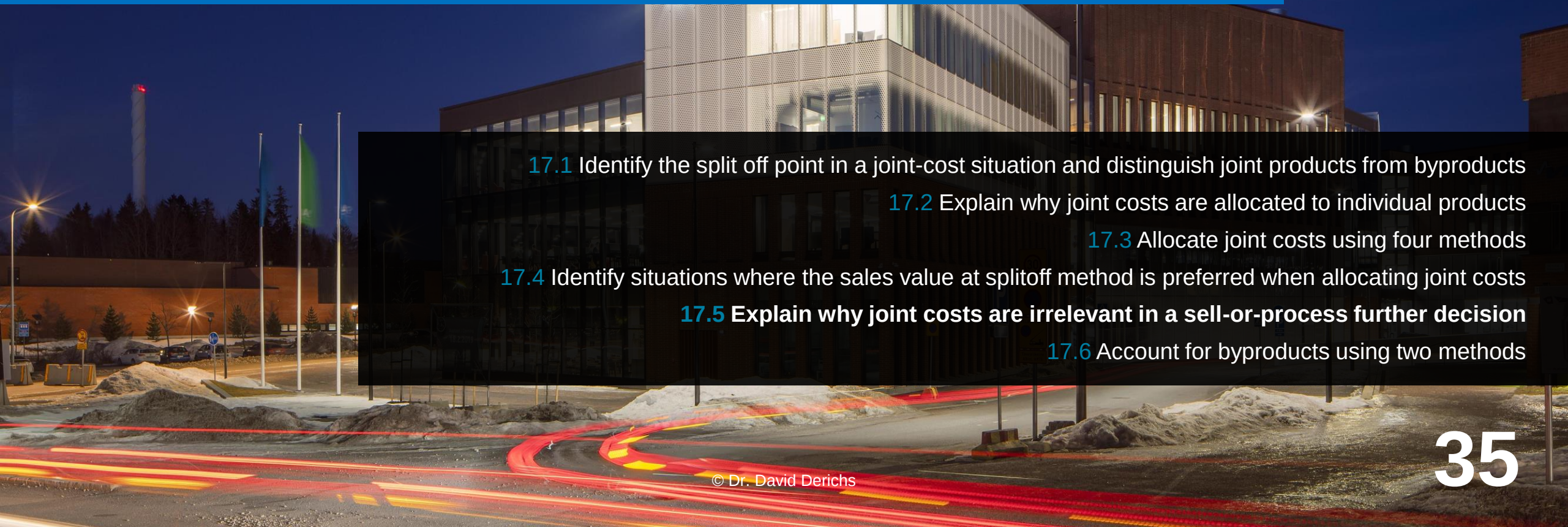
17.5 Explain why joint costs are irrelevant in a sell-or-process further decision



