17. Cost Calculation

In this part, we calculate the cost of our product, CleanSweep, using the surcharge method, which is commonly used in real businesses to estimate prices. First, we look at the basic costs like materials and labor. Then, we add extra costs such as material overhead, production overhead (based on machine hours), and admin/marketing expenses using fixed percentages. At the end, we include profit and commercial factors like cash discount, commission, and customer discount. This helps us find a realistic and fair final offer price that covers all our costs while still making a profit. The calculation adheres to the surcharge scheme below:

Direct Material Costs + Material Overhead = Total Material Costs

Direct Labor Costs + Production Overhead = Manufacturing Costs

Material + Manufacturing Costs = Production Costs

Production Costs + Administrative/Marketing Overheads = Cost of Goods Sold (COGS)

COGS + Profit + Discounts/Commissions = Final Offer Price

17.1. Direct Material Costs (for buying part)

Part Name	Manufacturer	Quantity	Price per Unit (EUR)	Total Price (EUR)
Microcontroller	Microchip Technology Inc.	1	€3.35	€3.35
Wheel Encoder	Keyes	1	€4	€4
Sensor	Lingchen LCD Module	1	€1.69	€1.69
Dual Axis Motor	ALMOCN	1	€1.88	€1.88
DC Motor	Dongming Motor	1	€3	€3
Voltage Regulator	Onsemi	1	€3.35	€3.35
RF Module	HiLetgo	1	€1.89	€1.89
Battery	MYKU	1	€7.99	€7.99
Remote Control	SmartWise	1	€2.59	€2.59

Part Name	Manufacturer	Quantity	Price per Unit (EUR)	Total Price (EUR)
Battery Management System	DollaTek	1	€2.50	€2.50
Magnets	HG Magnets Co., Ltd.	4	€0.40	€1.60
Buzzer	Kingstate Electronics	1	€0.10	€0.10
Mechanical Miscellaneous	Boohong	Various	€0.80	Aliexpress
2-pin header	JST	2	€0.13	€0.26
3-pin header	JST	1	€0.17	€0.34
4-pin header	JST	2	€0.22	€0.44
Motor Controller	Toshiba	1	€1.56	€1.56
ISCP Connector	Olimex Ltd.	1	€2.00	€2.00
ICSP header	Sunrom	1	€0.25	€0.25
Screw Terminal	Würth Elektronik	1	€0.32	€0.32
10k ohm resistor	Widerstand	1	€0.18	€0.18
1k ohm resistor	Widerstand	1	€0.17	€0.17
Crystal Oscillator 16 MHz	QD Frequency Products	1	€0.87	€0.87
22pF Capacitor	Vishay	2	€0.42	€0.84
Xh Connector	Berry Base	2	€0.39	€0.78
Wires	Elegoo	2	€1.75	€3.50
Rel to screw adapter	Funduino	1	€0.90	€0.90
Battery Charger	Fuyuang	1	€6.50	€6.50
Heat Shrink	Fuyuang	1	€3.28	€3.28
Crimp	Pololu Corporation	1	€2.23	€2.23

Part Name	Manufacturer	Quantity	Price per Unit (EUR)	Total Price (EUR)
Printed Circuit Board	-	1	€10	€10
Switch Button	Kabel Point	1	€1.00	€1.00
Sensor switch	Same Sky	1	€0.17	€0.17
Silicone Gasket Strip	eBay – Generic	1	€3.12	€3.12
O-Ring (ISO 3601)	Sealing Technologies	1	€0.98	€0.98
Silicone Sealant	Isolbau	1	€3.31	€3.31
Waterproof Charging Port (XT30)	Aliexpress - Generic	1	€0.95	€0.95
Rubber Washer/Grommet Kit	Temu - Generic	1	€1.11	€1.11
Male to male DC adapter	Electric7 Store	1	€0.22	€0.22
K0709 Needle Roller Bearing	Amazon - Generic	1	€4.49	€4.49
R74ZZ Ball Bearings	Amazon - Generic	4	€0.73	€1.46
Deep Groove Ball Bearing	Amazon - Generic	1	€4.00	€4.00
O-ring	O-ring stocks	4	€0.04	€0.16
Total Cost:	€73.69 per unit			

Raw Materials:

Name of Material	Supplier	Quantity	Price per kg in euro	Total price in euro
ABS plastic	Xiamen Keyuan Plastics Co. Ltd.	1.3 kg	2.75	3.61
Aluminum 6061 alloy	Castle Metals	2.15 kg	1.154	2.49
EPDM	Roofgiant	0.8 kg	1.69	1.352
TPU	Ningbo Dongbo New En	0.3 kg	4.98	1.46
Total	8.91			

Total cost per year for buy parts:

$$Yearly\ cost\ of\ parts\ =\ Cost\ of\ parts\ per\ unit\ x\ Total\ No.Of\ Units$$

$$Yearly\ cost\ of\ buy\ parts\ =\ (\ €73.69 + €8.91\ )x\ 1000\ = €82600$$

17.2. Material Overhead (5%)

- Calculation: $€82600 \times 5\% = €4130$
- Total Material Costs: $€82600 + €4130 = €86730$

17.3. Direct Labor Costs

This section explains the labor cost calculation for producing the CleanSweep device in Kleve, Germany, with a planned production of 1000 units per year. The team consists of 2 employees responsible for assembly. The average wage per worker is €23,43 hour including the annual vacations including wage related costs.

