



Cost modelling tool for sustainable innovation

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A simple cost model to try out ...

- See Template Provided (excel file can be opened click on the table below)

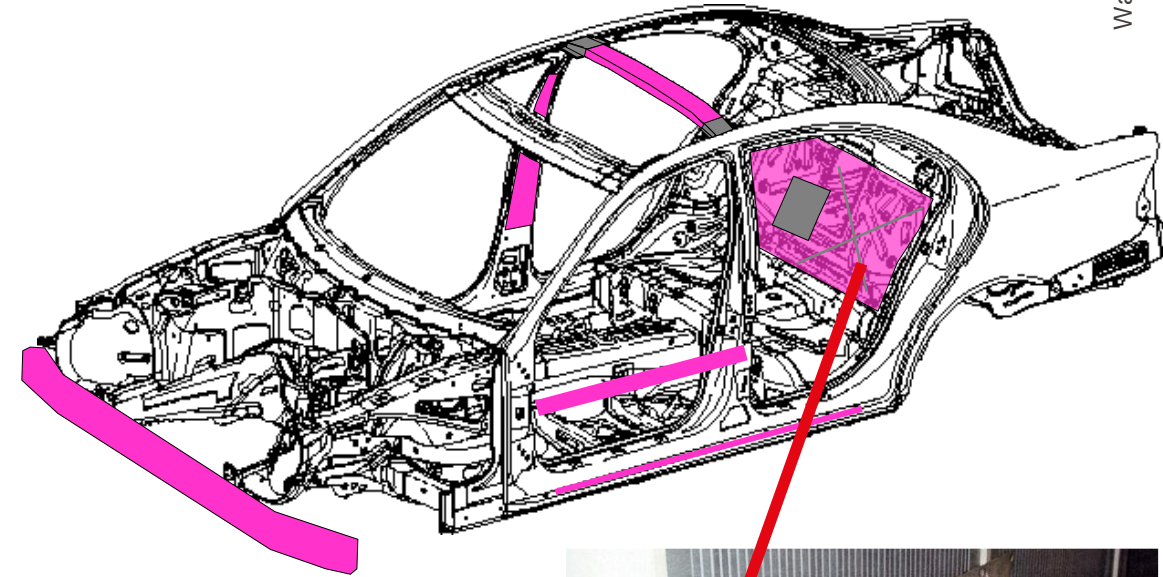
Simple technical cost model	Process Totals	Die casting	Punching	Machining
Process Goals				
Material 1 mass per part (kg)	2.2			
Material 2 mass per part (kg)				
Target production rate (p/yr)	120,000			
Production duration (yrs)	5			
Dashboard				
Hours per shift (hrs/d/sh)	7.3			
Days per year (d/yr)	220			
Available shift operational time at 100% efficiency (hr/yr/shift)		1,606	1,606	1,606
Time efficiency (.)		80%	80%	80%
Available shift operational time (hr/yr/shift)		1,285	1,285	1,285
Cycle time (s/p)		110	90	60
Available shift production rate (p/yr/sh)		42,048	51,392	77,088
Required production rate OUT (p/yr)		120,000	120,000	120,000
Reject (.)		5%	0%	2%
Actual production rate IN (p/yr)		125,654	120,000	122,449
Single shift utilisation (.)		2.99	2.33	1.59
No of shifts required (sh)	3	3	3	2
Max no of shifts (sh)	3	3	3	3
No of shifts employed (sh)		3	3	2
Available production rate (p/yr)		126,144	154,176	154,176
Actual utilisation rate (.) MUST BE < 1	1.00	1.00	0.78	0.79
Available operational time (hrs/yr)		4,818	4,818	3,212
Actual operational time (hrs/yr)		4,799	3,750	2,551
Dedicated / Utilised		dedicated	dedicated	dedicated
Effective utilisation (.)		1.00	1.00	1.00