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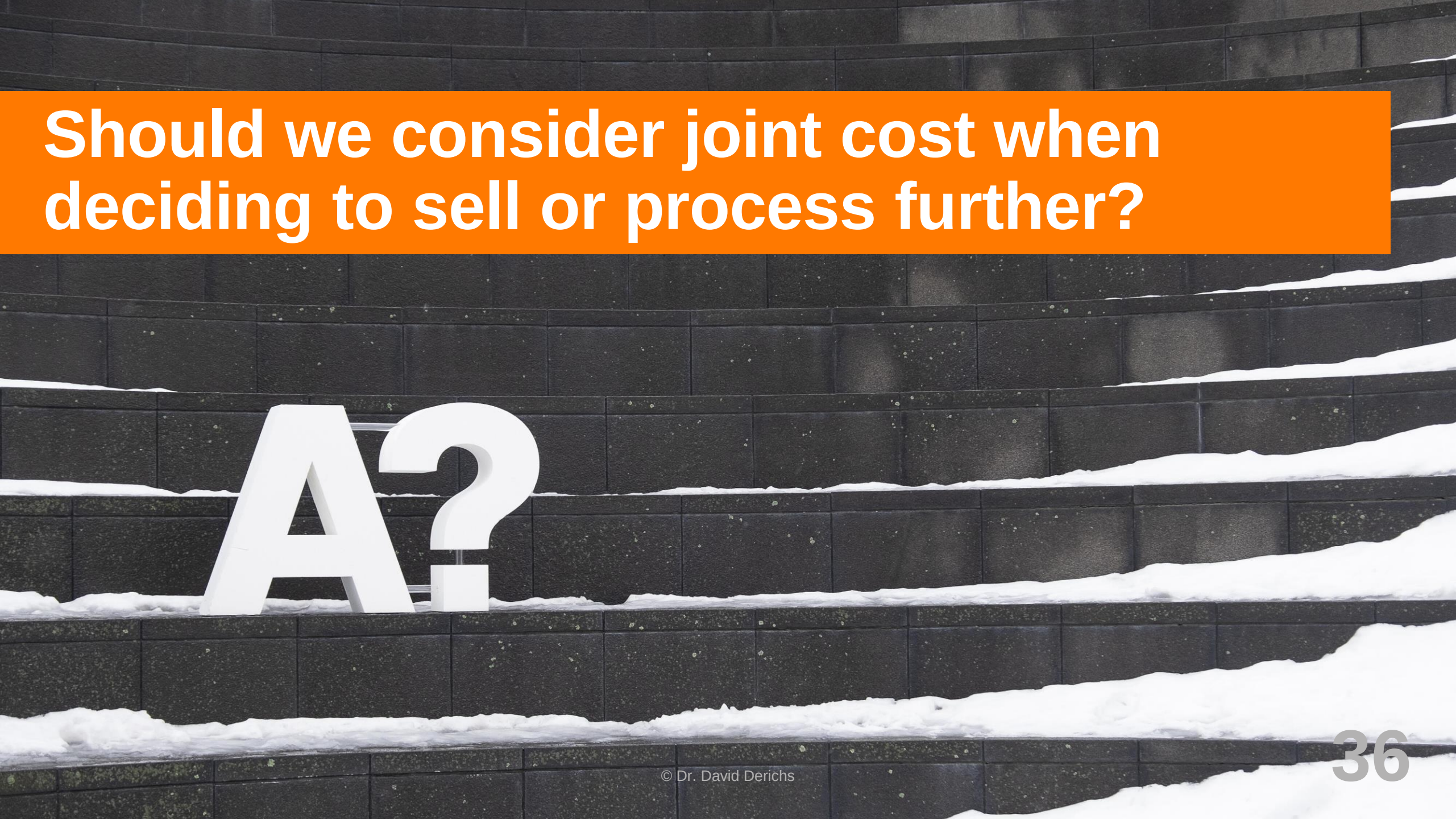
