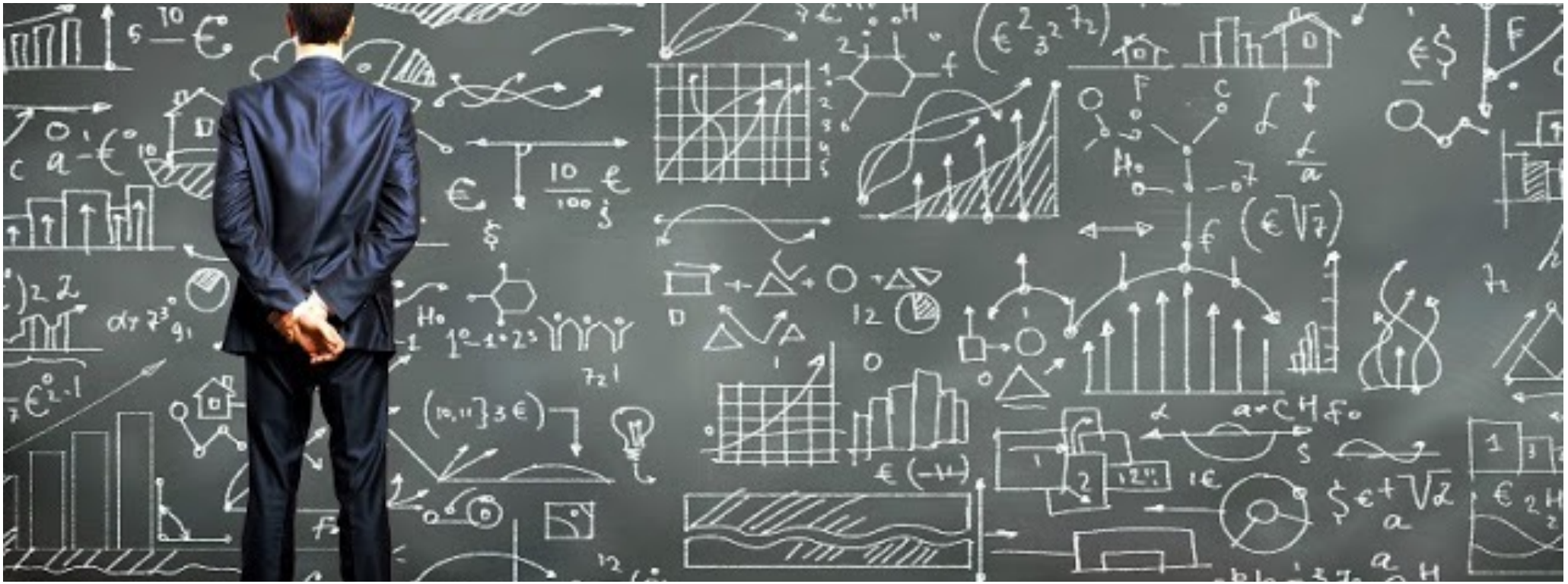
EFFICIENCY AND EFFECTIVENESS

Measuring process performance



WHAT TO MEASURE? BACK TO THE ROOTS

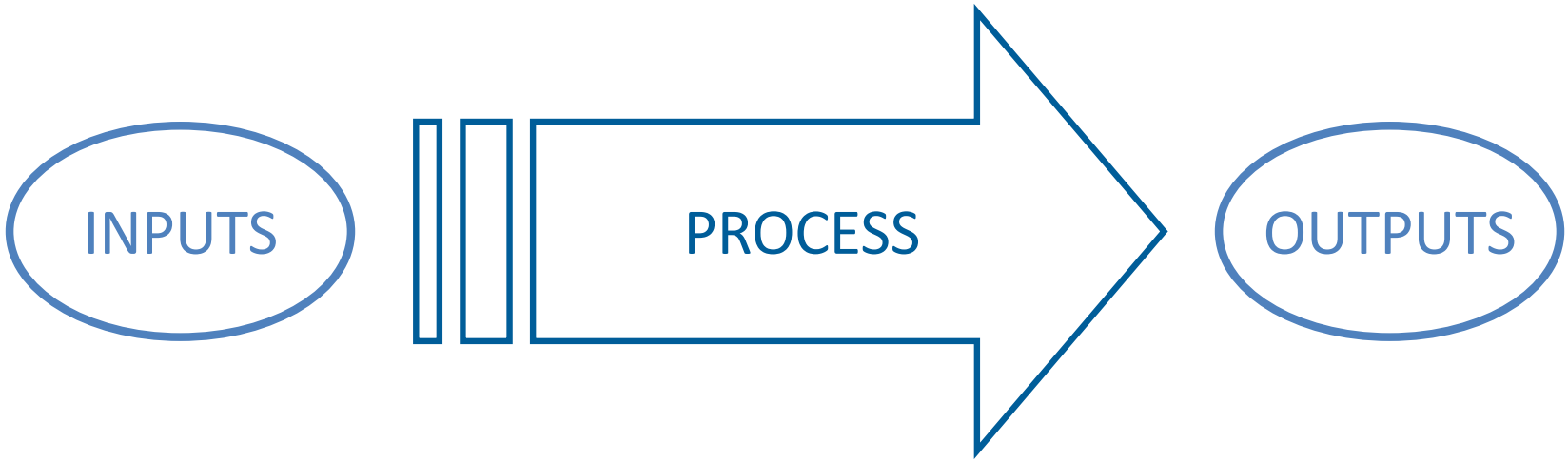
Robert Anthony initially (in 1965) defined Management Control as:

*«the process by which managers assure that resources are obtained and used **effectively** and **efficiently** in the accomplishment of the organization's objectives».*

Few years later (in 1988) he revised his original definition to the following:

«Management Control is the process by which managers influence other members of the organization to implement the organization's strategies».

ORGANIZATIONAL PROCESS MODEL

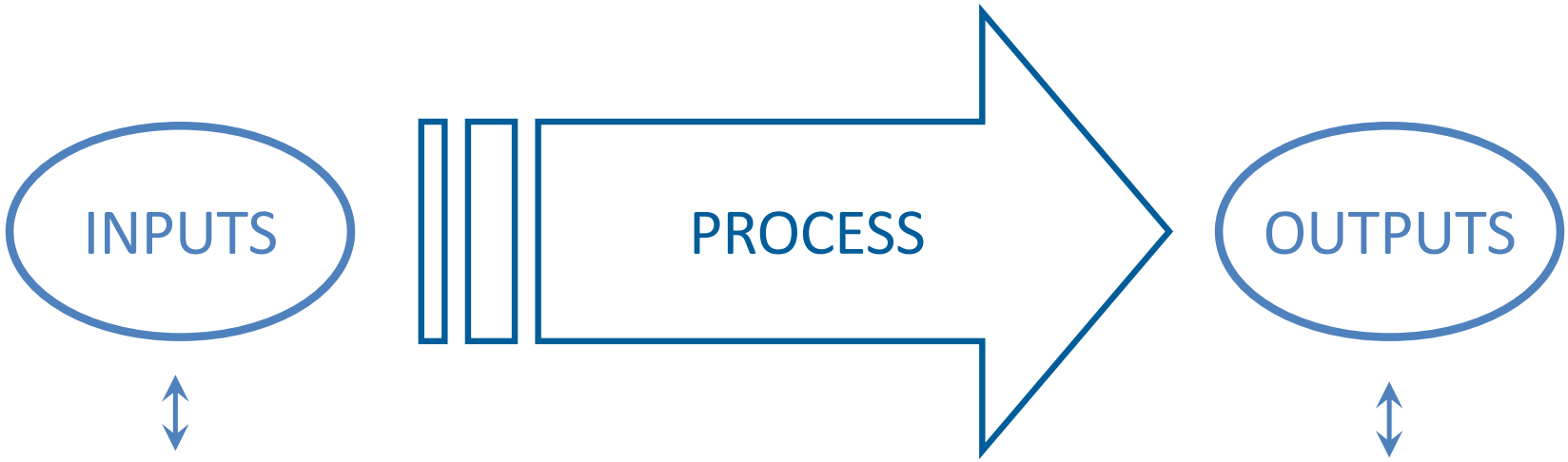


The input-process-output model is generic, so we can easily refer it to different entities: a machine, a factory, an individual worker, a team or the entire business. The principles are the same: absorb inputs, transform them through productive processes, and create outputs of value.

Managers are responsible for ensuring that:

- Inputs are appropriate to the task at hand and are adequate in quality and quantity,
- The transformation process is efficient, and
- The outputs meet specification.

THE LINK WITH THE OBJECTIVE OF CREATING VALUE



FACTORS OF PRODUCTION
(tangible and intangible resources needed to carry out production)
are **used, consumed.**

EXPENSES are incurred

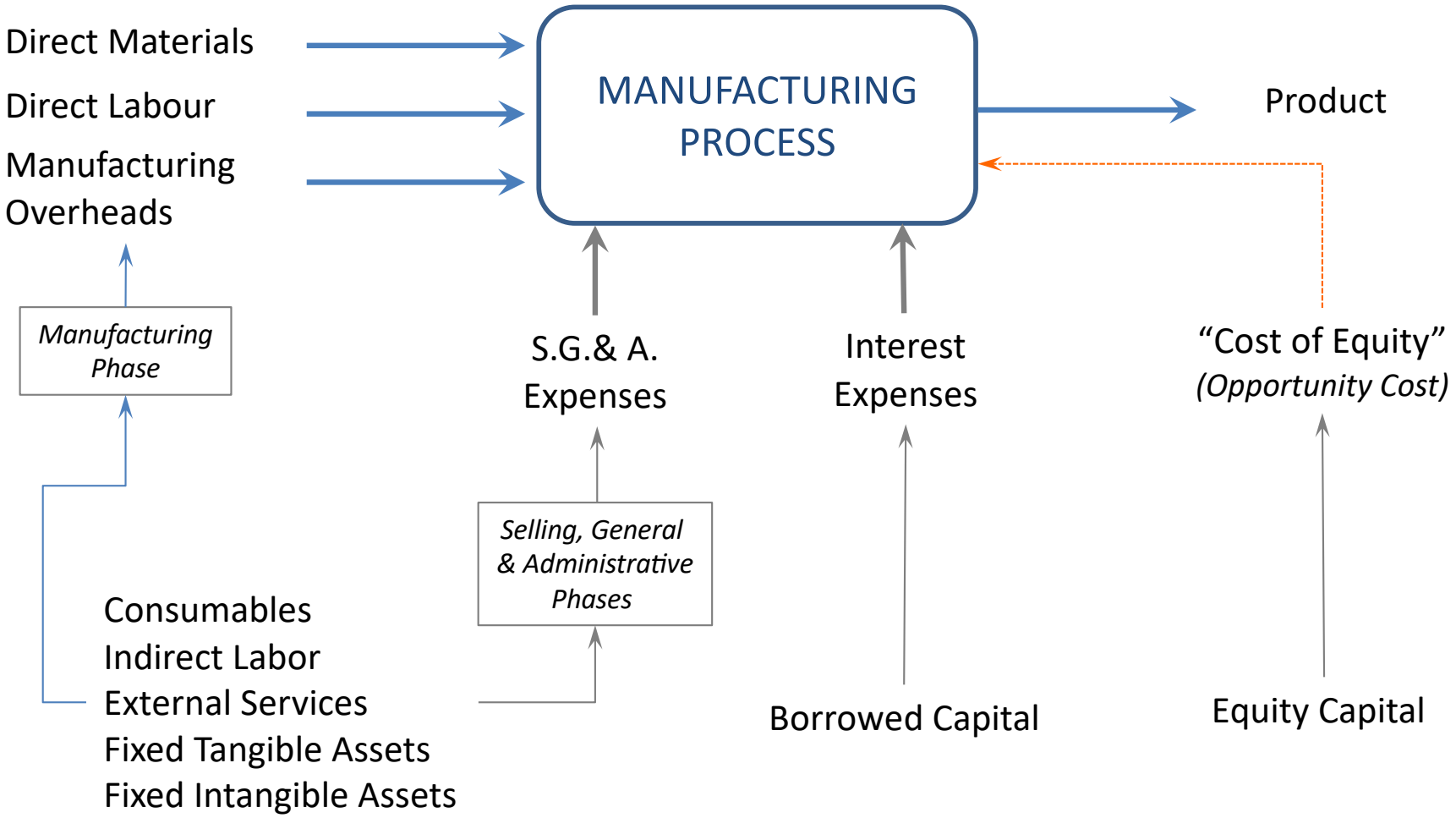
DESTRUCTION OF "VALUE"