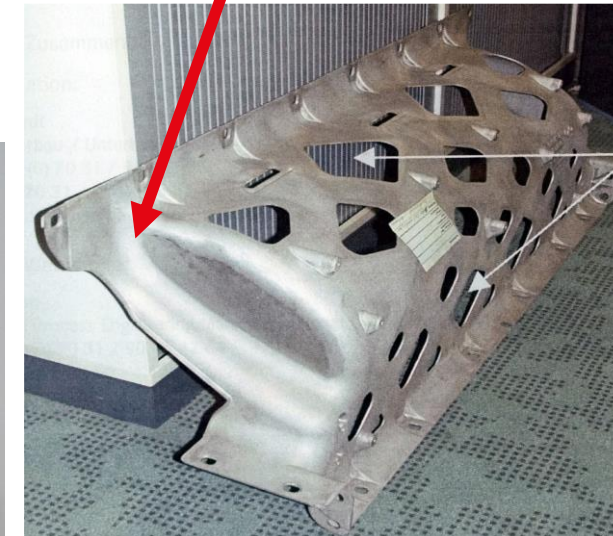
Functional unit:

Curved structural panel

- typical of BIW, rear bulkhead
 - does not need to pass through E-coat process (but could)
 - temperature capability if needed
 - magnesium benchmark
 - detailed sensitivity studies
-
- Rear Structural Bulkhead
 - Steel 5.8kg
 - Magnesium 2.2kg
 - SMC 2.5kg
 - GF/PA GMT 2.4kg
 - GF NCF/HP-RTM 2.3kg
 - CF NCF/HP-RTM 1.8kg (1.2kg)



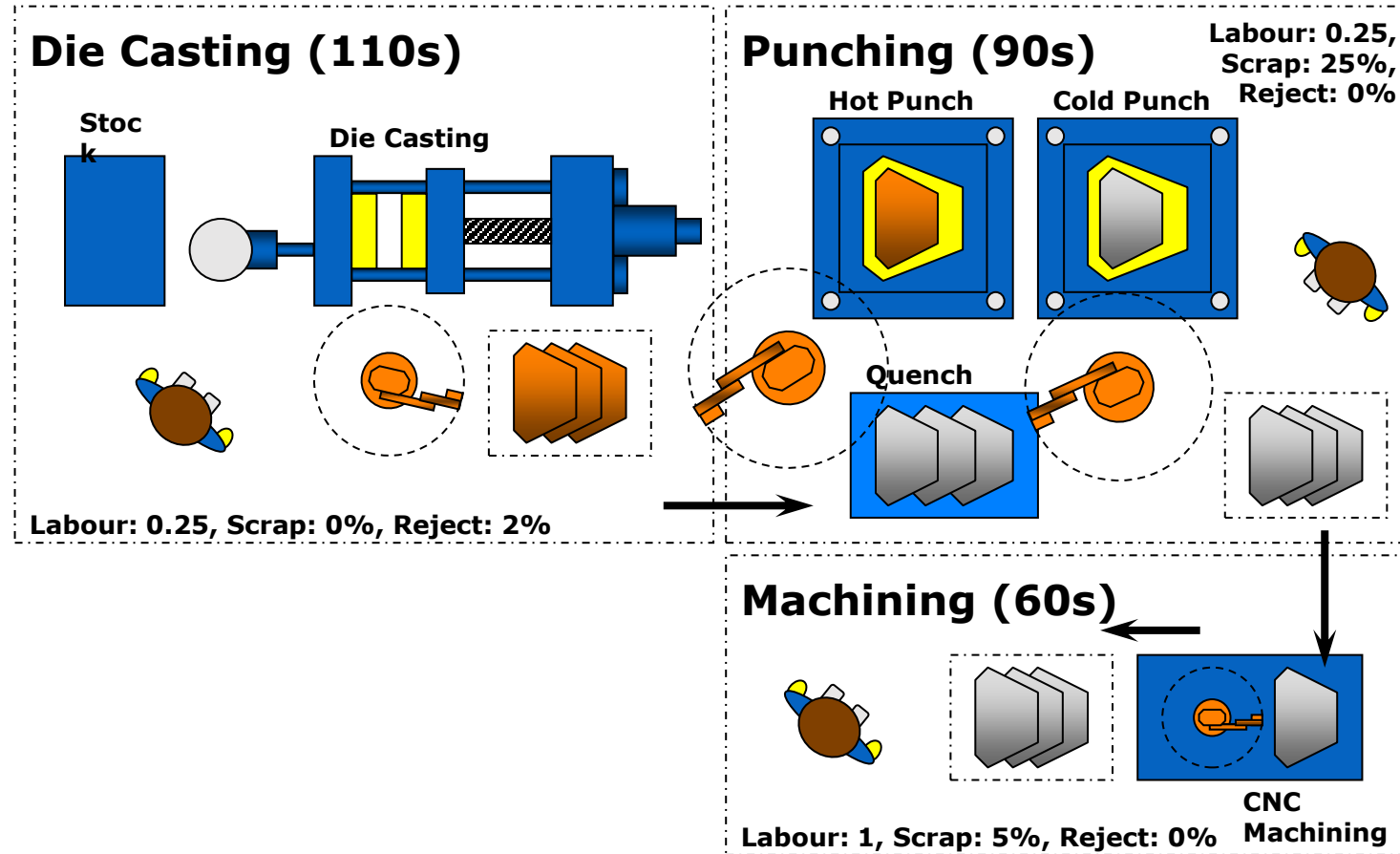
Aluminum?