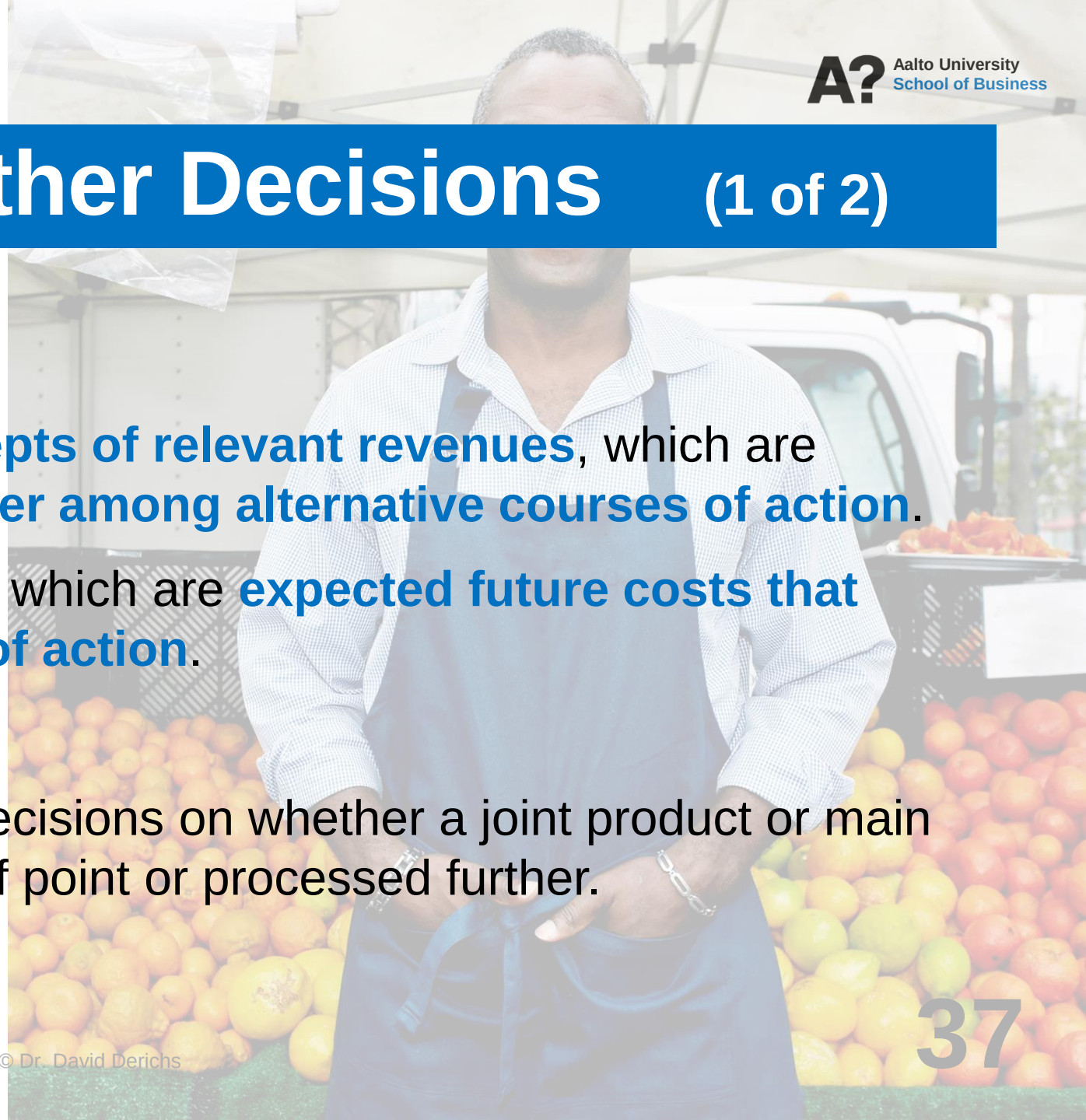
Should we consider joint cost when deciding to sell or process further?