PRODUCTS (tangible resources) and/or **SERVICES** (intangible resources)
are **made, obtained.**

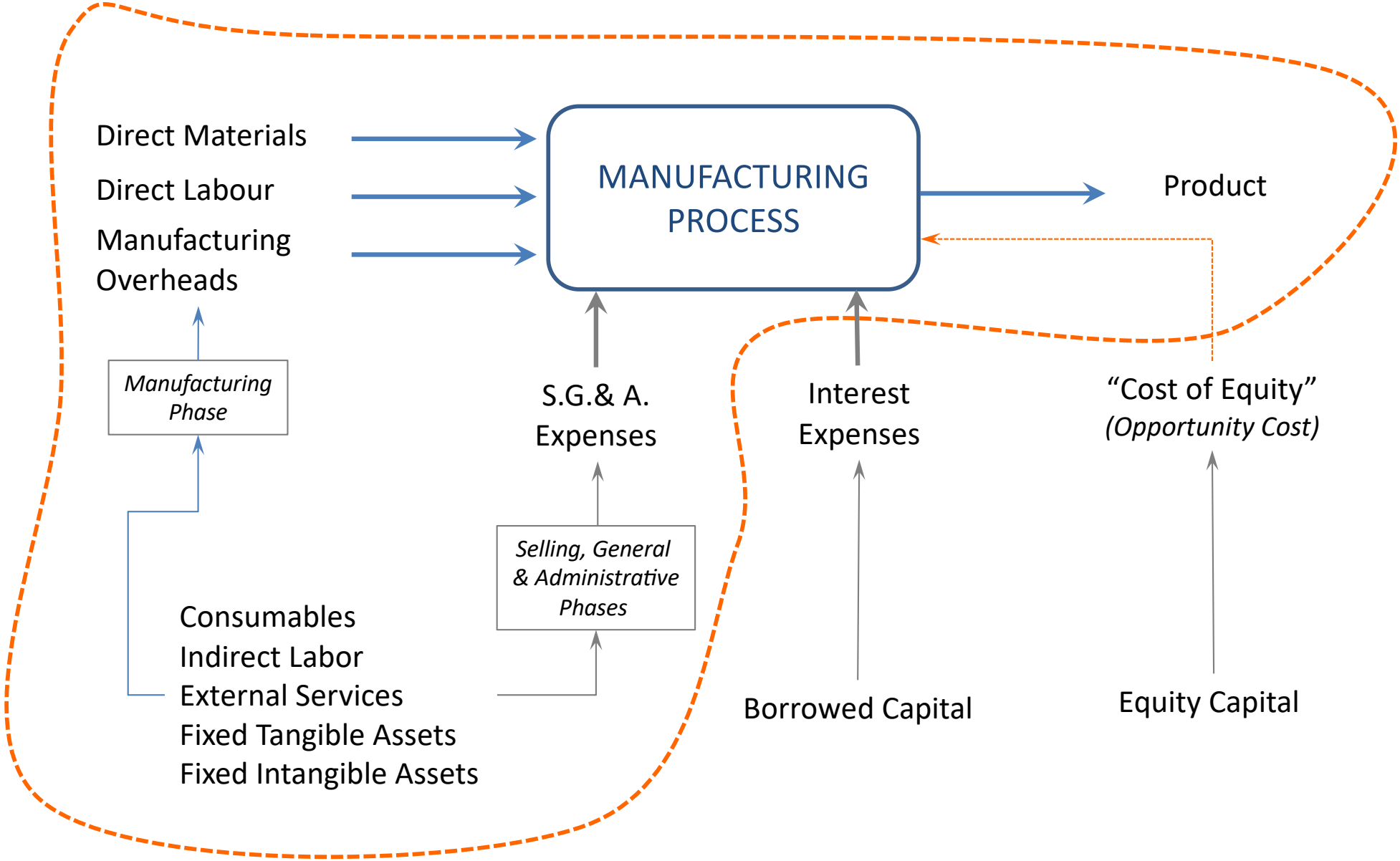
REVENUES are earned

CREATION OF "VALUE"

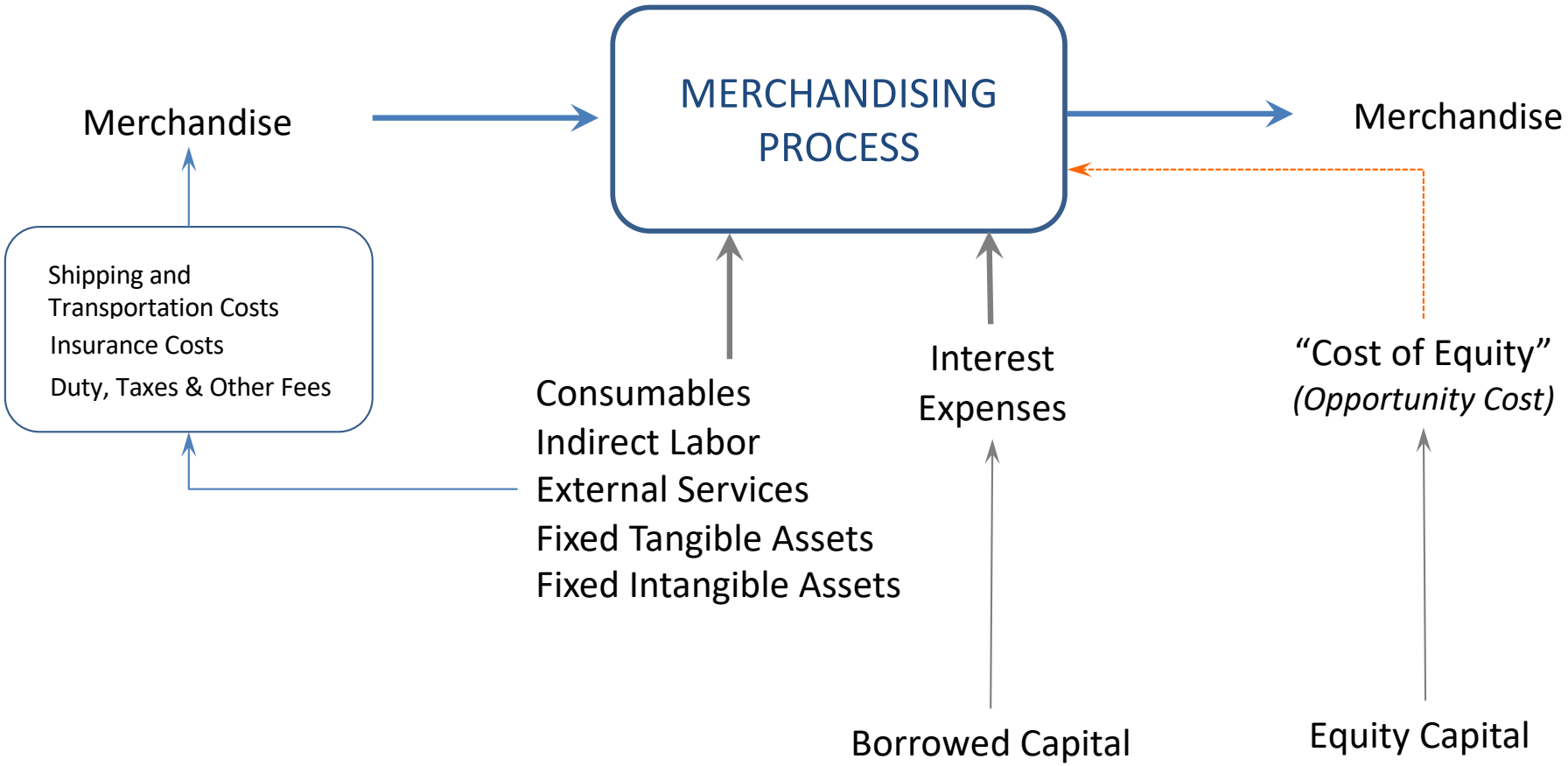
MANUFACTURING COMPANIES



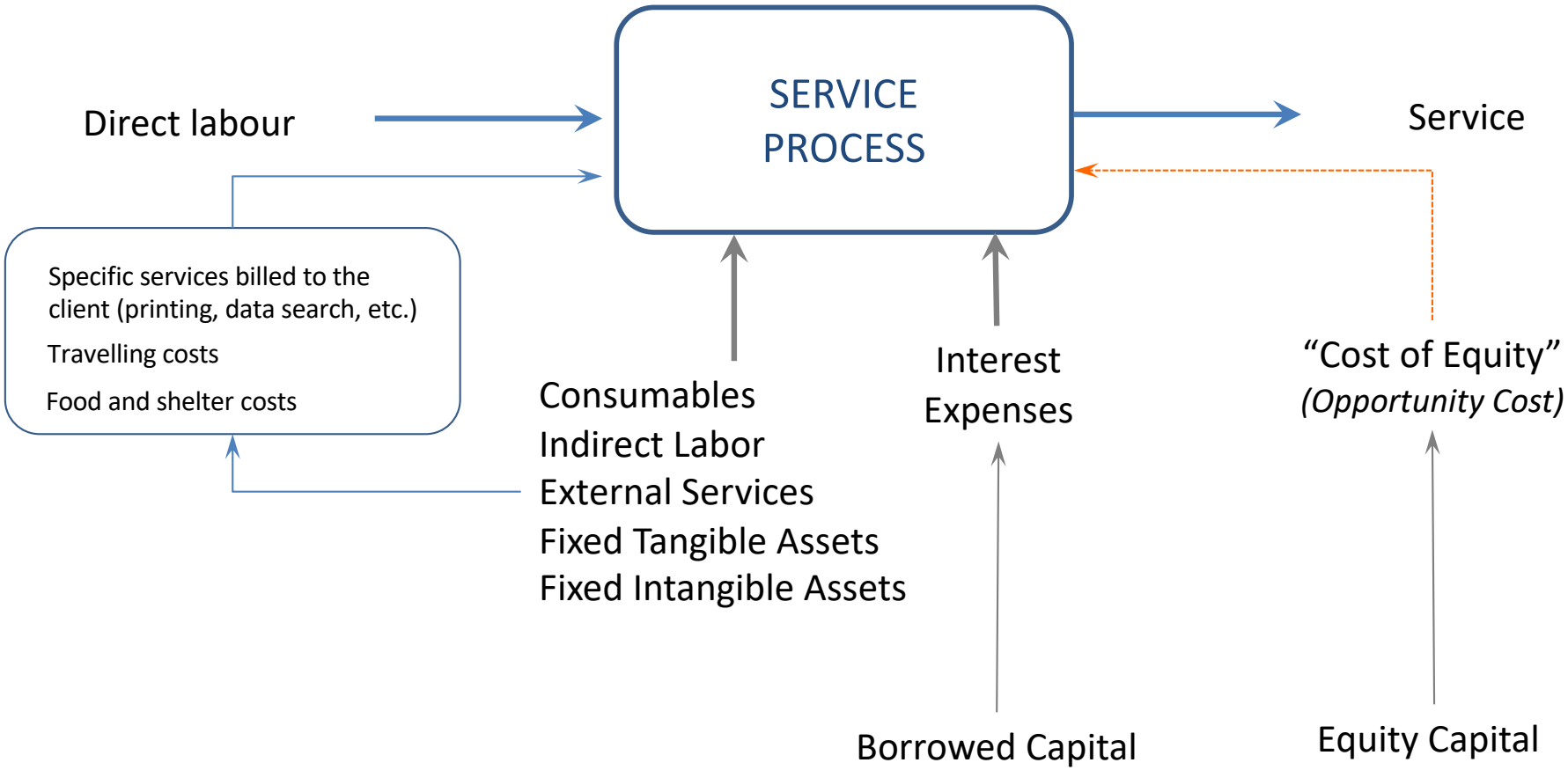
OPERATING ACTIVITIES



RETAIL & WHOLESALE ORGANIZATIONS



SERVICE ORGANIZATIONS



A SIMPLE REFLECTION

Which of the two runners will make the greater effort?