[Assessing the life cycle costs and environmental performance of lightweight materials in automobile applications - ScienceDirect](#)

Example process

- Magnesium Die Casting



■ Production Dashboard

Material mass per part (kg)

Target production rate (p/yr)

Production duration (yrs)

Actual operational time (hrs/yr)

Effective utilisation (.) = if a=dedicated then 1 else if a=utilised then b

Dedicated / Utilised

Actual utilisation (.)

No. of direct labour (pns)

Key

Data valid for entire process

Data valid for an activity / machine

Value from downstream activity

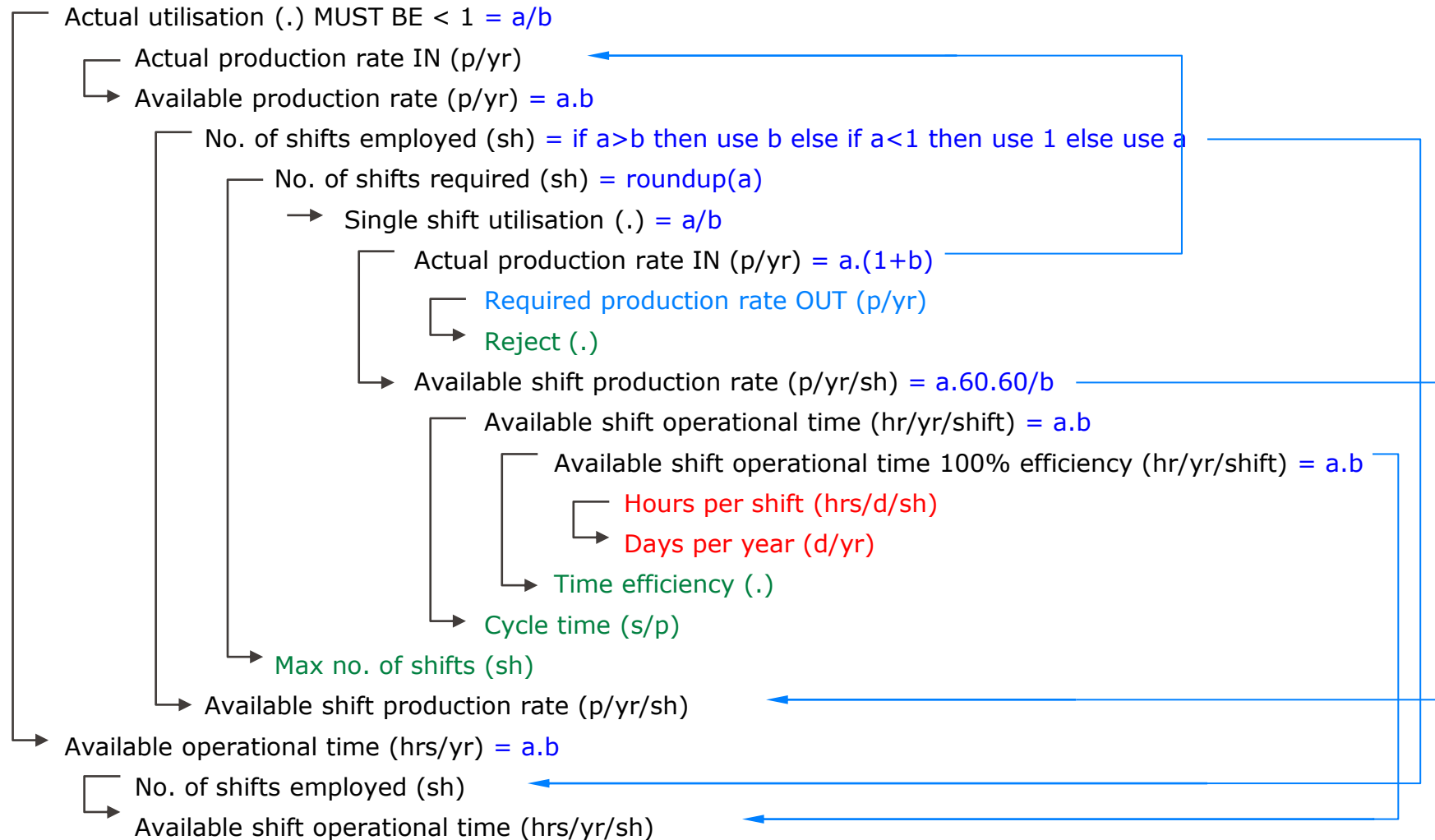
Calculated value = formula e.g. a/b

value a
value b

Value calculated elsewhere

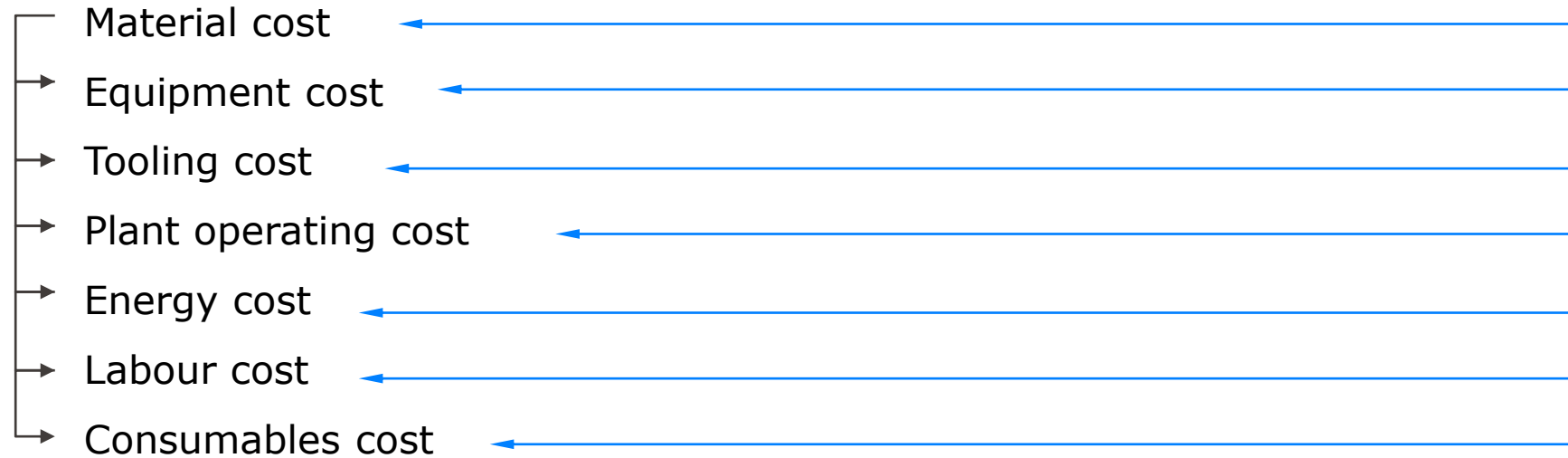
Production Dashboard

- Actual operational time (hrs/yr) = $a.b$



■ Total Production Cost

$$\text{Total Production Cost (€/p)} = a+b+c+d+e+f+g$$



Material Cost Calculation

■ Material Cost

Material value IN (€/p) = a/b

Annual material cost IN (€/yr) = $a.b$

Material cost (€/kg)

Material mass IN per year (kg/yr) = $a.b$

Actual production rate IN (p/yr)

Material mass per part IN (kg/p) = $a.(1+b)$

Material mass per part OUT (kg/p)

Scrap (.)