Base Labor Cost per Hour:

$$2\ workers \times €23{,}43/hour\ =\ €46.875/hour$$

Annual Working Hours and Production:

Each worker works 1875 hours/year (250 days × 7.5 hours).

Total labor hours: $2 \times 1875 = 3750\ hours/year$

Annual Total Labor Cost:

$1875\ hours \times €23{,}43/hour = €43931.25\ total\ cost/year$

Labor Cost per Unit

Using the total labor cost per year and the annual production target, the labor cost per unit is calculated as follows:

$€43931.25 \div 1000\ units = €43.93\ per\ unit$

Conclusion

With a production volume of 1000 units per year and 2 workers, the labor cost per CleanSweep unit is approximately €44. This cost reflects manual assembly and support activities, which are labor-intensive in small-to-medium batch production.

17.4. Production Overhead

No	Cost description	Amount (EUR)	Depreciation rate per year	Depreciation (EUR)	Annual Cost (EUR)	Hourly Rate (€/h)	Hours per Unit	Cost per Unit (€)
1.	Injection Molding Machine	€120,000	12.5%	€15,000	€20,000	€9.96	0.18	€1.80
2.	CNC Drilling Machine (3-axis)	€20,000	10%	€2,000	€4,000	€1.99	0.3	€0.60
3.	Compression Molding Machine	€60,000	10%	€6,000	€9,000	€4.48	0.3	€0.14
4.	CNC Milling Machine (3-axis)	€100,000	10%	€10,000	€13,000	€6.47	0.25	€1.63
5.	CNC Turning Machine	€80,000	10%	€8,000	€11,000	€5.48	0.20	€1.10
6.	CNC Thread Turning Machine	€40,000	10%	€4,000	€6,000	€2.99	0.05	€0.15
Total per Unit	€5.40							

Each machine's total annual cost is divided by its yearly operating hours (1875 hours) to calculate the hourly rate. Then, by multiplying this rate with the estimated usage time per unit, the cost per unit is determined.

Explanation of depreciation rates:

-Injection molding:

Depreciation Rate: %12.5 per year.

Useful Life: 8 years. Intensive and repetitive molding processes result in faster wear.

-All Other Machines:

Depreciation Rate: 10% per year
Useful Life: 10 years. Standard rate for CNC equipment in regular industrial use.

Energy and Operational Costs:

Machine	No. of Machines	Power (kW)	Cost per kW (€)	Time/Unit (h)	Energy Cost/unit	Operational Costs (maintenance, utilities etc)
Injection Molding	1	10	0.30	1.5 h	€4.5	€1.5
CNC Drilling (3-axis)	1	3	0.90	1.7 h	€4.59	€1.4
Compression Molding	1	6	1.80	0.3125 h	€3.38	€1.0
CNC Milling	1	8	2.40	0.79 h	€15.17	€4.0
CNC Turning	1	7	2.10	0.53 h	€7.79	€2.5
CNC Thread Turning	1	5	1.50	0.23 h	€1.72	0.7
Total	€37.15 + €11.1= €48.25					

Annual Plant Rental

The production space is 85 m² in Kleve, with an industrial rental rate of €110/m²/year.

Calculation:

- Base Rent: $85\ m^2 \times €110 = €9.350/year$
- Additional Costs (utilities, maintenance, insurance at 20%): $€9.350 \times 20\% = €1.870/year$
- Total Annual Rent: $€9.350 + €1.870 = €11.220/year$

→ Facility cost per unit = €11.220 ÷ 1000 = €11.2

Impact on Production Overhead:

Cost Component	Per Unit (€)
Machine Hourly Costs	€5.40
Energy Costs	€48.25
Facility Rental Allocation	€11.2
Total Production Overhead	€64.89

17.5. Production Costs

Material costs include €73.69 for components and €8.91 (10% material overhead), totaling €82.6.
Manufacturing costs consist of €43.93 for labor and €64.89 production overhead, totaling €108.82
→ Total production cost per unit = €82.6 + €108.82 = €191.42

This value serves as the basis for further pricing steps.

17.6. Administrative & Marketing Overheads

- Administrative: €191.42 × 8% = €15.31
- Marketing (12%): €191.42 × 12% = €22.97

Cost of Goods Sold (COGS):
= €191.42 + €15.31+ €22.97 = €229.70

Impact on Cost of goods sold:

Production Cost	€191.42
Administrative & Marketing Overheads	€38.28
COGS	€229.7

17.7. Profit & Final Price Calculation

After determining the cost of goods sold (COGS), the final selling price is calculated by including profit and other commercial additions such as cash discount, sales commission, and volume discount. These components reflect common business practices and help ensure both competitiveness and profitability.

Profit:

To achieve a reasonable margin, a 15% profit is added based on the COGS:

$$Profit = 25\% \times €243.13 = €60.78$$

$$Cash\ Selling\ Price = €243.13 + €60.78 = €303.91$$

Cash Discount:

A 2% cash discount is applied to incentivize early payment from customers:

$$Cash\ Discount = 5\% \times €303.91 = €15.195$$

Commission:

A 5% sales commission is included to cover distributor or reseller fees:

$$Commission = 5\% \times €303.91 = €15.195$$

$$Target\ Selling\ Price = €303.91 - (€15.195 + €15.195) = 273.52$$

Volume Discount:

A 3% volume discount is granted to customers placing large orders:

$$Volume\ Discount = 3\% \times €273.52 = €8.20$$

Final Offer Price:

$$Final\ Offer\ Price = €273.52 - €8.20 = €265.32$$