

How Automation, AI, and Agents Are Changing Cost & Value Engineering

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*“Every single company,
every single job, will have
AI assistance”*

Jensen Huang, CEO NVIDIA



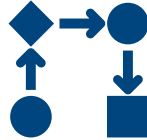
KNORR-BREMSE

AI in Cost Engineering: Leverage and Usage



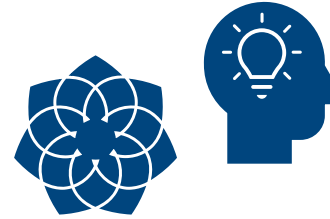
Data
availability

*Reading
drawings and
connecting data
sources*



Process
Automation

*Automated cost
analysis*



Pattern recognition
& idea generation

*Technical
potentials with
agents;
Similar parts
search with ML*



Workflow
orchestration

*Multiagent
system for an
intelligent
workflow*

AI in Cost Engineering: Leverage and Usage





Lever 1: Extraction of raw data from technical drawings

Use Case: Reading Drawings and Data Sheets

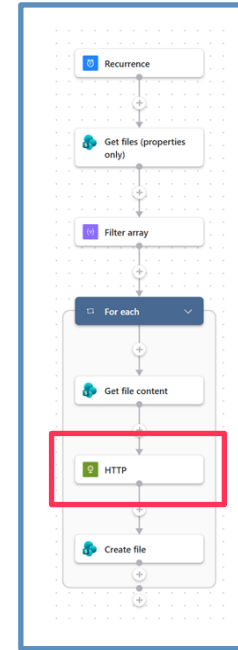
Automation
[Deterministic]



AI [OCR for reading the
drawings]



Flow in Azure



Automation
workflow with AI
capabilities

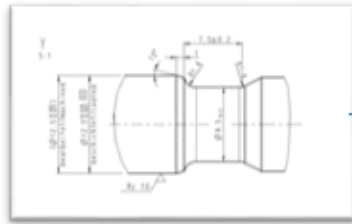


Lever 1: Extraction of raw data from technical drawings

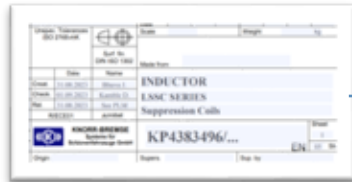
Use Case: Reading Drawings and Data Sheets

INPUT

Drawings

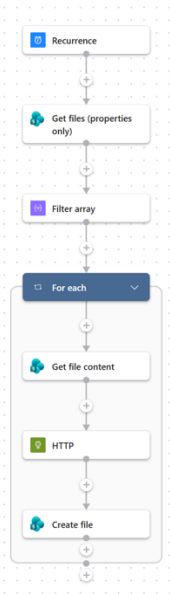


Or data sheets (electronics)