Which of the two will win the race?

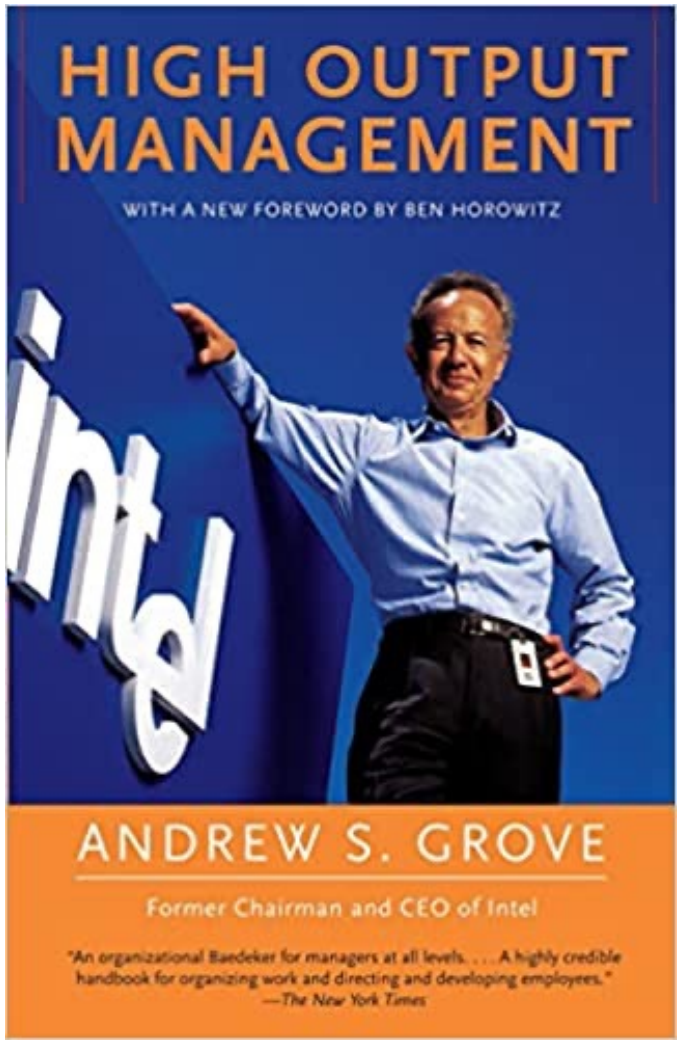
REAL LIFE EXAMPLE

BDR: *«What grade would you assign to your exam?»*

STUDENT: *«Professor, if I consider the time it took me to study this course, I would give me an A+!»*

Please note and keep in mind: with the same result, the greater the effort produced, the worse the performance!

MEASURE THE OUTPUT NOT THE EFFORT



«The first rule is that a measurement—any measurement—is better than none. But a genuinely effective indicator will cover the output of the work unit and not simply the activity involved. Obviously, you measure a salesman by the orders he gets (output), not by the calls he makes (activity)».

Excerpt from: Andrew S. Grove. "High output management"

INDICATORS TEND TO DIRECT YOUR ATTENTION

«As manager of the factory, you have a substantial staff and a lot of automated equipment. But to run your operation well, you will need a set of good indicators, or measurements. […] Just to get a fix on your output, you need a number of indicators; to get efficiency and high output, you need even more of them. The number of possible indicators you can choose is virtually limitless, but for any set of them to be useful, you have to focus each indicator on a specific operational goal. […]

Indicators measure factors essential to running your factory. If you look at them early every day, you will often be able to do something to correct a potential problem before it becomes a real one during the course of the day.

Indicators tend to direct your attention toward what they are monitoring. It is like riding a bicycle: you will probably steer it where you are looking».

Excerpt from: Andrew S. Grove. "High output management"

… THEREFORE, YOU SHOULD GUARD AGAINST OVERREACTING

«So, because indicators direct one's activities, you should guard against overreacting. This you can do by **pairing indicators**, so that together both **effect** and **counter-effect** are measured.

Examples of effective measures of administrative output are:

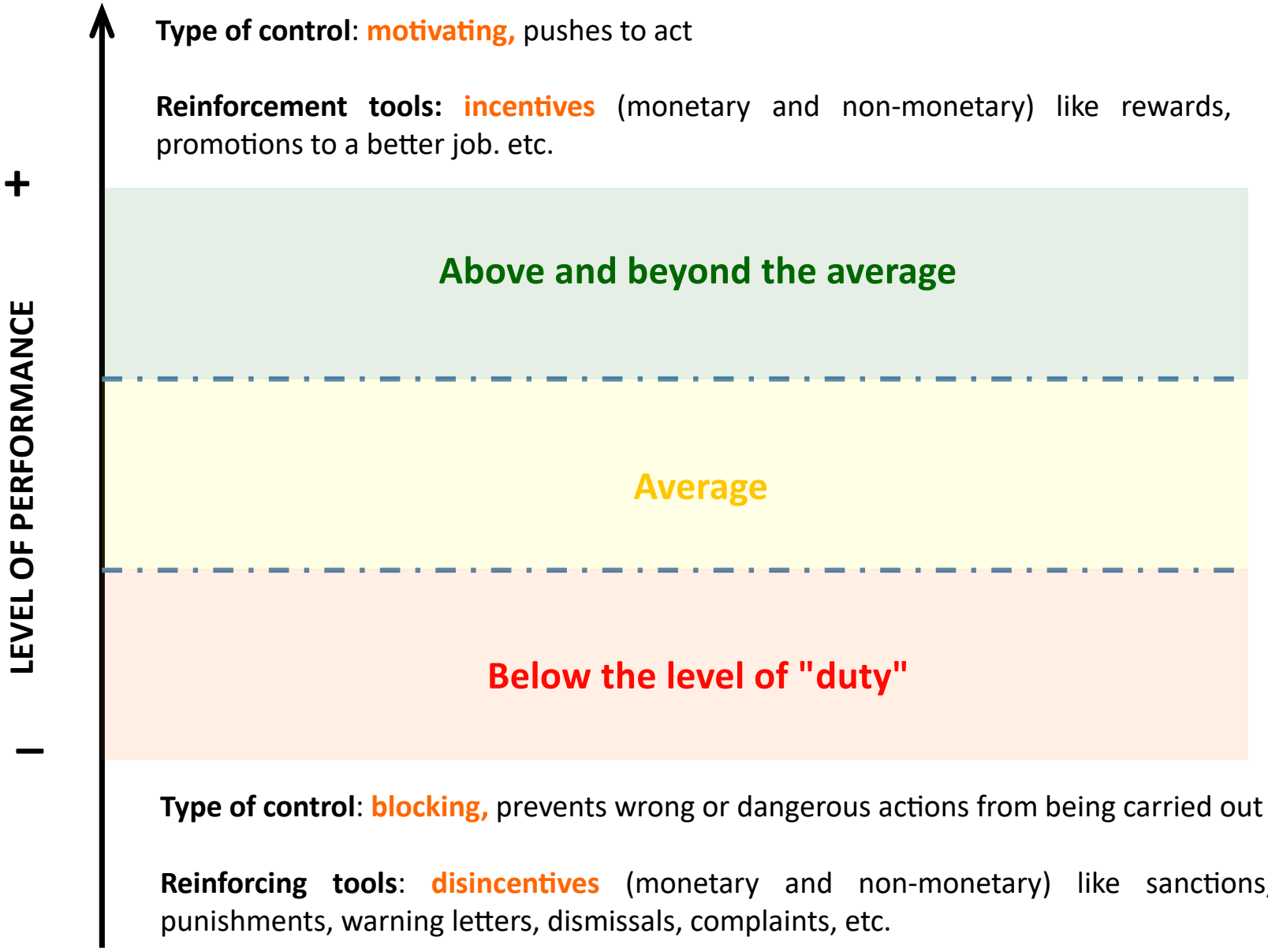
ADMINISTRATIVE FUNCTION	WORK OUTPUT INDICATOR
Accounts payable	# Vouchers processed
Custodial	# Square feet cleaned
Customer service	# Sales orders entered
Data entry	# Transactions processed
Employment	# People hired (by type of hire)
Inventory control	# Items managed in inventory"

Because those listed here are all quantity or output indicators, their paired counterparts should stress the quality of work. Thus, in accounts payable, the number of vouchers processed should be paired with the number of errors found either by auditing or by our suppliers. For another example, the number of square feet cleaned by a custodial group should be paired with a partially objective/partially subjective rating of the quality of work as assessed by a senior manager with an office in that building».

Excerpt from: Andrew S. Grove. "High output management"

	INPUT MEASURES	PROCESS MEASURES	OUTPUT MEASURES
Non-Financial Measures for:			
(a) New Products	# of engineering hours	# of product delivery milestones achieved	# of new products introduced
(b) Order Processing	# of telephone answering staff	Order completion time	# of orders processed
(c) Parts Manufacture	# of components rejected	Set-up time	% of units meeting standard
Financial Measures for:			
(a) New Products	Labor and material $	$ cost of prototyping	% of sales $ from new products
(b) Order processing	Clerical labor $	$ cost of backorder handling	$ cost per order processed
(c) Parts Manufacture	$ cost of defective components	Set-up $ cost, cost of rework	$ cost per unit

DIFFERENT TYPES OF CONTROLS FOR DIFFERENT REASONS



Type of control: **motivating,** pushes to act

Reinforcement tools: **incentives** (monetary and non-monetary) like rewards, promotions to a better job. etc.

Type of control: **blocking,** prevents wrong or dangerous actions from being carried out

Reinforcing tools: **disincentives** (monetary and non-monetary) like sanctions, punishments, warning letters, dismissals, complaints, etc.

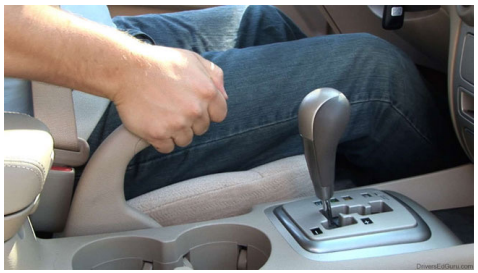
MANAGEMENT INVOLVES DIRECTING THE ACTIVITIES OF OTHERS

A dual sets of
control mechanisms
Is needed

LIMITS AGAINST UNDESIRABLE BEHAVIOR

The "Administration" responsibility centre may not, in the coming year, exceed the following values for any single cost item

- consultancy costs $250,000
- training expenses $120,000
- travel and transfers $80,000