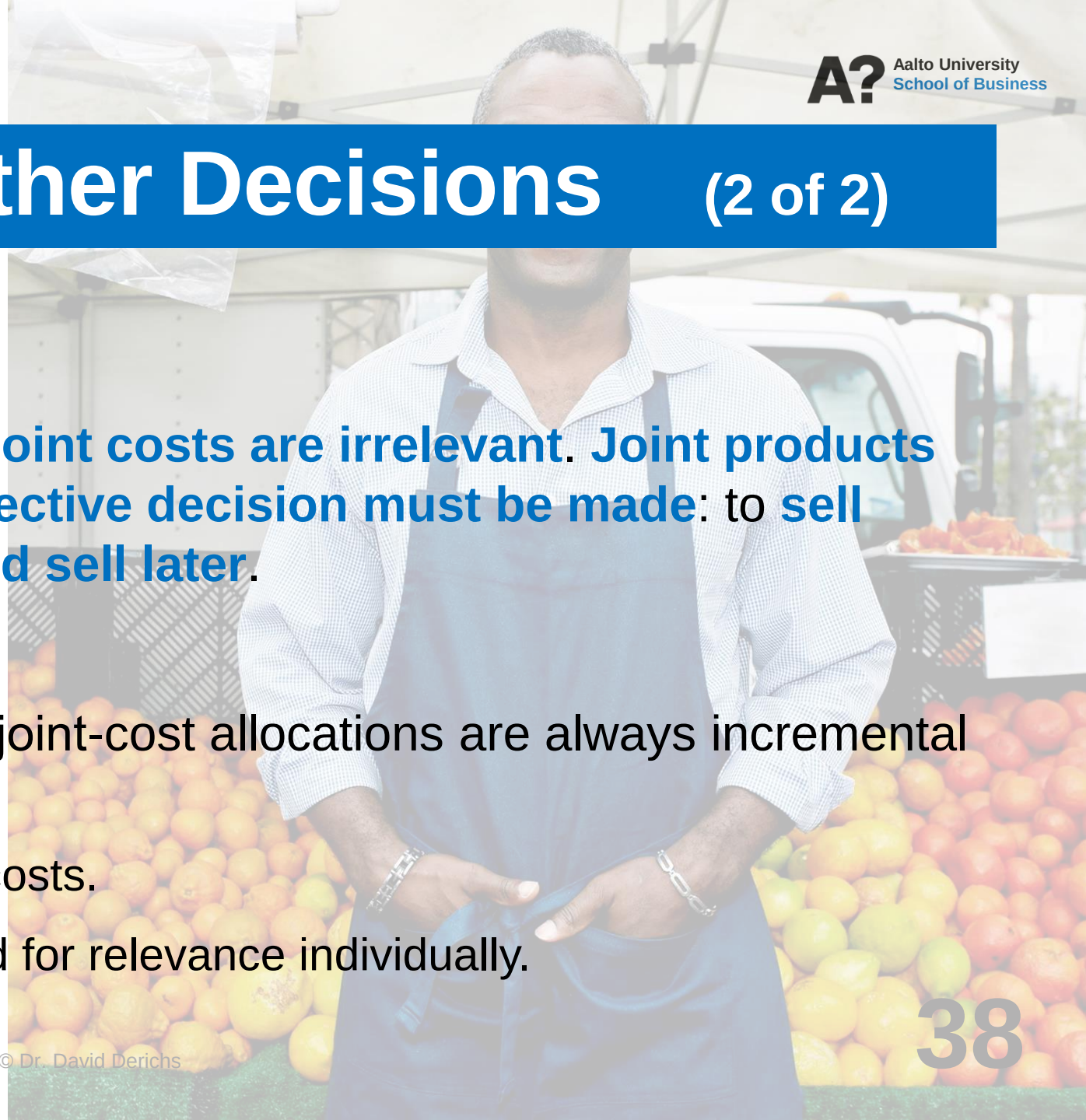
Sell-or-Process Further Decisions (1 of 2)



