Inventory and Cost analysis

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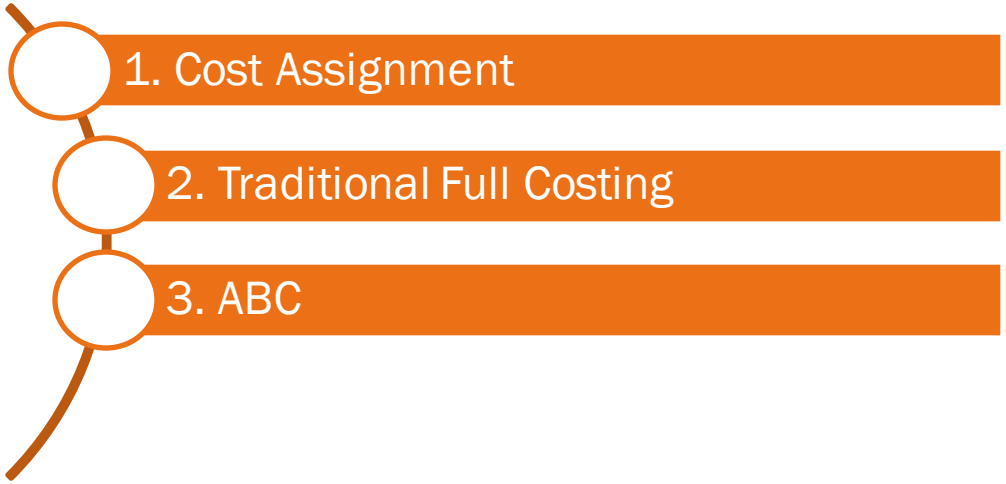


1. Cost Assignment

In previous sections, we covered Inventories (topic 3) and Income Statement (topic 4).

The focus of this topic is to learn
(1) What costs are reported as *Cost of Sales* or *SG&A?*
(2) Timing of the cost recognition.
(3) Cost assignment across product lines.

COLGATE-PALMOLIVE COMPANY
Consolidated Statements of Income
For the years ended December 31,
(Dollars in Millions Except Per Share Amounts)

	2022
Net sales	$ 17,967
Cost of sales	7,719
Gross profit	10,248
Selling, general and administrative expenses	6,565
Other (income) expense, net	69
Goodwill and intangible assets impairment charges	721
Operating profit	2,893

17. Supplemental Balance Sheet Information

Inventories by major class are as follows at December 31:

Inventories	2022	2021
Raw materials and supplies	$ 666	$ 505
Work-in-process	48	39
Finished goods	1,508	1,248
Total Inventories, net	$ 2,222	$ 1,792
Non-current inventory, net	(148)	(100)
Current Inventories, net	$ 2,074	$ 1,692

Inventories valued under LIFO amounted to $458 and $410 at December 31, 2022 and 2021, respectively. The excess of current cost over LIFO cost at the end of each year was $146 and $60, respectively. The liquidations of LIFO inventory quantities had no material effect on income in 2022, 2021 and 2020. Inventory classified as non-current at December 31, 2022 was recorded on the Consolidated Balance Sheets as "Other assets."

1. Cost Assignment

Inventory costs -> Cost of Sales

Inventory costs: All costs of purchasing, converting, or bringing inventories to their present location and condition.

- Not all of them are capitalized in the year-end inventory value
- Some of them are expenses in the current year.
- The key is classifying the item as a *product* or *periodic* expense.

1. Cost Assignment

Product Costs

- All costs directly tied with the acquisition or production of goods.
- **Capitalized in the inventory balance and expensed when the product is sold.**
- Manufacturing firms:
  - Direct material
  - Direct labor
  - Overhead (rent and utilities of the manufactoring plants)
- Merchandising firms:
  - acquisition costs.

Periodic Costs

- **Expensed as ocurred.**
- "Other operating expenses":
  - Abnormal waste of material during production
  - Product storage costs
- SG&A expenses:
  - Selling costs
  - Marketing and advertising costs
  - Salaries and comission for sales staff
  - Administrative expenses

1. Cost Assignment

A) How much is the total cost capitalized in "inventory" at year-end?
B) How much are the total period expenses for the year?
C) How much are the "other operating expenses" and "SGA expenses"?