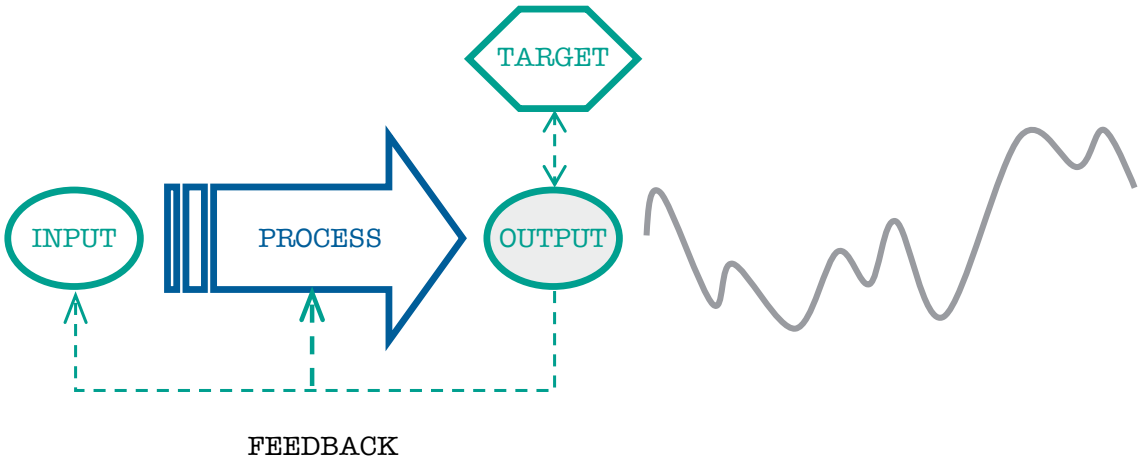


INCENTIVE TO CARRY OUT DESIRED ACTIONS

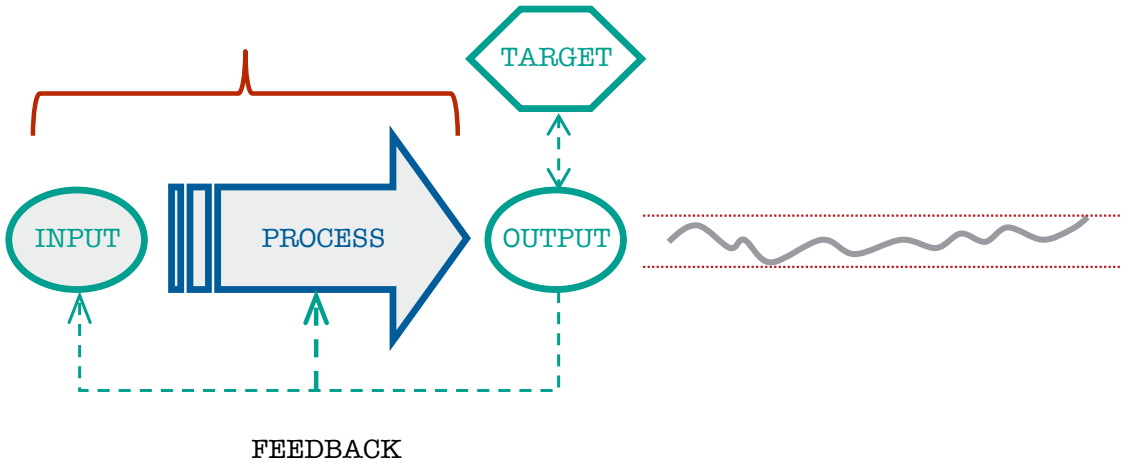
The manager of the “Painting” centre will receive a bonus if the average cost per square centimetre painted is less than $ 2.15

DIFFERENT TYPES OF CONTROLS WITH DIFFERENT EFFECTS

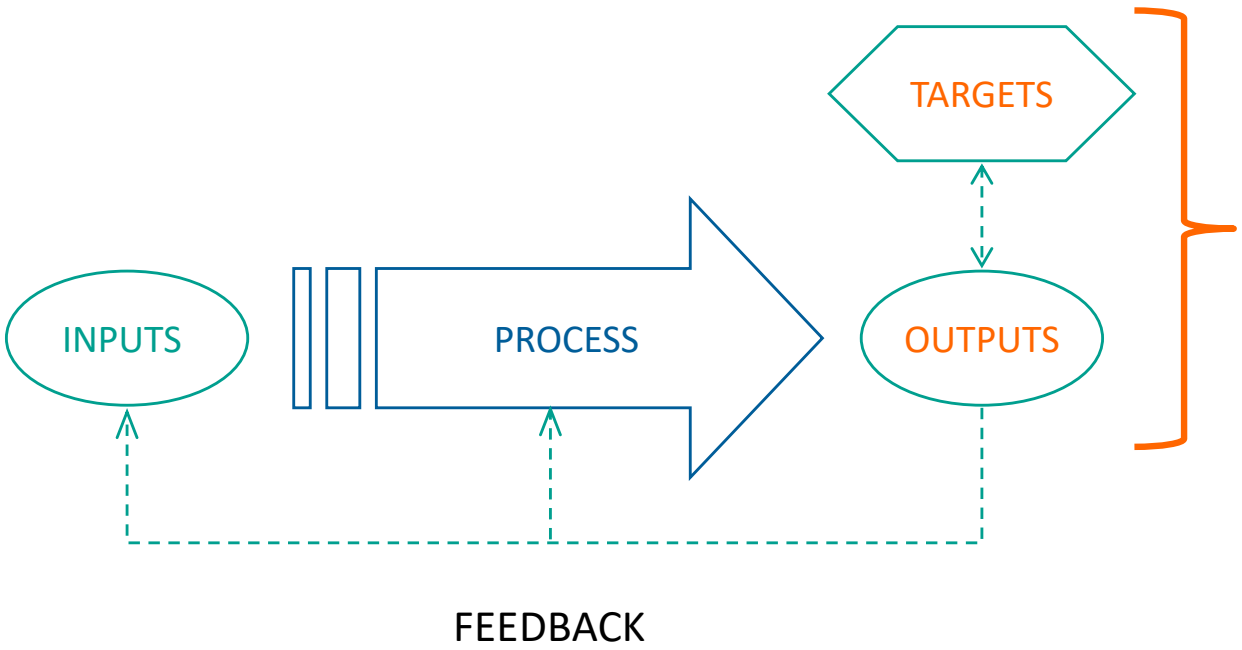
ACCOUNTABILITY



STANDARDIZATION



EFFECTIVENESS



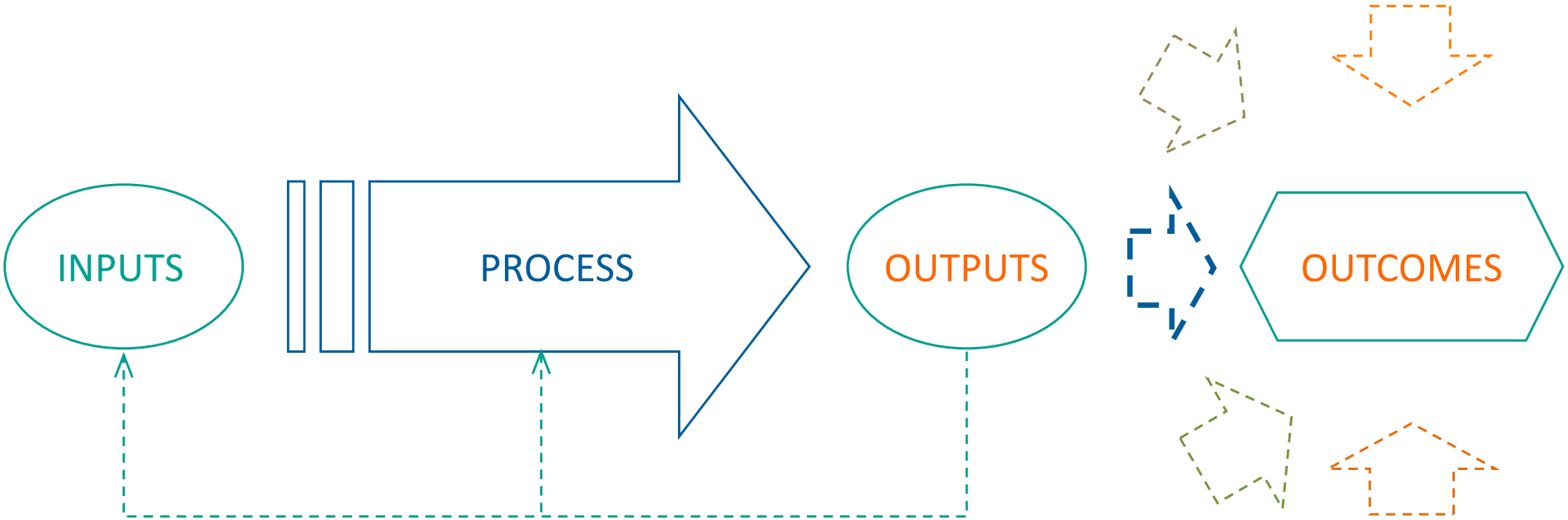
Effectiveness refers to the extent to which an activity achieves desired outcomes.

Effectiveness answers the question: Did we achieve what we set out to do?

Thus, measures of effectiveness focus on the comparison of actual results with preset expectations or standards.

Source: Robert Simons, "Strategy Execution Module 3: Evaluating Strategic Performance", HBS Publishing, 2017

OUTPUTS AND OUTCOMES



OUTPUTS VS OUTCOMES

OUTPUTS	OUTCOMES
Cause	Effect
System-oriented	Context-oriented
Immediate effects	Intermediate and long-term effects
Descriptive	Normative
Easily measurable	Fuzzy and hard to measure

SOME EXAMPLES

$$\frac{\text{Actual Quantity of Product Made}}{\text{Budgeted Quantity}}$$

$$\frac{\text{\# of Tasks completed}}{\text{\# of Tasks attempted}}$$

$$\frac{\text{Actual Sales Revenues}}{\text{Budgeted Sales}}$$

$$\frac{\text{Desired Delivery Time}}{\text{Actual Delivery Time}}$$

$$\frac{\text{\# of products without defects}}{\text{\# of products made}}$$

$$\frac{\text{\# of products delivered}}{\text{\# of order}}$$

DRILL DOWN ANALYSIS

Company Level

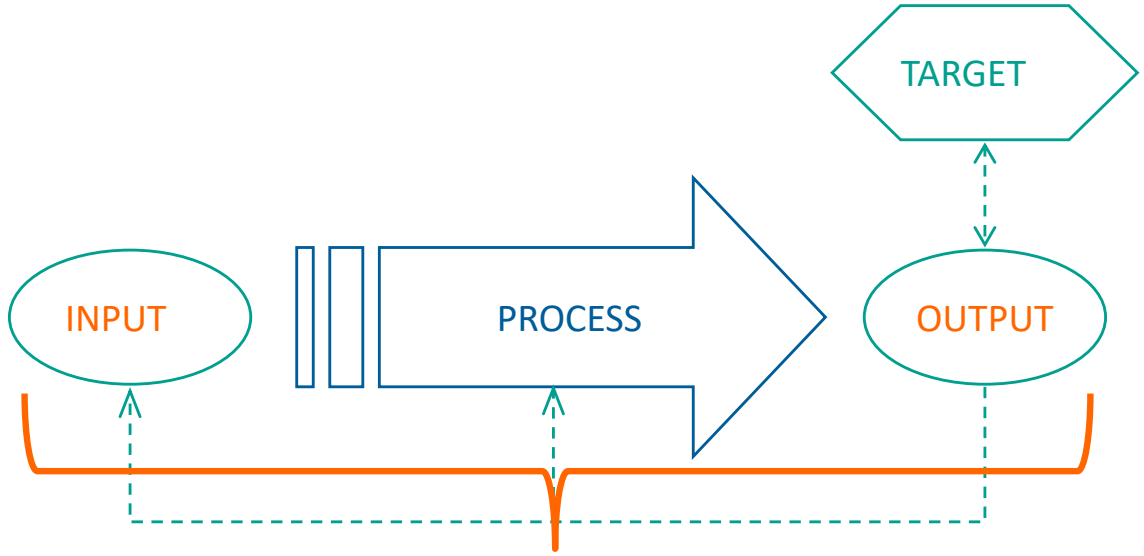
Division Level

Department Level

DIFFERENT KINDS OF MEASURES

TARGET	ACTUAL RESULT	KIND OF MESSURE
To decrease delivery time	Yes, delivery time has been reduced (but we don't know by how much)	Dichotomous
To finish the project by 12/31/2020	Failed	Dichotomous
To be one of the first 5 players in the market	# 2	Ordinal
To sell 20.000 liters of Chardonnay	22.650 liters sold	Cardinal
To decrease average delivery time below 8 days	Average delivery time equal to 7 day and 1/2	Cardinal

EFFICIENCY



Efficiency refers to the level of resources that were consumed to achieve a certain level of output.

Measures of efficiency answer the question: How many resources were used to achieve the actual outputs?

Thus, efficiency variances focus on ratios of inputs to outputs.

Source: Robert Simons, "Strategy Execution Module 3: Evaluating Strategic Performence", HBS Publishing, 2017

PRODUCTIVITY

Productivity is concerned with producing output efficiently, and it specifically addresses the relationship of output and the inputs used to produce the output.

Usually, different combinations or mixes of inputs can be used to produce a given level of output.

Total productive efficiency is the point at which two conditions are satisfied:

1. For any mix of inputs that will produce a given output, no more of any one input is used than necessary to produce the output (technical efficiency) and
2. given the mixes that satisfy the first condition, the least costly mix is chosen (allocative efficiency).