- Previously, we introduced the **concepts of relevant revenues**, which are **expected future revenues that differ among alternative courses of action**.
- We also **discussed relevant costs**, which are **expected future costs that differ among alternative courses of action**.

- These concepts can be applied to decisions on whether a joint product or main product should be sold at the split off point or processed further.

Sell-or-Process Further Decisions (2 of 2)



- In sell-or-process further decisions, **joint costs are irrelevant**. **Joint products have been produced, and a prospective decision must be made**: to **sell immediately or process further and sell later**.
- **Joint costs are sunk costs.**
- Don’t assume all separable costs in joint-cost allocations are always incremental costs.
  - Some separable costs may be fixed costs.
  - Separable costs need to be evaluated for relevance individually.

Source: Datar/Rajan (2021)
Managerial Accounting

Decision-Making and Performance Evaluation: Other Issues to Consider

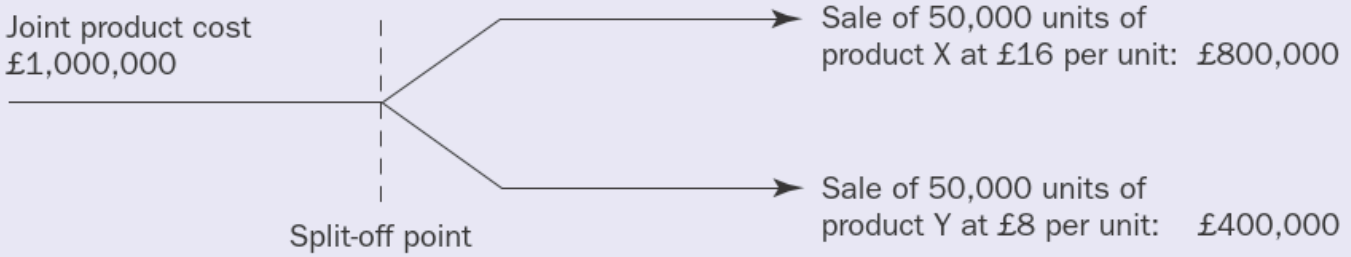
- The potential conflict between cost concepts used for decision-making and cost concepts used for evaluating the performance of managers often arises when sell-or-process further decisions are being made.
- **Firms should be wary of using the full cost of a joint product as the basis for making pricing decisions (potential lack of cause-and-effect relationship).**

Source: Datar/Rajan (2021) Managerial Accounting

Example of decision irrelevance

EXAMPLE

The Adriatic Company incurs joint product costs of £1,000,000 for the production of two joint products, X and Y. Both products can be sold at the split-off point. However, if additional costs of £60,000 are incurred on product Y then it can be converted into product Z and sold for £10 per unit. The joint costs and the sales revenue at the split-off point are illustrated in the following diagram:



You are requested to advise management whether or not product Y should be converted into product Z.

Solution of Example of decision

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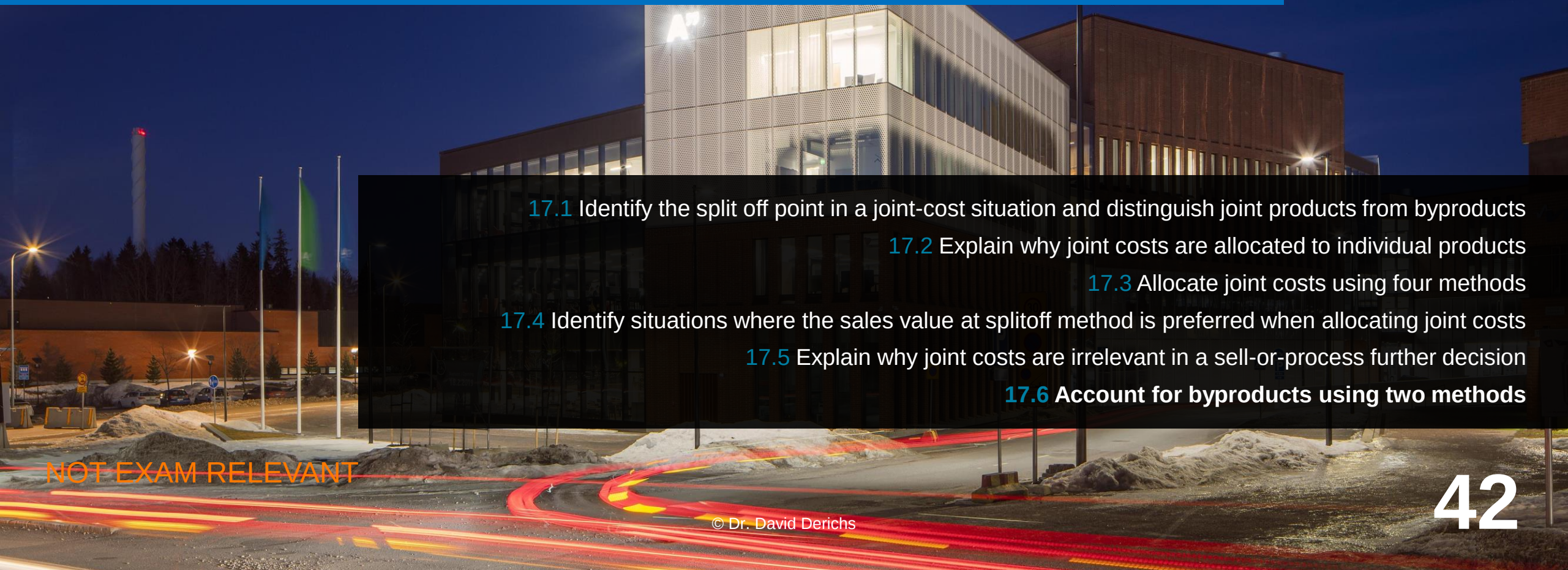
School of Business