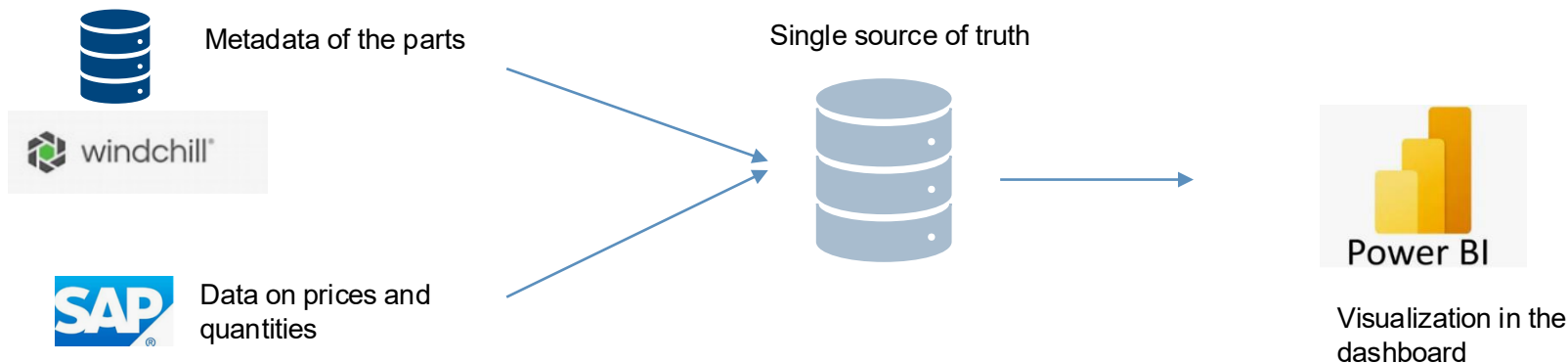
OUTPUT

Database with
structured
metadata*



*Metadata: weight, size, material, weight, size, envelope volume

Lever 2: Connecting data sources to a central dashboard



- ✓ Overview of 100k part numbers
- ✓ Discrepancies quickly visible to purchasing
- ✓ Historical price development (quantities vs. prices)
- ✓ Similarity analyses



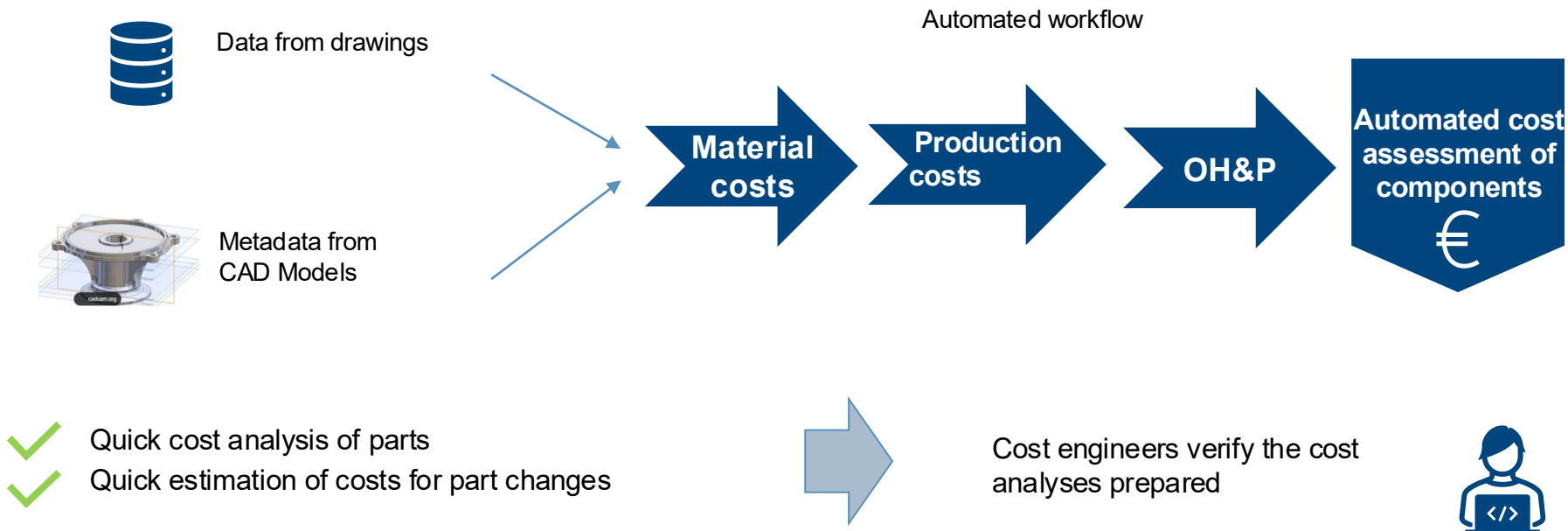
Cost engineers focus on the largest variances

Buyers are enabled to see discrepancies quicker





Lever 3: Merge the information into an automated workflow for a cost assessment



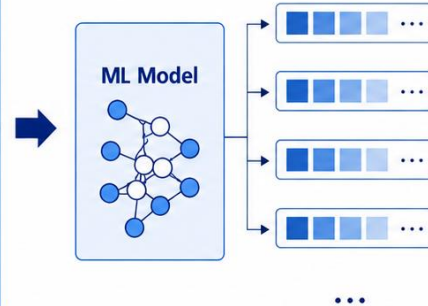
Lever 4: Component similarity detection with machine learning

1 Input Data



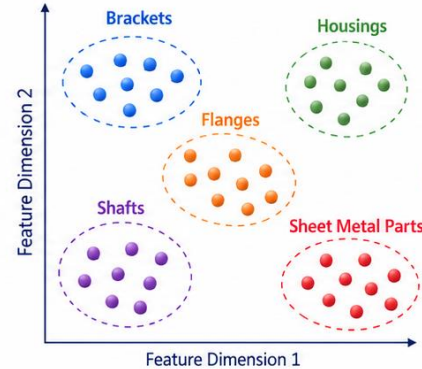
2 Features / Embeddings

Parts and their attributes are converted into numerical vectors.