Source: Don R. Hansen & Maryanne M. Mowen, "Cost Management. Accounting and Control", Fifth Edition, Chapter 15 *Productivity Measurement and Control,* Thomson South-Western, 2006

TOTAL PRODUCTIVE EFFICIENCY: AN EXAMPLE

Resource “A“

Resource “B“

Product “X“

1 dose of "A” = $ 18.00

1 dose of "A” = $ 10.00

2 doses of "A"	2 doses of "A"	1 dose of "A"	1 dose of "A"
1 dose of ”B"	1,5 doses of ”B"	3 doses of ”B"	2,5 doses of ”B"

TOTAL PRODUCTIVE EFFICIENCY: AN EXAMPLE

Resource “A“

Resource “B“

Product “X“

1 dose of "A” = $ 18.00

1 dose of "A” = $ 10.00

2 doses of "A"

1 dose of ”B"

2 doses of "A"

1,5 doses of ”B"

1 dose of "A"

3 doses of ”B"

1 dose of "A"

2,5 doses of ”B"

TOTAL PRODUCTIVE EFFICIENCY: AN EXAMPLE

Resource “A“

Resource “B“

Product “X“

1 dose of "A” = $ 18.00

1 dose of "A” = $ 10.00

2 doses of "A"

1 dose of ”B"

$ 46.00

2 doses of "A"

1,5 doses of ”B"

1 dose of "A"

3 doses of ”B"

1 dose of "A"

2,5 doses of ”B"

$ 43.00

PRODUCTIVITY MEASUREMENT

Productivity measurement is simply a quantitative assessment of productivity changes. The objective is to assess whether productive efficiency has increased or decreased.

Productivity measurement can be actual or prospective.

Actual productivity measurement allows managers to assess, monitor, and control changes.

Prospective measurement is forward-looking, and it serves as input for strategic decision making.

Specifically, prospective measurement allows managers to compare relative benefits of different input combinations, choosing the inputs and input mix that provide the greatest benefit.

Source: Don R. Hansen & Maryanne M. Mowen, "Cost Management. Accounting and Control", Fifth Edition, Chapter 15 *Productivity Measurement and Control,* Thomson South-Western, 2006

PARTIAL PRODUCTIVITY MEASURES

Productivity measures can be developed for each input separately or for all inputs jointly. Measuring productivity for one input at a time is called partial productivity measurement.

Productivity of a single input is typically measured by calculating the ratio of the output to the input as follows:

Productivity = Output/Input

Because the productivity of only one input is being measured, the measure is called a partial productivity measure.

If both output and input are measured in physical quantities, then we have an operational productivity measure. If output or input is expressed in dollars, then we have a financial productivity measure.

Source: Don R. Hansen & Maryanne M. Mowen, "Cost Management. Accounting and Control", Fifth Edition, Chapter 15 *Productivity Measurement and Control,* Thomson South-Western, 2006

PARTIAL OPERATIONAL PRODUCTIVITY

100 km	67.2 miles
3.5 liter	1 gallon

OPERATIONAL PRODUCTIVITY

$$\frac{\text{\# items sold}}{\text{square meters}} \qquad \frac{\text{hectoliters of wine}}{\text{hectares of vineyard}} \qquad \frac{\text{1 liter of wine}}{\text{kg grapes}}$$

$$\frac{\text{square meters “served”}}{\text{\# Full Time Equivalents}} \qquad \frac{\text{\# salable chairs}}{\text{1 day of production}}$$

$$\frac{\text{\# of products}}{\text{hours of labor}} \qquad \frac{\text{\# of dossiers}}{\text{\# of clerks}} \qquad \frac{\text{\# of km}}{\text{\# of day}} \qquad \frac{\text{\# of km sold}}{\text{\# of km travelled}}$$

HOW TO MEASURE RETAIL PERFORMANCE?

1. Number of Customers (Customer Traffic)
2. Effectivity (Retail Conversion Rate)
3. Average Sale (Average purchase value)
4. Items per purchase (Size of an average shopping cart)
5. Gross margin (Sales profit before costs)

SOURCE: https://erply.com/how-to-measure-retail-performance-5-essential-metrics/

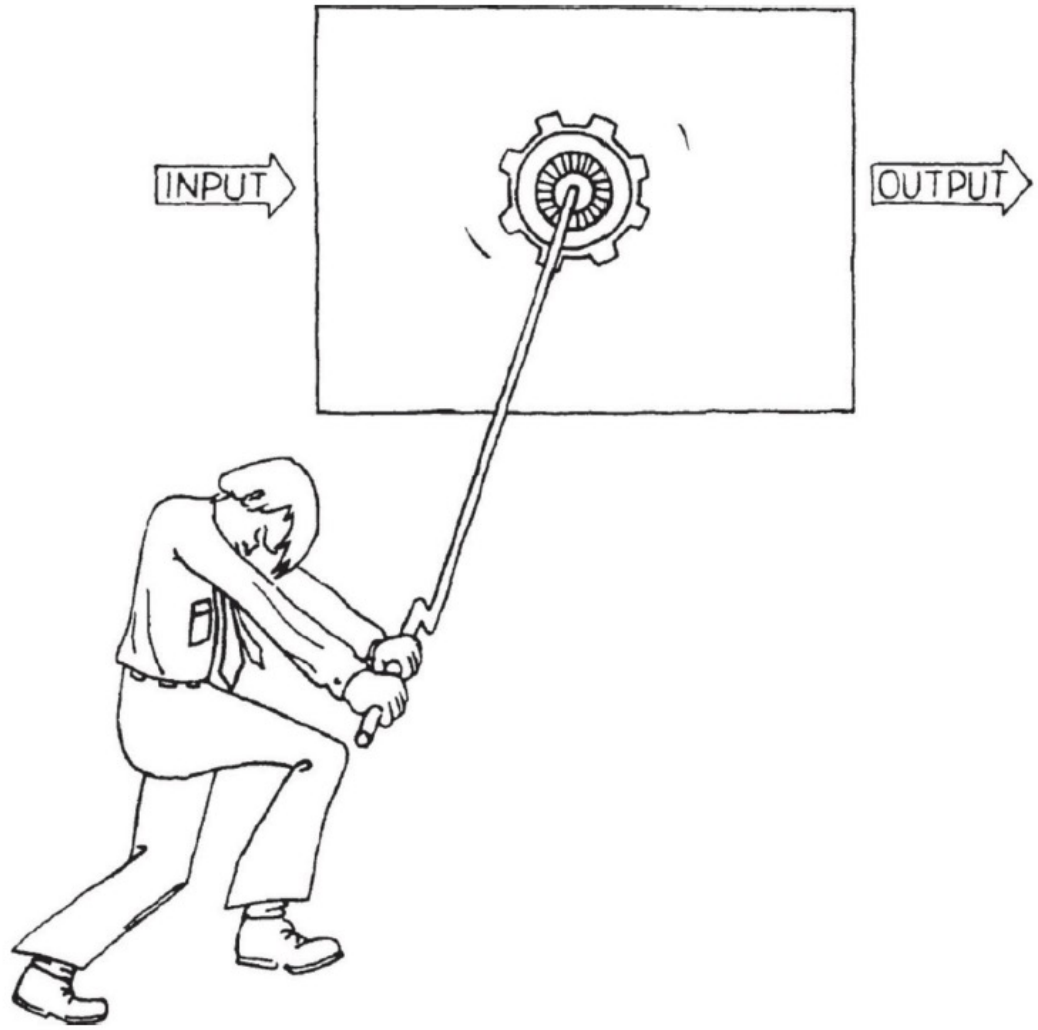
HOW TO LINK THE MEASURES TOGETHER

1. Number of Customers (Customer Traffic)
2. Effectivity (Retail Conversion Rate)
3. Average Sale (Average purchase value)
4. Items per purchase (Size of an average shopping cart)
5. Gross margin (Sales profit before costs)

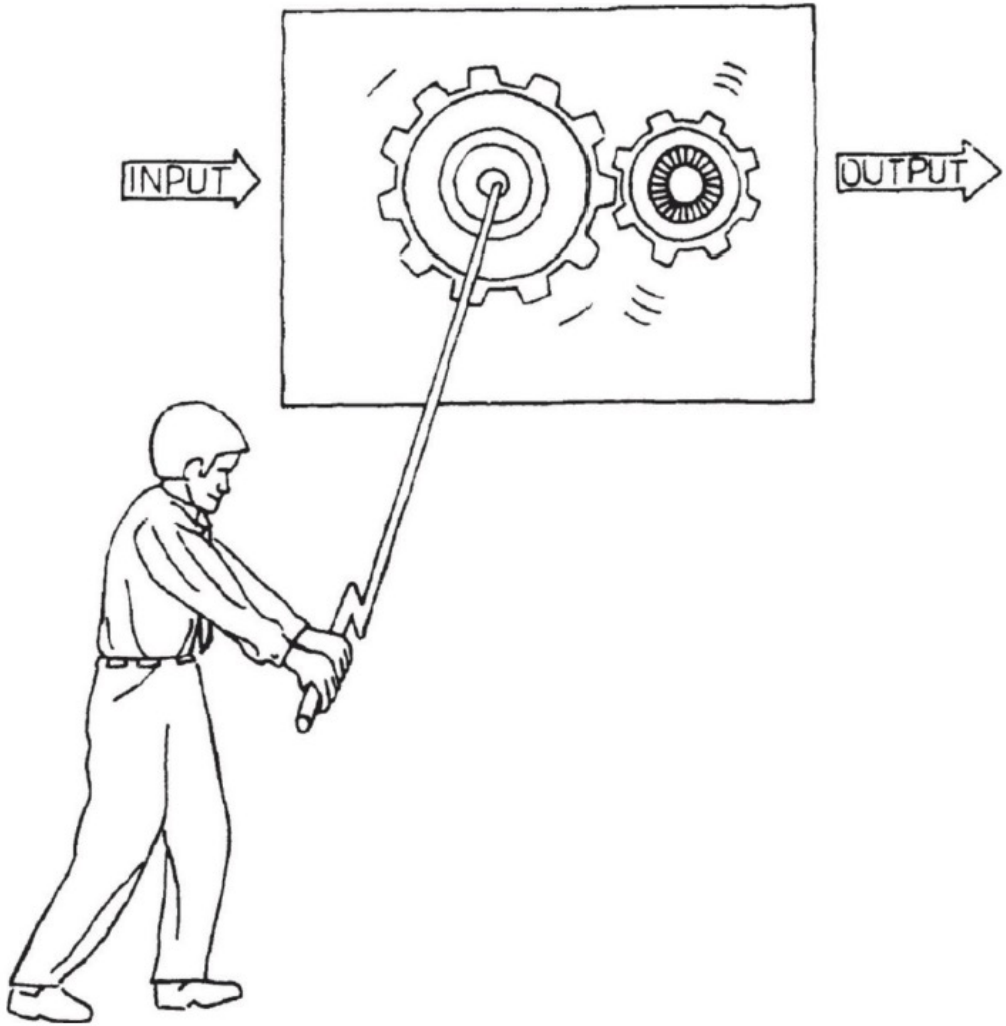
$$\frac{\#\text{ Visitors}}{\#\text{ Square meters}} * \frac{\#\text{ Transactions}}{\#\text{ Visitors}} * \frac{\#\text{ Items sold}}{\#\text{ Transactions}} * \left\{ \frac{\text{Sales revenue}}{\#\text{ Items sold}} - \frac{\text{COGS}}{\#\text{ Items sold}} \right\}$$

Partial operational productivity measures

WORKING FASTER (HARDER ?)



WORKING SMARTER



WORKING HARDER OR SMARTER

«The workings of our black box can furnish us with the simplest and most useful definition of productivity. The productivity of any function occurring within it is the output divided by the labor required to generate the output. Thus, one way to increase productivity is to do whatever we are now doing, but faster. This could be done by reorganizing the work area or just by working harder. Here we've not changed what work we do, we've just instituted ways to do it faster—getting more activities per employee-hour to go on inside the black box. Because the output of the black box is proportional to the activity that occurs within it, we will get more output per hour.

There is a second way to improve productivity. We can change the nature of the work performed: what we do, not how fast we do it. We want to increase the ratio of output to activity, thereby increasing output even if the activity per employee-hour remains the same. As the slogan has it, we want to "work smarter, not harder"».

Excerpt from: Andrew S. Grove. "High output management"

WHICH IS THE BEST?