III. Cost Allocation: Joint Products and Byproducts

17.6 Account for byproducts using two methods



17.1 Identify the split off point in a joint-cost situation and distinguish joint products from byproducts

17.2 Explain why joint costs are allocated to individual products

17.3 Allocate joint costs using four methods

17.4 Identify situations where the sales value at splitoff method is preferred when allocating joint costs

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NOT EXAM RELEVANT

Case in point: Products from paper mill sludge

1. Assuming paper mills decide to sell their sludge for a small fee, how might they account for the revenue generated?
2. Can you think of any other ‘waste’ by-products that are re-used rather than disposed of?

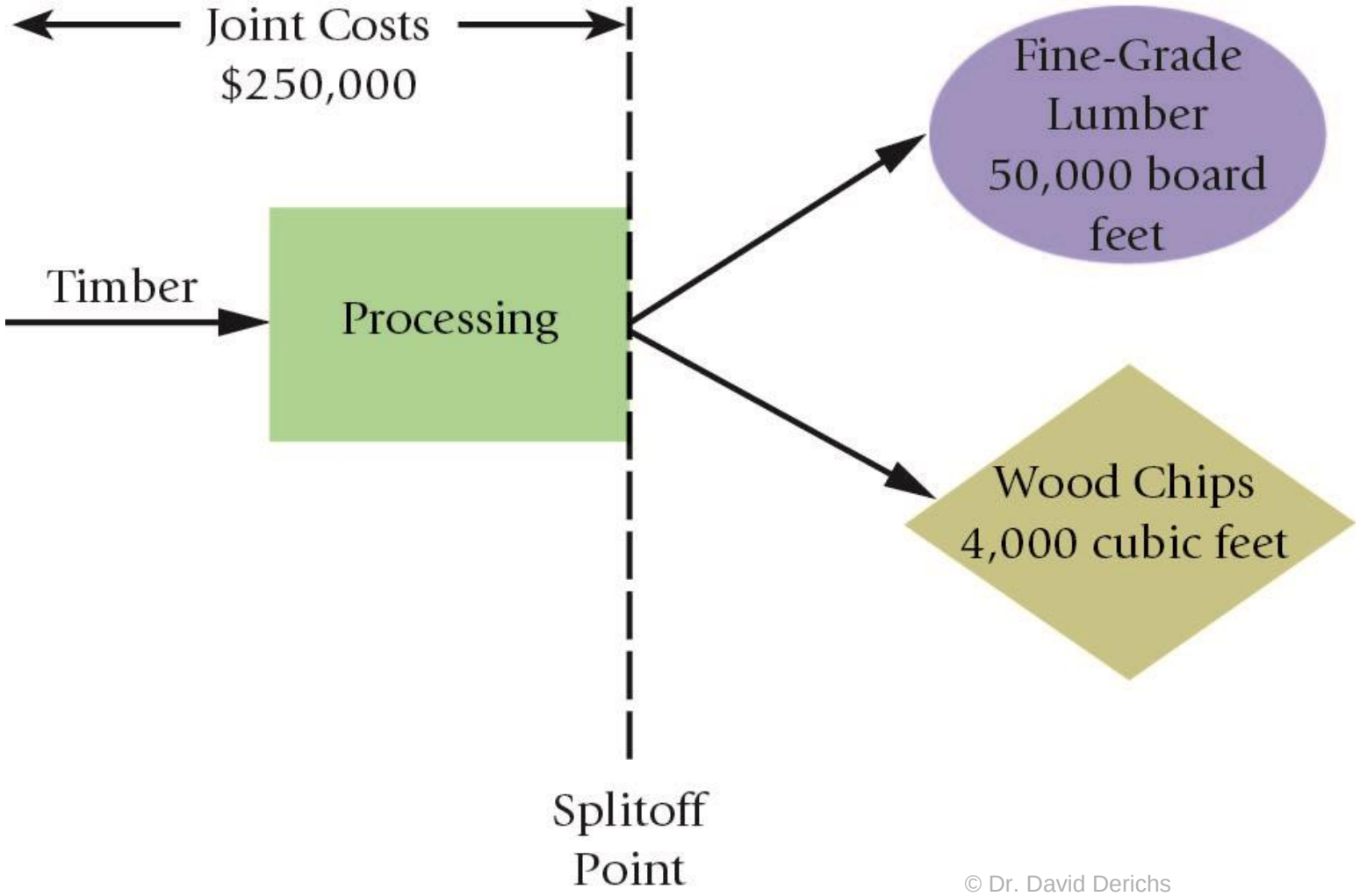
Accounting for Byproducts

Two methods for accounting for byproducts used:

- **Production method** recognizes byproduct inventory as it is created and sales and costs at the time of sale.
- **Sales method** recognizes no byproduct inventory, and recognizes only sales at the time of sales: byproduct costs are not tracked separately.