Cost	Amount ($)
Raw material transportation costs	3,500
Google ads expenses	400
Finished goods transportation cost to clients	2,100
Warehouse personnel - salaries	10,000
Purchase cost of materials	40,000
Furniture designers and constructors - salaries	11,000
Storage costs	4,200
Abnormal waste	1,300
Manufacturing overhead	9,000
Office supplies	200
Sales comissions	700

1. Cost Assignment

Given the previous cost structure, discuss

1) Product cost:
    - % variable costs
    - How sensible is the Operating Margin to the distribution of variable costs?
2) % Product vs Periodic costs:
    - Economic boom or sharp production increase: is the firm really more profitable?

2. Traditional Full Costing

In many cases, the financial reports include information on sales and operating margin per product line or service.

Products and Services Performance

The following table shows net sales by category for 2022, 2021 and 2020 (dollars in millions):

	2022	Change
Net sales by category:		
iPhone (1)	$ 205,489	7 %
Mac (1)	40,177	14 %
iPad (1)	29,292	(8)%
Wearables, Home and Accessories (1)(2)	41,241	7 %
Services (3)	78,129	14 %
Total net sales	$ 394,328	8 %

Gross Margin

Products and Services gross margin and gross margin percentage for 2022, 2021 and 2020 were as follows (dollars in millions):

	2022	2021
Gross margin:		
Products	$ 114,728	$ 105,126
Services	56,054	47,710
Total gross margin	$ 170,782	$ 152,836
Gross margin percentage:		
Products	36.3 %	35.3 %
Services	71.7 %	69.7 %
Total gross margin percentage	43.3 %	41.8 %

So now we will learn two methods companies use to decompose "product costs" across several product/service lines.

A) Traditional method
B) ABC method

2. Traditional Full Costing

Juice Factory: production process

2. Traditional Full Costing

Determining costs per product unit is not as easy as most people assume:

- Cost of apples --> Apple juice's cost (the same for all fruits)
- Knives purchase/maintenance --> used for all products
- Machines purchase/maintenance --> used for all products
- Employees: hrs cleaning, pealing apples --> Apple juice's cost
- Employees: coordinating or supervising plant --> used for all products
- Electricity bill--> used for all products

Key question: how to allocate *all* product costs into *specific* products lines?

We will start by learning the traditional cost allocation method.

2. Traditional Full Costing

Key concepts:

1. Direct Material
2. Direct Labor
3. Overhead: indirect material, labor, and other costs are closely associated with the manufacturing process but not tied to a specific product.
    1. Indirect material: e.g., cleaning wipes for machine maintenance.
    2. Indirect labor: supervisors' and maintenance staff's wages, engineers' wages.
    3. Other: depreciation or rent of the factory, insurance expenses of machinery and factory, electricity bill.

The economic relevance of overhead costs has increased with technology as less labor force is used in manufacturing.

2. Traditional Full Costing

Overhead allocation in the "Traditional" approach:

Step 1: Compute (o estimate) the **manufacturing overhead ($)** and **total activity level**.
Step 2: Compute the "**overhead rate**" as the ratio of the overhead costs to the activity level.
Step 3: Use overhead rate to assign OH cost to each product.

2. Traditional Full Costing

What activity measures should be used to calculate the overhead rate across products?

- Key principle: It should have a causal relationship between the metric and the related (overhead) costs.
- These activity measures are technically called "cost drivers."

- Most common cost drivers :
  - in manufacturing: unit produced, direct labor hours, direct labor cost, machine hours.
  - in customer service costs: number of product returns or client calls.
  - In cleaning costs: square meters.
  - in office supplies: number of employees.
  - In website costs: number of online orders.

2. Traditional Full Costing

Example

- Product Details: Your company manufactures two products: A and B.
- Direct Costs per Unit:
  - Product A: $20 for materials, $15 for labor
  - Product B: $30 for materials, $25 for labor
- Total Overhead Costs: $60,000 for the period.
- Total Production Units: 3,000 (1,000 units of A + 2,000 units of B)
- The company uses "total production units" as the cost driver.

What is the total cost of product A? B?