CAB DRIVER FURIO

$$\frac{100 \text{ km travelled}}{8 \text{ liters}}$$

CAB DRIVER NEVIO

$$\frac{150 \text{ km travelled}}{12 \text{ liters}}$$

WHICH IS THE BEST?

CAB DRIVER FURIO

$$\frac{50 \text{ km sold}}{8 \text{ liters}}$$

CAB DRIVER NEVIO

$$\frac{50 \text{ km sold}}{12 \text{ liters}}$$

WHICH IS THE BEST?

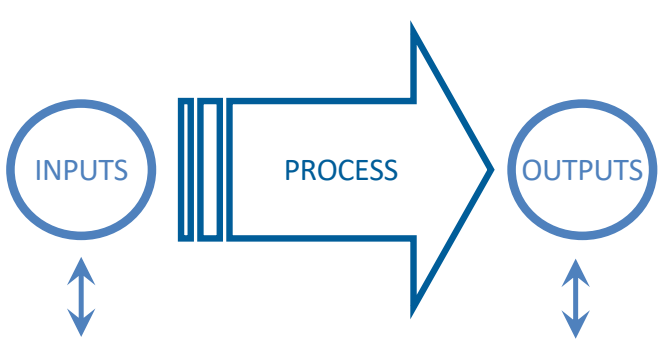
CAB DRIVER FURIO

$$\frac{50 \text{ km sold}}{8 \text{ liters}} = \frac{50 \text{ km sold}}{100 \text{ km travelled}} \times \frac{100 \text{ km travelled}}{8 \text{ liters}}$$

CAB DRIVER NEVIO

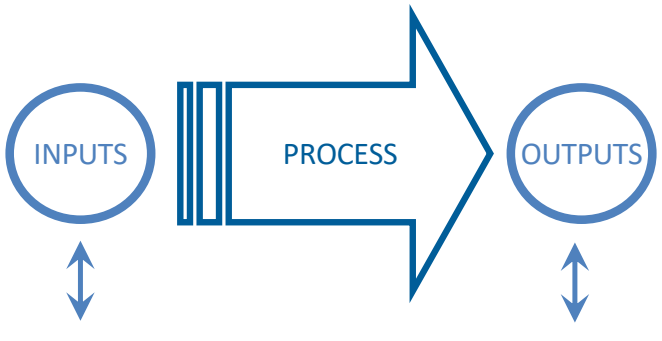
$$\frac{50 \text{ km sold}}{12 \text{ liters}} = \frac{50 \text{ km sold}}{150 \text{ km travelled}} \times \frac{150 \text{ km travelled}}{12 \text{ liters}}$$

TWO DIFFERENT PERSPECTIVE



Level of **resources consumed** to produce the output

Total output made in the period



Level of the **resources sacrificed to sell**

Output sold in the period

input and output compared must be coherent, in the sense that they must refer to the same entity (outputs made or outputs sold)

TWO DIFFERENT PERSPECTIVE: A VERY SIMPLE EXAMPLE

Let's imagine that in order to produce one unit of Product "K" we need 0,5 units of Resource "L" and that we have the following relationships between products obtained and sold:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
Made	850	730	620	670	630	600	**4100**
Sold	790	690	700	650	650	620	**4100**

Focus on outputs SOLD:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Output sold	790	690	700	650	650	620	**4100**
(B) Input used to make the whole production	395	345	350	325	325	310	**2050**
(C) Operational productivity = A/B	2,00	2,00	2,00	2,00	2,00	2,00	**2,00**

Focus on outputs MADE:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Output made	850	730	620	670	630	600	**4100**
(B) Input used to make the portion of product sold	425	365	310	335	315	300	**2050**
(C) Operational productivity = A/B	2,00	2,00	2,00	2,00	2,00	2,00	**2,00**

TWO DIFFERENT PERSPECTIVE: A MORE COMPLEX EXAMPLE

Let's imagine that in order to produce one unit of Product "K" we need 0,4 units of Resource "G" and that we have the following relationships between outputs obtained, sold and removed from inventory because obsolete:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
Made	600	570	610	650	620	550	**3600**
Sold	540	595	629	614	598	584	**3560**
Removed					28	12	**40**

Focus on outputs SOLD:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Outputs sold	540	595	629	614	598	584	**3560**
(B) Inputs used to make the outputs that have been sold	216	238	252	246	239	234	**1424**
(C) Inputs used to make the outputs that have been removed					11,20	4,80	**16**
(D) Operational productivity = A/(B+C)	2,50	2,50	2,50	2,50	2,39	2,45	**2,47**

Focus on outputs MADE:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Outputs made	600	570	610	650	620	550	**3600**
(B) Outputs removed					28	12	**40**
(C) Inputs used to make the outputs	240	228	244	260	248	220	**1440**
(D) Operational productivity = (A-B)/C	2,50	2,50	2,50	2,50	2,39	2,45	**2,47**

IN THE LONG RUN

$$\frac{OUTPUT_{SOLD}}{INPUT_{USED}} = \frac{OUTPUT_{SOLD}}{OUTPUT_{MADE}} * \frac{OUTPUT_{MADE}}{INPUT_{USED}}$$

First example:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Output made	850	730	620	670	630	600	**4100**
(B) Input used to make the portion of product sold	425	365	310	335	315	300	**2050**
(C) Operational productivity = A/B	2,00	2,00	2,00	2,00	2,00	2,00	**2,00**

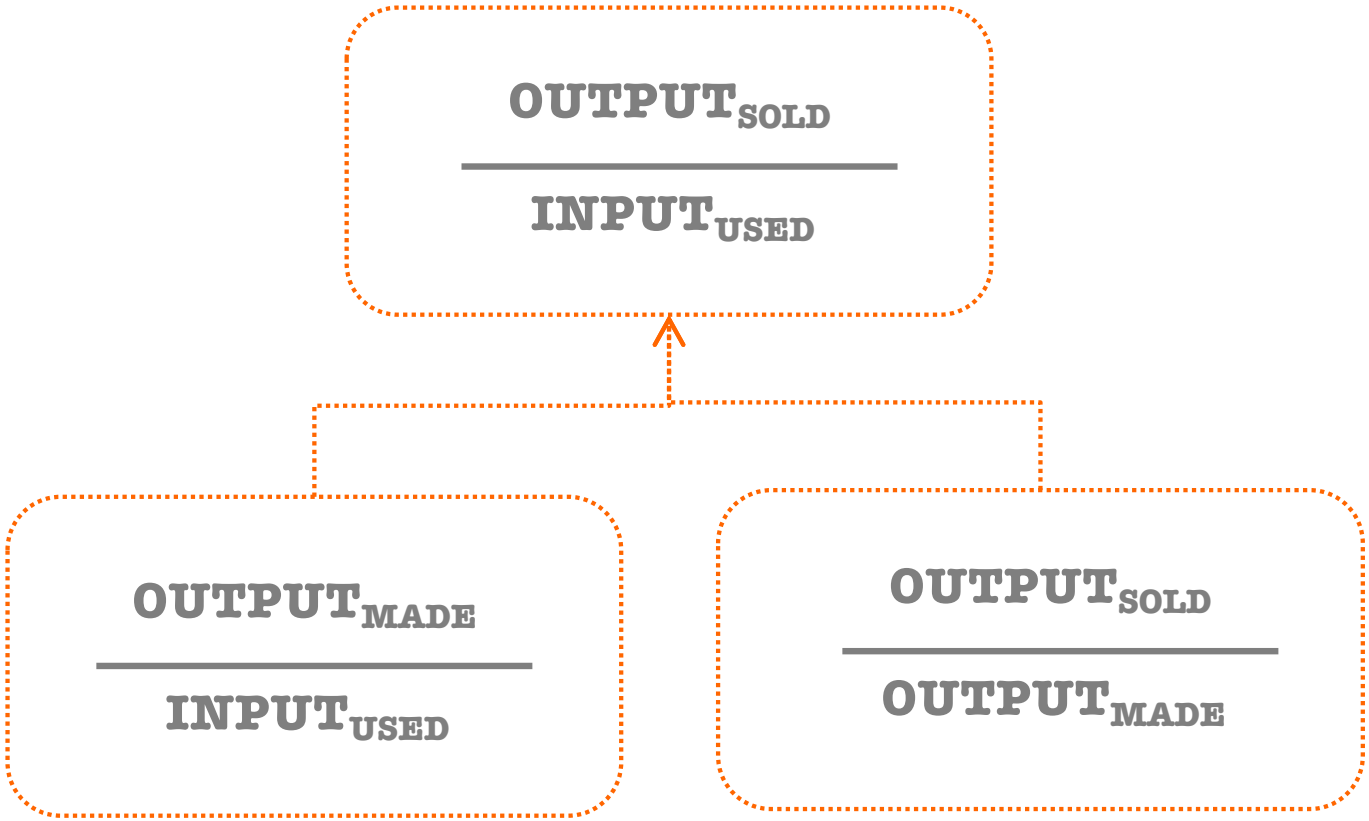
$$\frac{4{,}100 \text{ units}}{2{,}050 \text{ doses}} = \frac{4{,}100 \text{ units}}{4{,}100 \text{ units}} * \frac{4{,}100 \text{ units}}{2{,}050 \text{ doses}} = \mathbf{2{,}00}$$

Second example:

	20X0	20X1	20X2	20X3	20X4	20X5	Total
(A) Outputs made	600	570	610	650	620	550	**3600**
(B) Outputs removed					28	12	**40**
(C) Inputs used to make the outputs	240	228	244	260	248	220	**1440**
(D) Operational productivity = (A-B)/C	2,50	2,50	2,50	2,50	2,39	2,45	**2,47**

$$\frac{3{,}560 \text{ units}}{1{,}440 \text{ doses}} = \frac{3{,}560 \text{ units}}{3{,}600 \text{ units}} * \frac{3{,}600 \text{ units}}{1{,}440 \text{ doses}} = \mathbf{2{,}47}$$