Source: Datar/Rajan (2021)

Byproducts Illustration Overview



Comparative Income Statements for Accounting for Byproducts

	Production Method	Sales Method
Revenues		
Main product: Fine-grade lumber (40,000 b.f. × $6 per b.f.)	$240,000	$240,000
Byproduct: Wood chips (1,200 c.f. × $1 per c.f.)	—	1,200
Total revenues	240,000	241,200
Cost of goods sold:		
Total manufacturing costs	250,000	250,000
Deduct byproduct revenue and inventory (4,000 c.f. × $1 per c.f.)	(4,000)	—
Net manufacturing costs	246,000	250,000
Deduct main-product inventory	(49,200)[a]	(50,000)[b]
Cost of goods sold	196,800	200,000
Gross margin	$ 43,200	$ 41,200
Gross-margin percentage ($43,200 ÷ $240,000; $41,200 ÷ $241,200)	18.00%	17.08%
Inventoriable costs (end of period):		
Main product: Fine-grade lumber	$ 49,200	$ 50,000
Byproduct: Wood chips (2,800 c.f. × $1 per c.f.)[c]	2,800	0

[a](10,000 ÷ 50,000) × net manufacturing cost = (10,000 ÷ 50,000) × $246,000 = $49,200

[b](10,000 ÷ 50,000) × total manufacturing cost = (10,000 ÷ 50,000) × $250,000 = $50,000