Critical thinking:
(1) What if one unit of Product A consumes 20 times more machine maintenance or quality inspection hrs than Product B?
(2) Assume you are responsible for the profitability of Product B and have no price power. How is this (arbitrary) cost allocation affecting your performance evaluation?

2. Traditional Full Costing

Example 2

See MS Excel file

3. ABC

In the last decades, progress in robotics and IT has changed the ratio between direct labor and overhead.

More and more overhead costs are linked to drivers other than direct labor or unit produced.

This situation created severe distortions in the allocation of overhead costs.

Companies needed more information to be able to track the activities triggering overhead costs and assign the cost of these activities to the product…

That is how the Activity-Based Product Cost (ABC) assignment emerged.

The rationale behind ABC cost allocation is simple: products consume activities, and activities consume resources.

3. ABC

ABC assignment is **more precise** than the traditional allocation of overhead costs since it assigns these costs to the products based on the use of the **activities triggering overhead costs**.

Steps:

1. List the activities performed in the factory
2. Aggregate activities into cost pools
3. Estimate the level of activity and cost for each cost pool.
4. Compute the overhead ABC rate for each cost pool.
5. Allocate overhead costs of each pool to products using ABC rates.

3. ABC

Steps:

1. List the activities performed in the factory

Activities: action or process involved in the production of inventory.

Examples of common manufacturing activities (and overhead costs):

- Taking orders
- Setting up machines
- Purchasing material
- Assembling products (ie, order assembling in Mcdonald)
- Inspecting products
- Providing customer service during the ordering process

3. ABC

Steps:

2. Aggregate activities into cost pools

Overhead costs are assigned to each activity to become a cost pool. A cost pool is a list of costs incurred when related activities are performed.

Examples:

Activities	Cost Pool
Taking orders Verifying/confirming orders	Customer Order
Setting up machines Machine insurances, utilities	Production Machines
Preparing purchaces of materials Cost to move materials from reception into production department	Purchasing Materials
Inspection/Quality staff costs	Inspect Products
Cost of assembly machine Cost of label machine	Assemble Products
Computers' depreciation Online store maintenance	Technological production

3. ABC

Steps:

3. Estimate the level of activity and total cost for each cost pool.

What activities drive the costs in that pool? (again, the concept of "cost driver", but now, not only one)
Examples:

Activity Cost Pool	Estimated Activity of the Cost drivers
Customer Order	# of orders
Production Machines	# of machine setups
Purchasing Materials	# Purchases requests
Inspect Products	# Inspectors or Hrs.
Assemble Products	# direct labor hours
Technological production	# online orders or visits.

How to determine the cost driver for an activity pool?

R: find an objective metric with a **causal relationship** with the cost of the activity pool ("the driver").

3. ABC

Steps:

4. Compute the overhead ABC rate for each cost pool.

This step is similar to finding the traditional overhead rate.

However, each cost driver be linked to a different overhead rate.

- This is why ABC is a more accurate method of allocating overhead.

3. ABC

Steps:

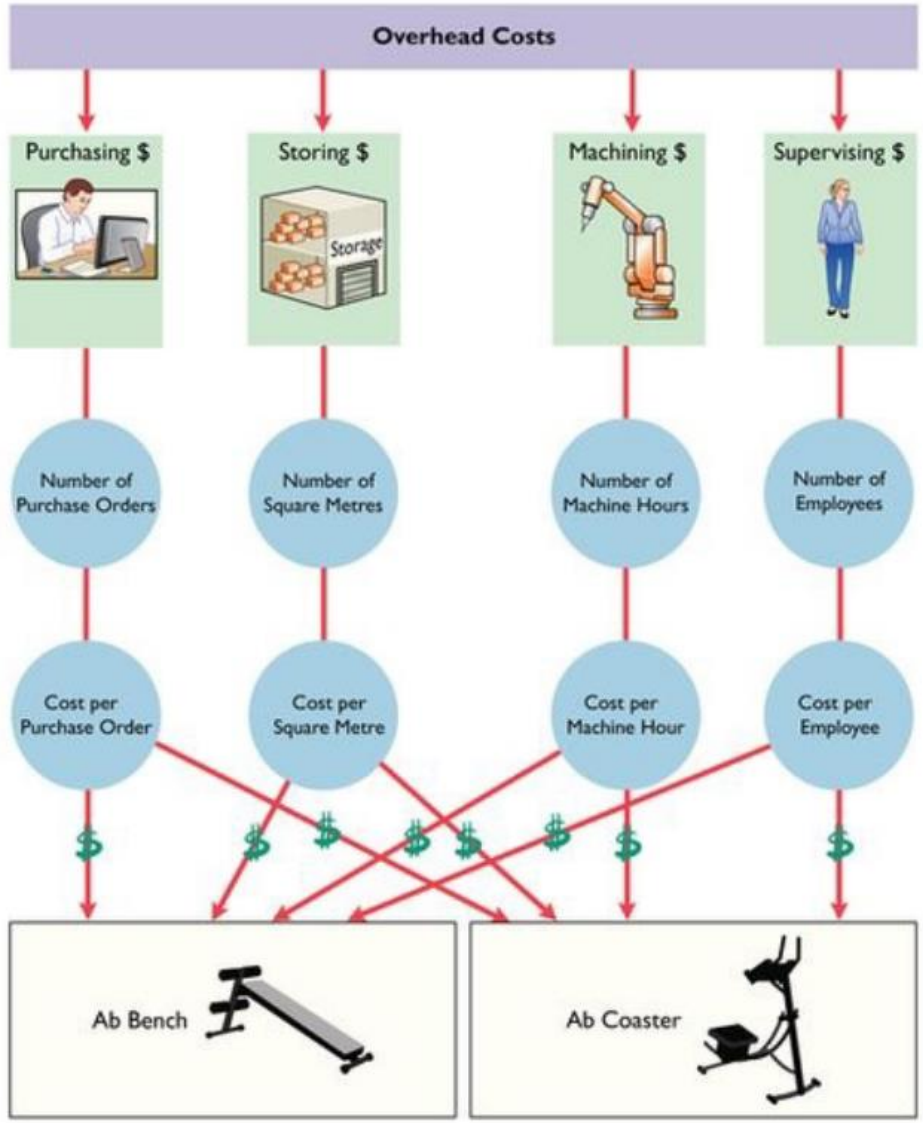
5. Allocate overhead costs to products using ABC rates.

This step is equivalent to the last step in the traditional approach

Summary of the 5-step process into just 2 stages:

First, allocating overhead costs to the various activities to get a cost per activity.

Second, allocating the cost per activity to each product based on that product's usage of the activities.



Weygandt et al (2018)

3. ABC

Example:

- Product Details: Your company manufactures two products: A and B.
- Units Produced:
  - 1,000 units of Product A
  - 2,000 units of Product B
- Direct Costs per Unit:
  - Product A: $20 for materials, $15 for labor
  - Product B: $30 for materials, $25 for labor
- Total Overhead Costs: $60,000 for the period.
  - Activity Pools and Costs:
    - Machine Setup: $20,000
    - Quality Control: $25,000
    - Packaging: $15,000
  - Activity Metrics:
    - Machine Setups: 50 for Product A, 50 for Product B
    - Quality Control Tests: 200 for Product A, 100 for Product B
    - Packaging Instances: 1,000 for Product A, 2,000 for Product B

Compute total cost using the ABC method and compare it with the Traditional approach.

3. ABC

Example 2
See MS file.

3. ABC

Comparing and contrasting both cost allocation methods.

	Traditional system	ABC
PROS	Simple to explain and implement. Cheap cost-information system.	More Accurate. Identify opportunities for improvements and unprofitable business.
CONS	Allocation base can be arbitrary Penalizes products with high volumen.	Complex to implement Expensive to implement, more sophisticated information system.

3. ABC

How many Cost Activity Pools are appropriate?