Target production rate (p/yr)

Equipment Cost Calculation

■ Equipment Cost

Machine depreciation (€/p) = a/b

Process depreciation cost (€/yr) = $a.b$

Annual depreciation cost (€/yr) = a/b

Equipment capital cost (€)

Depreciation time (yrs) = if a=utilised then b else c

Dedicated / Utilised

Time until replacement (yrs)

Production duration (yrs)

Effective utilisation (.)

Target Production rate (p/yr)

Tooling Cost Calculation

■ Tooling Cost

Tool cost (€/p) = a/b

Annual tool cost (€/yr) = a/b

Total tool cost (€) = $a.b$

Tool cost (€/tl)

No. of tools (tls) = $\text{roundup}(a/b)$

Total no of shots in process (shots) = $a.b$

Actual production rate IN (p/yr)

Production duration (yrs)

Tool life in shots (shots)

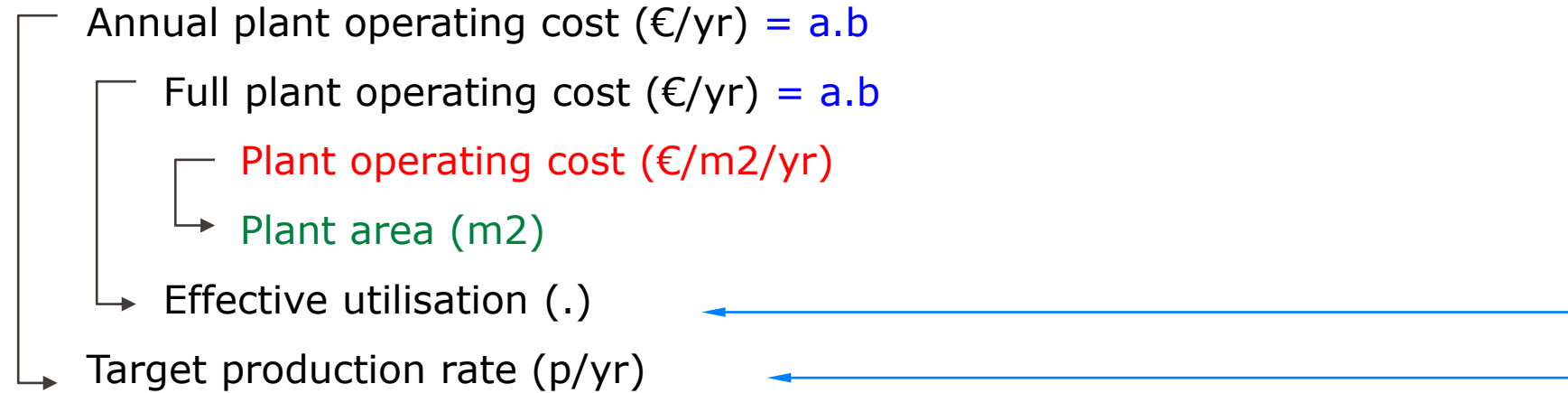
Production duration (yrs)

Target production rate (p/yr)