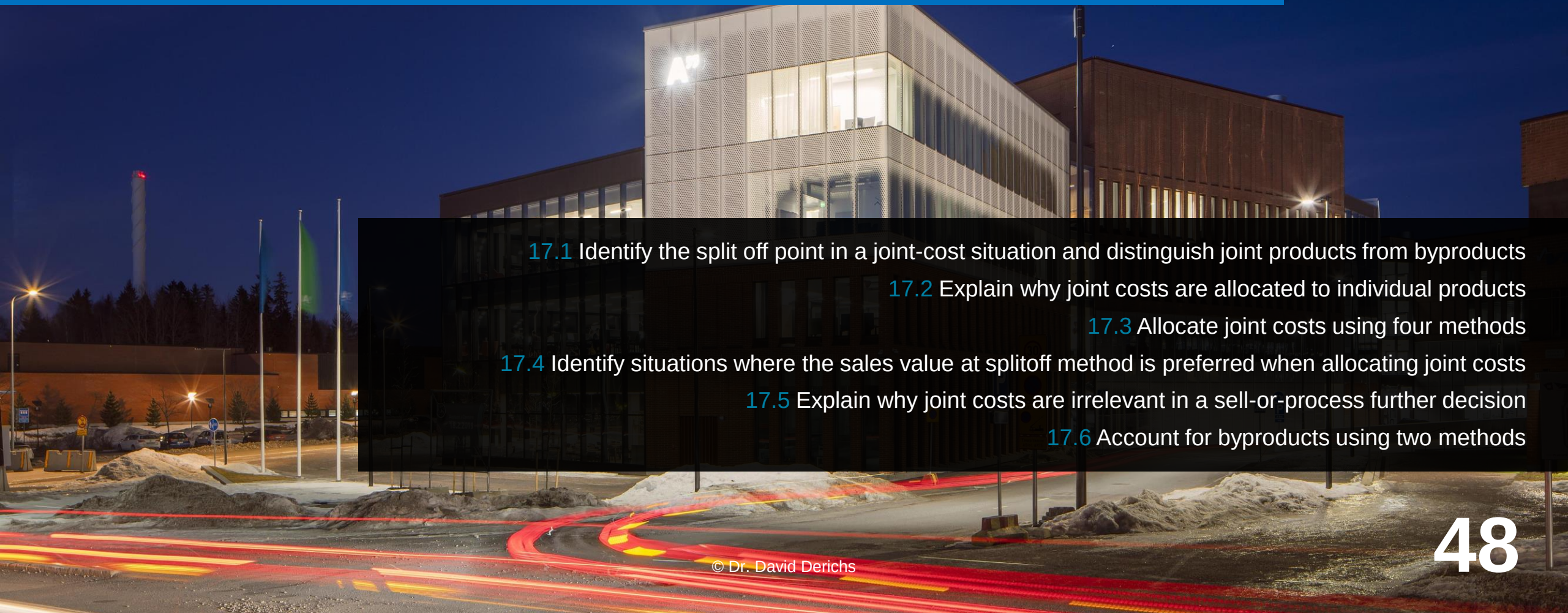
[c]Recorded at selling prices.

Selecting an Accounting Method for Byproducts

- The **production method** is **consistent** with the **matching principle and is the preferred method**.
- The production method recognizes the byproduct inventory in the accounting period in which it is produced and simultaneously reduces the cost of manufacturing the main or joint products, thereby better matching the revenues and expenses from selling the main product.
- **Sales method is simpler** and is often used in practice, primarily because dollar amounts of byproducts are immaterial. The drawback of the method is that it allows a firm to “manage” its reported earnings by timing the sale of byproducts.

Source: Datar/Rajan (2021)
Managerial Accounting

III. Cost Allocation: Joint Products and Byproducts



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Terms to Learn

Byproducts
Constant gross-margin percentage NRV method
Joint costs
Joint products
Main product
Net realizable value (NRV) method
Physical-measures method
Product
Sales value at split off method
Separable costs
Split off point

References

Main Reference

- Datar, S and Rajan, M; Horngren's Cost Accounting: A Managerial Emphasis (Seventeenth Edition); 2021; Pearson

Supplementary materials

- Drury, C; Management and Cost Accounting (Eleventh Edition); 2021; Cengage