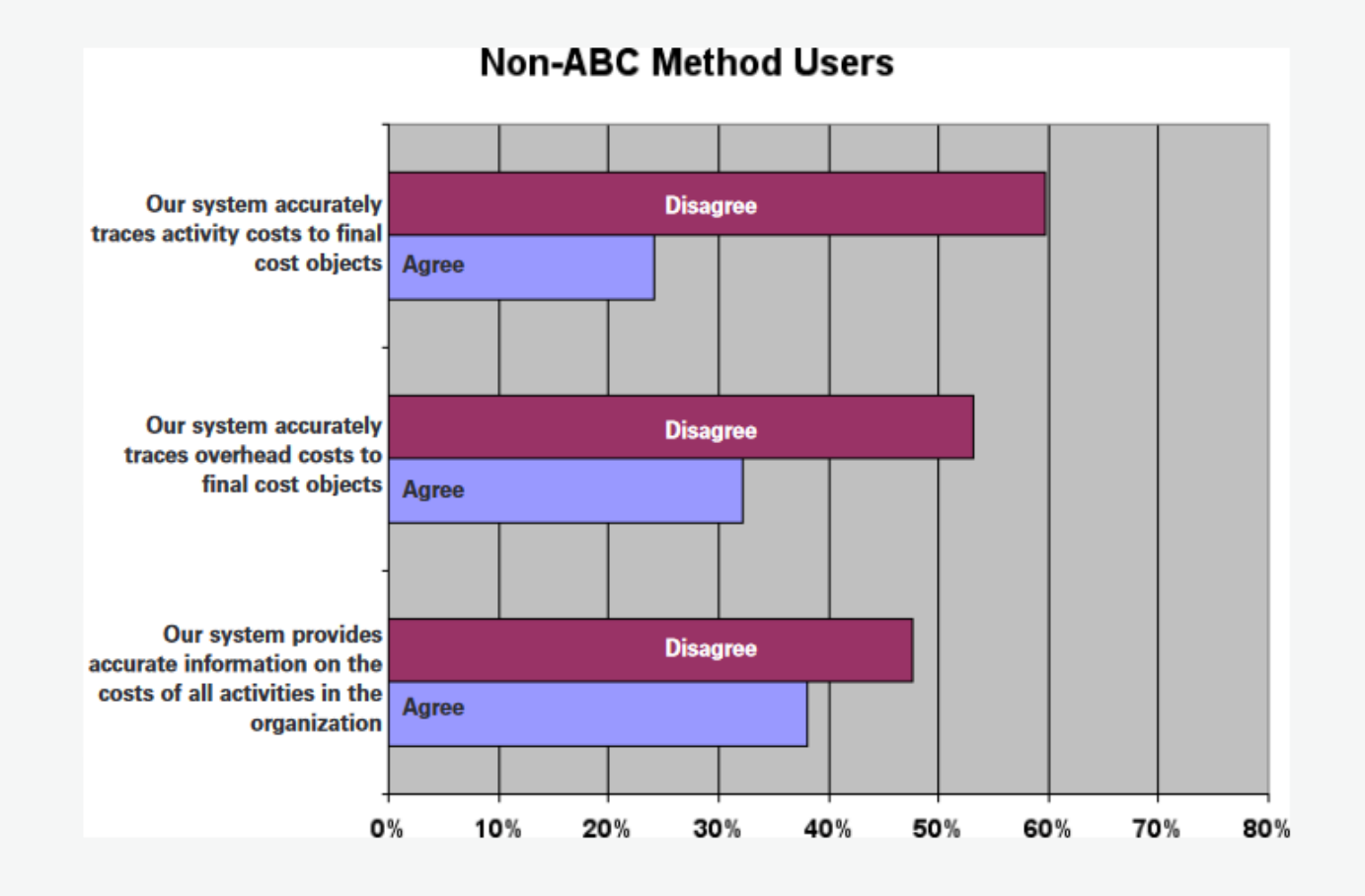
Empirical evidence indicates that manufacturers identify between 50-150 activities with the respective cost drivers.