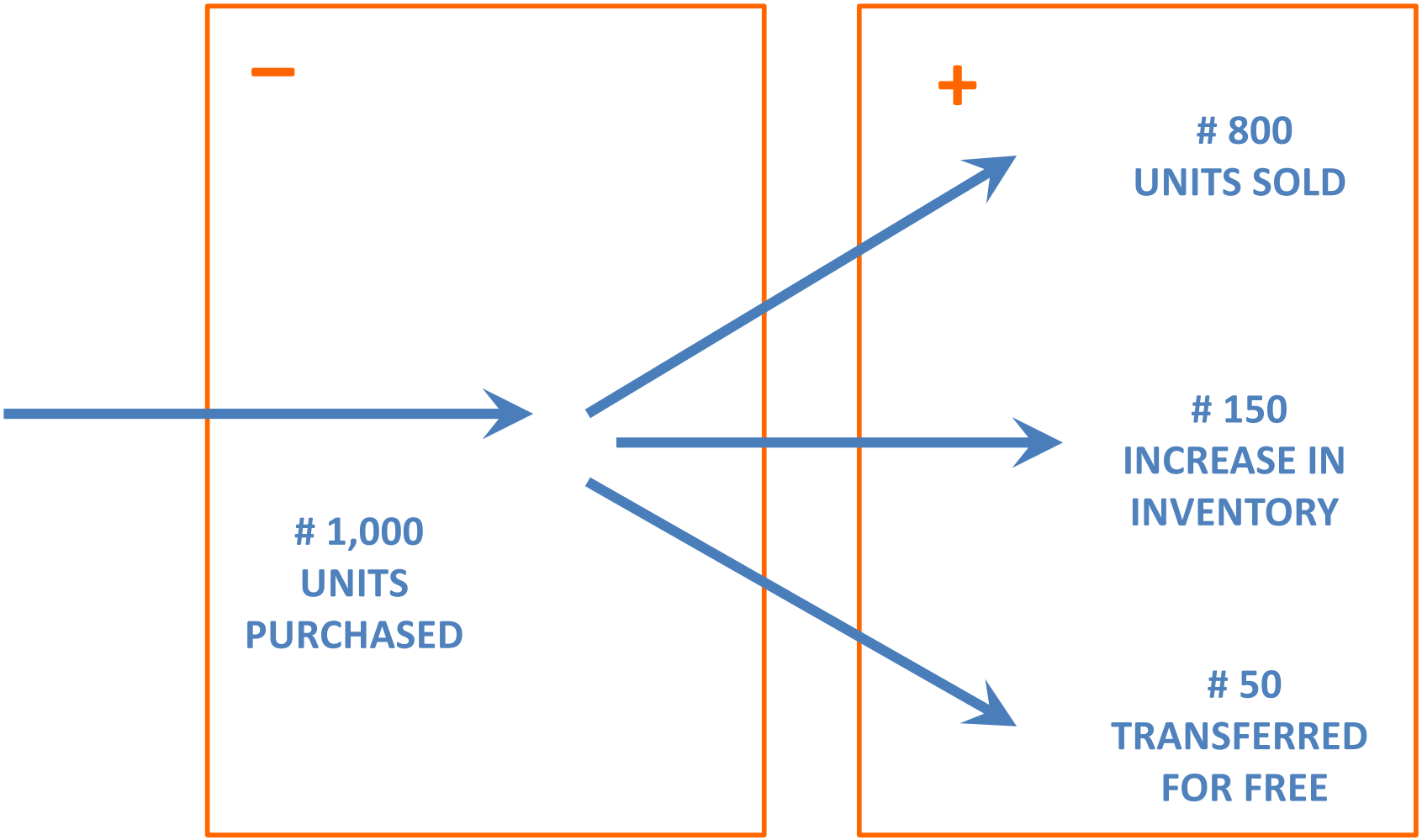
CAUSE AND EFFECT RELATIOSHIP



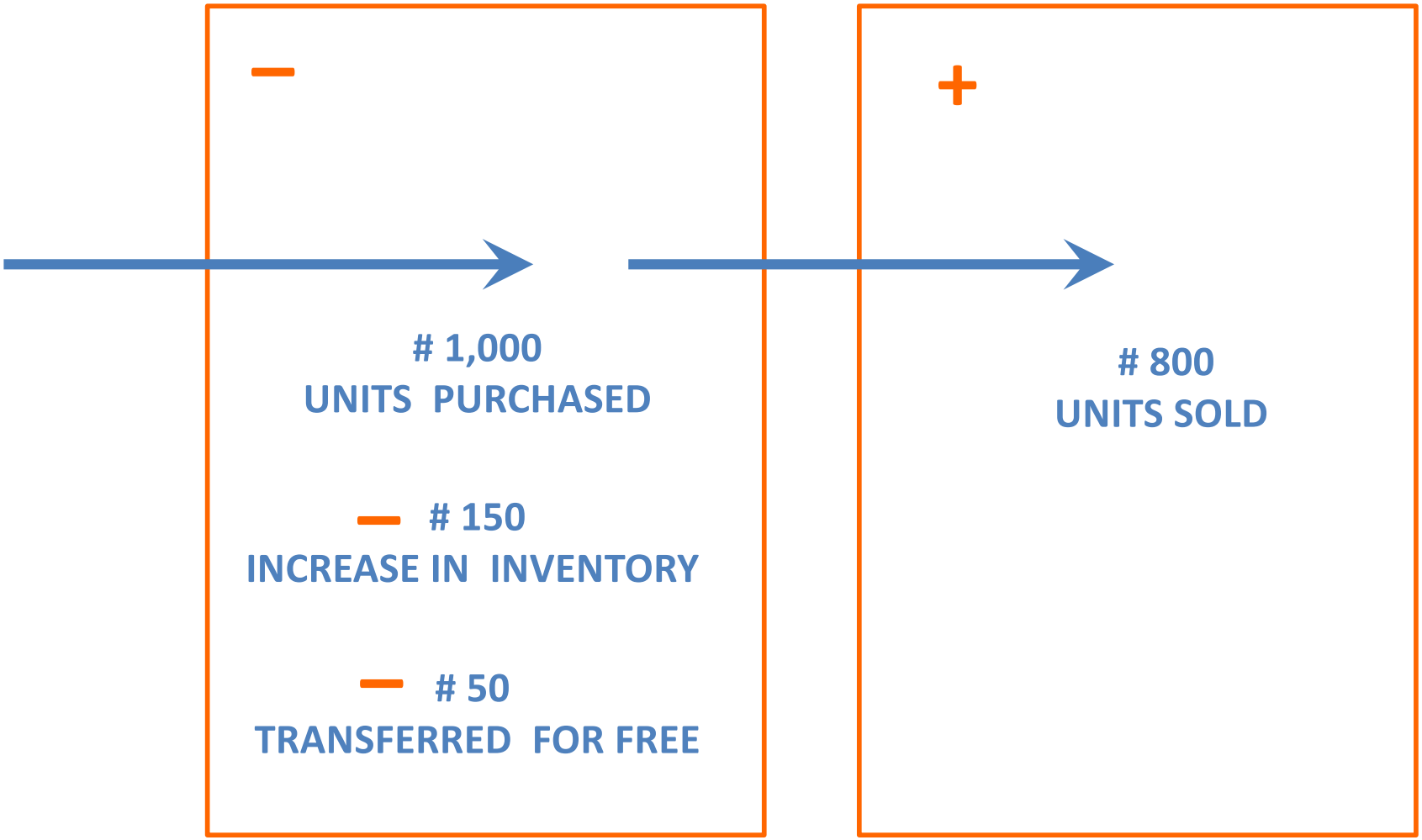
In the long run is necessarily less than or at most equal to 1!

This component if not correctly managed **can only destroy value**

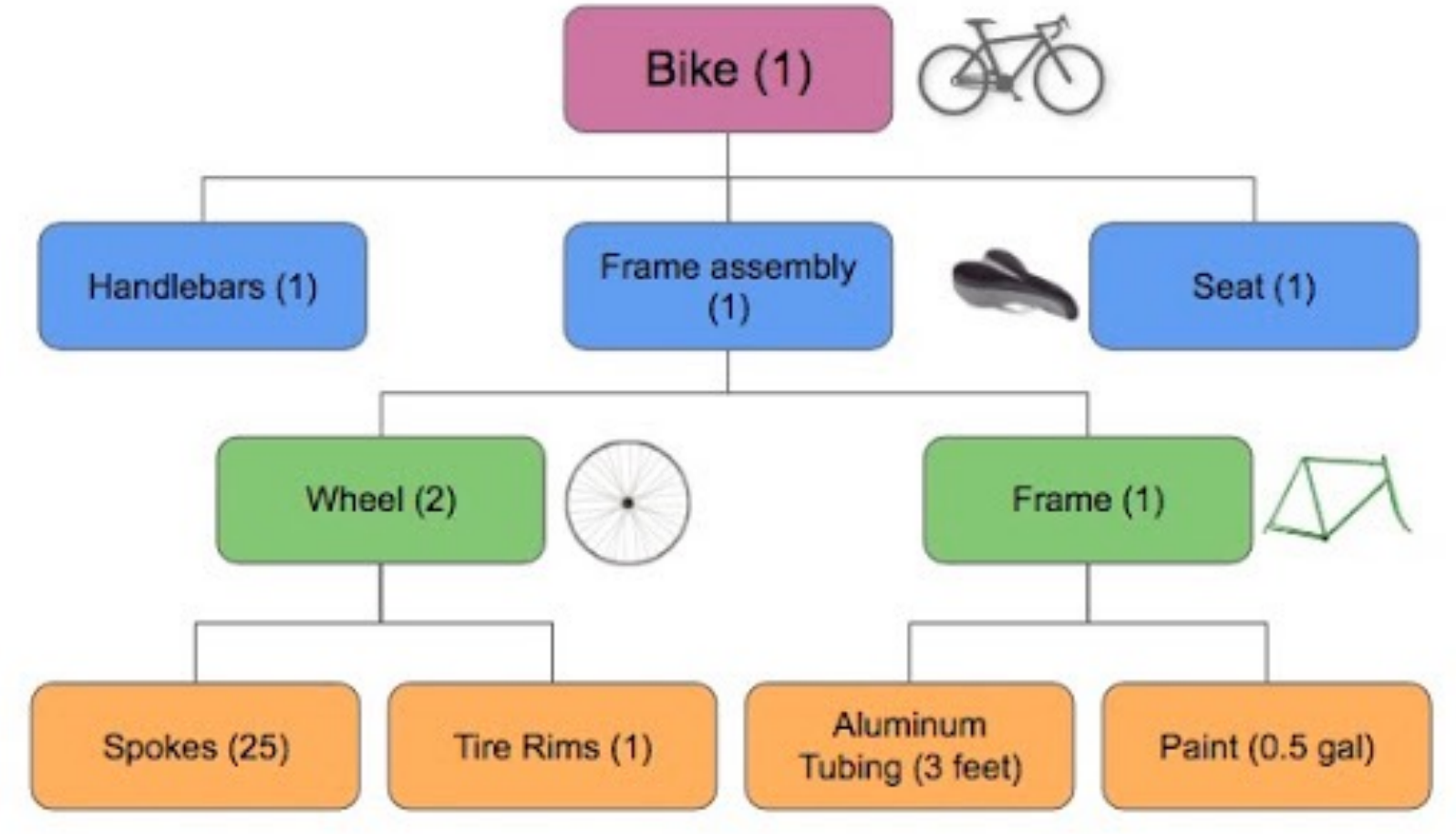
TOTAL OUTPUT INCOME STATEMENT (MERCHANDISING)



COGS INCOME STATEMENT (MERCHANDISING)



BILL OF MATERIALS



DIFFERENT STANDARDS

How many corks are needed to cork a bottle of wine?

$$\frac{1\ \text{CORK}}{1\ \text{BOTTLE}} = 1$$

$$\frac{21\ \text{CORKS}}{18\ \text{BOTTLES}} = 1.3125$$

IDEAL VS NORMAL STANDARD

Companies set standards at one of two levels: ideal or normal.

- Ideal standards represent optimum levels of performance under perfect operating conditions.
- Normal standards represent efficient levels of performance that are attainable under expected operating conditions.

Some managers believe ideal standards will stimulate workers to ever-increasing improvement. However, most managers believe that ideal standards lower the morale of the entire workforce because they are difficult, if not impossible, to meet. Very few companies use ideal standards.

Most companies that use standards set them at a normal level. Properly set, normal standards should be rigorous but attainable. Normal standards allow for rest periods, machine breakdowns, and other "normal" contingencies in the production process.

SPOILAGE, SCRAP AND REWORK

Spoilage refers to unacceptable units that are discarded or sold for disposal value.
Scrap is the material left over from the manufacture of the product; it has little or no value.
Rework units are units produced that must be reworked into good units that can be sold in regular channels.

"Level" of the problem

Normal: *occurs under normal operating conditions; it is uncontrollable in the short term and is considered a normal part of production and product cost.*
➜ the cost incurred is absorbed by the cost of good units produced.

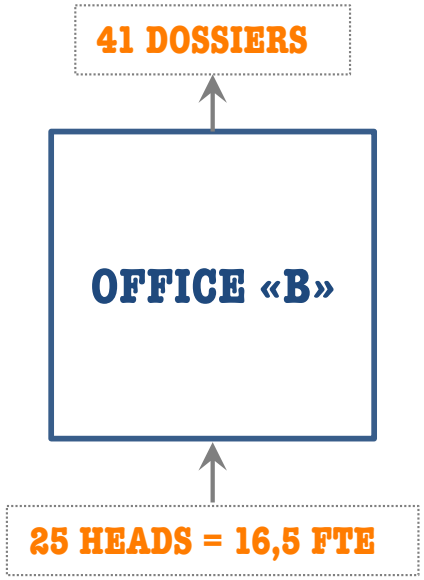
Abnormal: *is in excess over the amount of normal spoilage expected under normal operating conditions.*
➜ the cost incurred is charged as a loss to operations in the period detected.