Plant Operation Cost Calculation

■ Plant Operation Cost

Plant operating cost (€/p) = a/b



Energy Cost Calculation

- Energy Cost

$$\text{Energy cost (€/p)} = a/b$$

$$\text{Annual energy cost (€/yr)} = a.b$$

$$\text{Energy cost (€/hr)} = a.b$$

$$\text{Energy cost (€/kWh)}$$

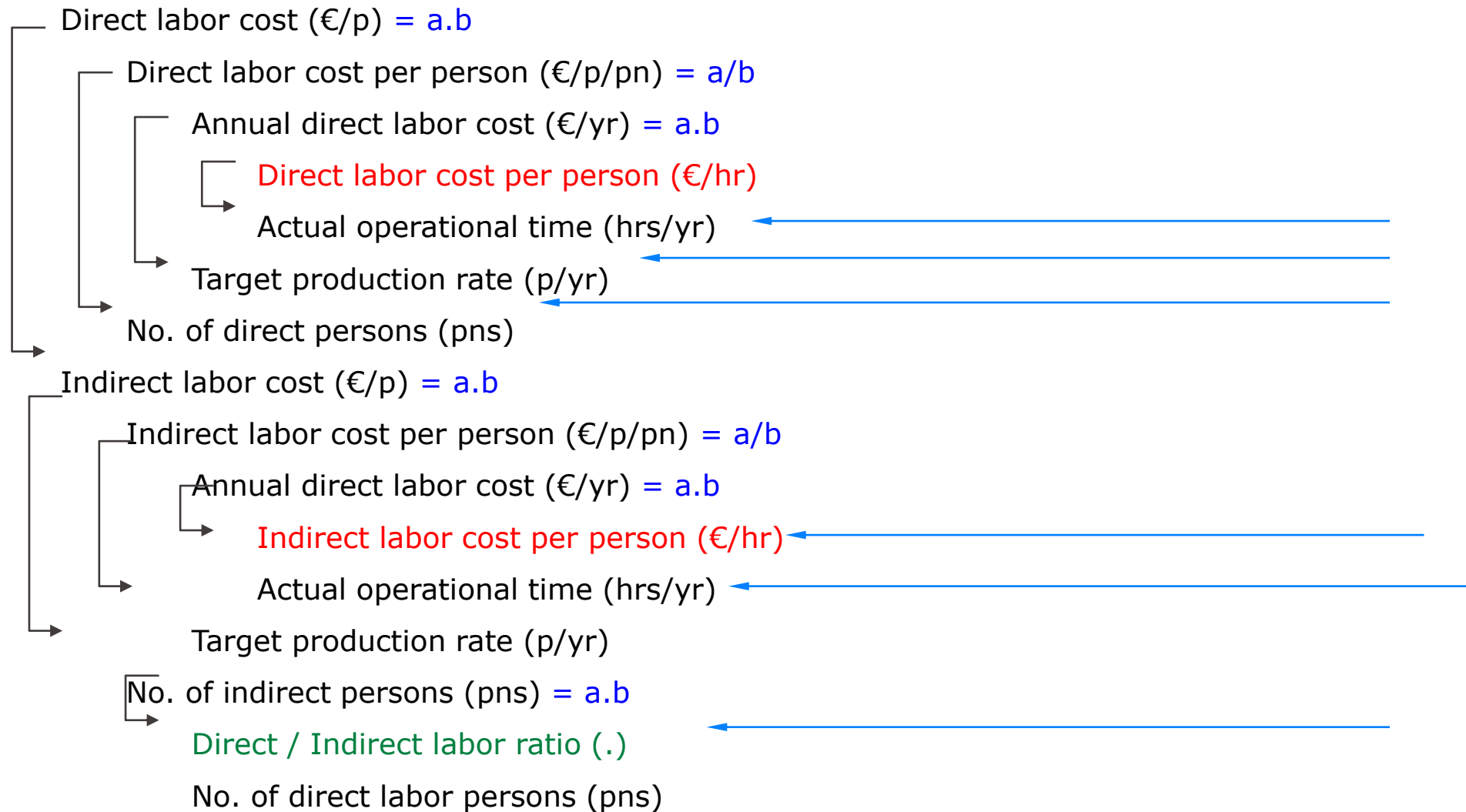
$$\text{Machine power (kW)}$$

$$\text{Actual operational time (hrs/yr)}$$

$$\text{Target production rate (p/yr)}$$

Labor Cost Calculation

■ Labor cost (€/p) = $a+b$



Consumable Cost Calculation

■ Consumable Cost

Consumables cost (€/p) = $a.b$