The number depends on:

- complexity of the production process.
a) manufacturing steps
b) number of different raw materials
c) coordination among divisions
d) level of automatization

- complexity of the product.
a) relevance of quality
b) number of elements or parts

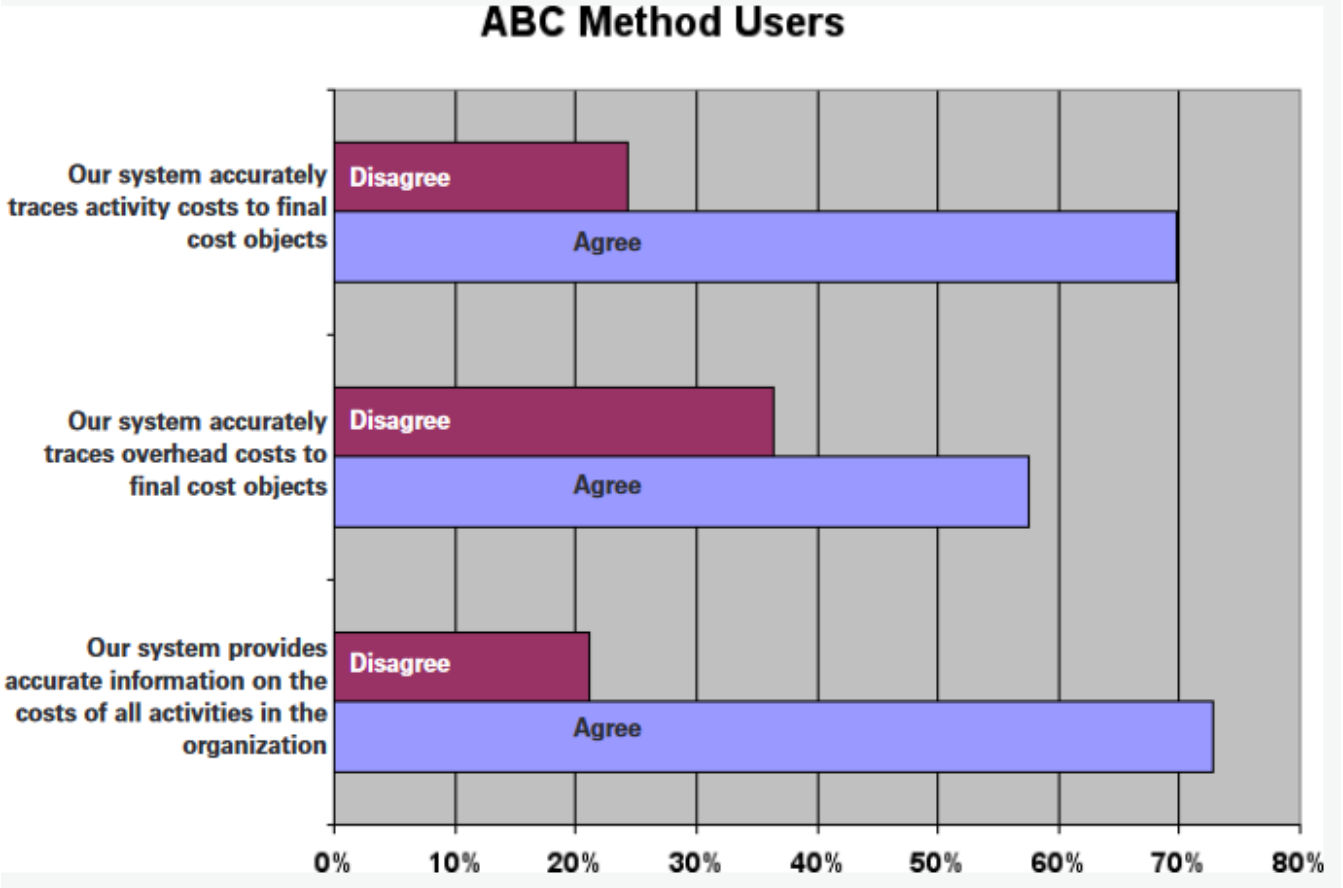
How common is the ABC system?



Lawson (2009)

3. ABC

How common is the ABC system?



Lawson (2009)

3. ABC

How does a company know when to use ABC?

1) Product lines are very different in terms of volume of production or manufacturing complexity?

2) Product lines require many supporting services (cleaning, set-ups, utilities, inspections, moving parts/materials, coordination, and building maintenance).

3) Overhead Cost is a large % of total costs.

4) Managers are ignoring data provided by the existing cost system when deciding pricing or other producto decisions.

Thanks

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www.marceloortizm.com