COMPARISON BETWEEN TWO OFFICES

- 10 clerks working 8 hours/day
- 8 clerks working 6 hours/day
- 2 clerks working 4 hours/day

- 1 clerk working 8 hours/day
- 14 clerks working 6 hours/day
- 10 clerks working 4 hours/day

COMPARISON BETWEEN TWO OFFICES



10 clerks working 8 hours/day * 8/8 = 10 FTE

8 clerks working 6 hours/day * 6/8 =. 6 FTE

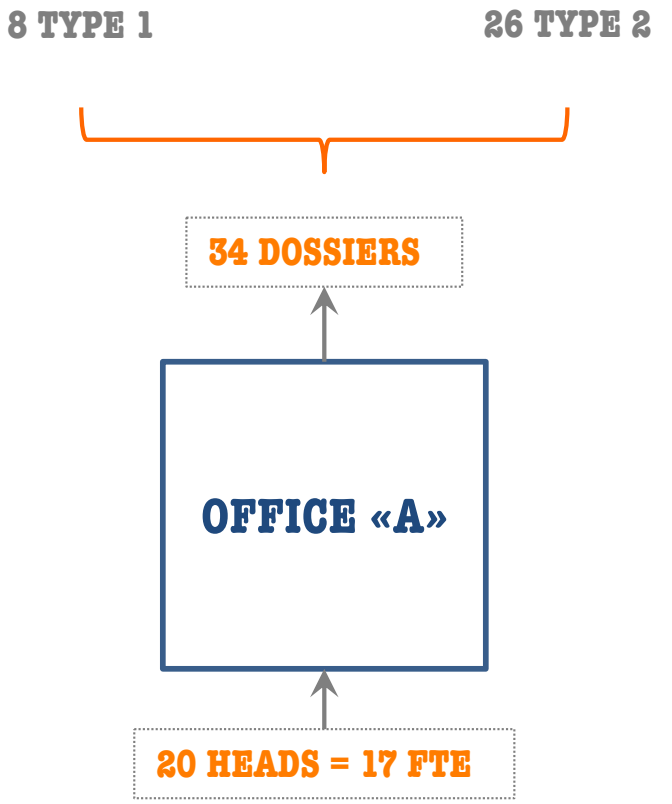
2 clerks working 4 hours/day * 4/8 = 1 FTE

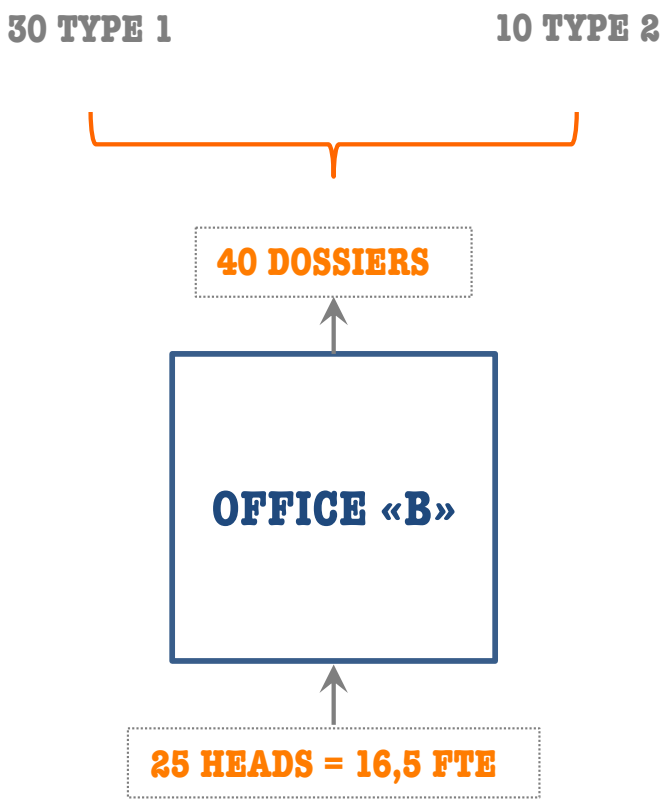
1 clerk working 8 hours/day * 8/8 = 1 FTE

14 clerks working 6 hours/day * 6/8 = 10,5 FTE

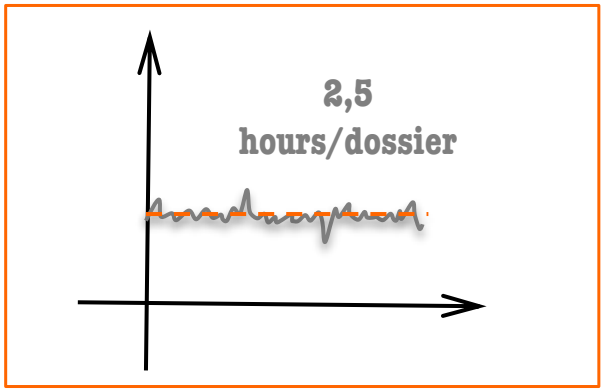
10 clerks working 4 hours/day * 4/8 = 5 FTE

DIFFERENT KINDS OF OUTPUTS

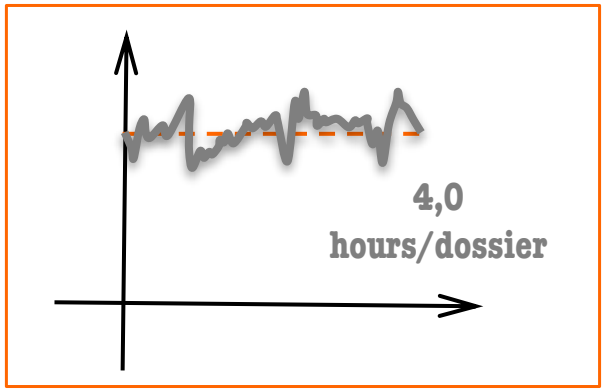




ESTABLISHING EQUIVALENCE



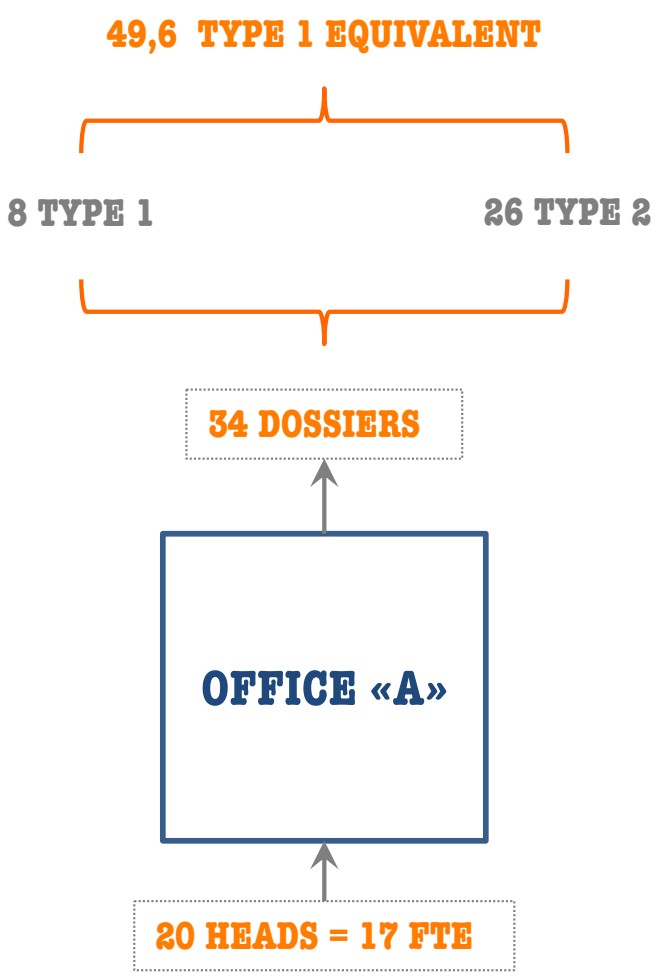
DOSSIER TYPE 1

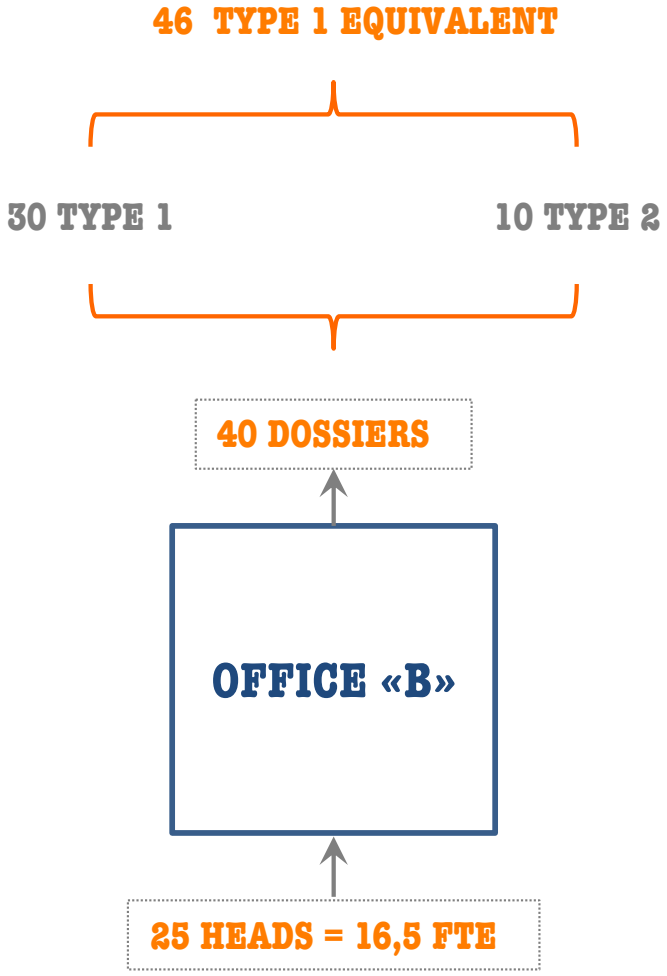


DOSSIER TYPE 2

$$\text{DOSSIER TYPE 2} = \frac{4}{2,5} * \text{DOSSIER TYPE 1}$$

DIFFERENT KINDS OF OUTPUTS





DIFFERENT WINE BOTTLE SIZES

AVERAGE SALES PRICE "PER BOTTLE"

The owner of Birre dal Mondo S.r.l., a company that sells beer imported from abroad, wishes to calculate the average unit selling price of a particular S.K.U. (Stock Keeping Unit) for the purpose of calculating the breakeven point.
The brand in question is sold in bottles of different sizes. The sales figures for the period under consideration are as follows:

- 330 cl format 14,580 bottles sold € 10,206.00
- 660 cl format 39,126 bottles sold € 43,038,60
- 1000 cl format 24,168 bottles sold € 36,252.00

Required:

The owner asks you to calculate the average sales price "per bottle". Can you help him out?

AVERAGE SALES PRICE “PER BOTTLE”: SOLUTION

Format	Bottles Sold	Sales Revenue	Price per bottle	Conversion Rate	Equivalent bottles	
330	14,580	€ 10,206.00	€ 0,70	0,50	7,290	
660	39,126	€ 43,038.60	€ 1,10	1,00	39,126	
1000	24,165	€ 36,252.00	€ 1,50	1,52	36,614	
		€ 89.496,60			**83,030**	**€ 1,08**

AVERAGE SALES PRICE “PER BOTTLE”

The company “Wines from the World” sells three different product lines having completely different qualitative characteristics, to the point of being completely incomparable with each other, both in terms of enology and economics.
The first line consists of a superior Barolo, an outstanding wine that has won coveted awards. This is a wine for true connoisseurs that has a particularly high price and therefore cannot be intended for the general public. Of this line, 1,450 0.75-liter bottles were sold, achieving sales revenues of € 543,750. In addition, 300 bottles in magnum format (1.5 liters) of this line were also sold, achieving a total turnover of € 202,500
The second line, on the other hand, is dedicated to a discreet Cabernet Franc, which achieved considerable success among the distributor company's clientele due to its excellent price-quality ratio. Of this wine, 74,349 bottles (all in 0.75-liter format) were sold for total sales revenue of € 1,189,584
Finally, there is the lowest quality wine, which is sold under the joking label “Alcool da ferite,” a wine that is often used in low-level taverns and is known for its particularly advantageous price. Of this, 215,670 bottles were sold (all in 0.75-liter format) achieving total sales revenue of € 539,175.

Required:

Determine, first, the average price per equivalent bottle (in the 0.75 format) relative to the Barolo line.
Then, proceed to determine the average price of the entire offer proposed by “Wines from the World”