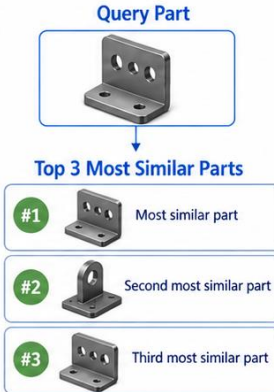
3 Clustering of Similar Parts

Parts are grouped based on similarity in the feature space.



4 Find Similar Parts

For a query part, the most similar parts are identified.



Benefits for Cost Engineers



Find similar parts
faster



Identify
standardization
potential



Make cost drivers
visible

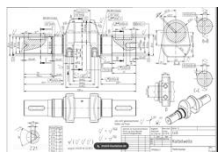


Save time on evaluation
instead of manual search

Structured part data enables faster comparisons, better transparency and more informed cost decisions

Lever 5: AI Agents - From Cost Estimation to VAVE Ideas – Optimind

AI-based support for idea workshops



- 15+ VAVE ideas in seconds
- Combining ideas into hybrid solutions
- Use reasoning for deeper idea evaluation



Development engineer focuses on productive co-development of VAVE ideas

TRIZ

Technical contradiction

The component should be cheaper and easier to manufacture, but it must not lose the mechanical behavior provided by the reduced chamfer and smooth transitions.

TRIZ 1: Local quality

Keep high precision only in locally critical areas: the active waist, tangent transitions, seating interface and thread-related features.

Less critical surfaces receive wider tolerances and standard finishes. This concentrates manufacturing effort where the stress and machining justify it.

TRIZ 2: Curvature

Replace combinations of short straight sections, chamfers and radii with one smooth tangent curve.

A tangent transition avoids an abrupt slope change in the lead path. In manufacturing, the same contour can be generated by a continuous CNC movement or form tool.

TRIZ 3: Symmetry

Make both ends of the waist geometrically identical unless an assembly interface prevents this.

The physical load user may not be fully symmetric, so this proposal requires stress verification. The manufacturing benefit comes from common tooling, simpler programming and fewer drawing definitions.

TRIZ 4: Parameter change

Do not initially change the nominal Ø25 waist. Change the manufacturing parameters around it: tolerance

SCAMPER

Substitute

1. Substitute several local radii and chamfers with one tangent profile.
2. Substitute multiple tools with one profiling tool or form tool.
3. Substitute full contour turning with a near-net shape process.

Combine

1. Combine the left transition, waist and right transition into one CNC machining operation.
2. Combine separate transition inspections into one profile measurement.
3. Combine repeated drawing notes into one common contour requirement.

Adapt

1. Adapt a supplier standard transition radius instead of retaining a unique part-specific radius.
2. Adapt proven full forming processes to generate more of the precursor geometry.
3. Adapt a standard thread-removed solution if compatible with the safety and installation requirements.

Modify

1. Increase the transition radius while retaining the waist diameter.
2. Widen tolerances on surfaces that do not determine assembly or mechanical performance.
3. Shorten non-functional full diameter lengths if packaging and engagement permit it.

Eliminate

1. Eliminate non-functional cylindrical steps.

DFMA

DFMA 1: One continuous tool path

Proposal: Generate the two transitions and central waist with one continuous CNC multiple independent tool movements.

The tool enters through a tangent transition, machines the constant waist and exit tangent transition. This removes unnecessary stops, repositioning and blending of mechanism is contour continuity, a smooth tool trajectory produces a smooth loss of machining steps.

- Parts reduced: No
- Machining time shortened: Yes
- Error risk reduced: Yes
- Cost potential: High

DFMA 2: Identical transition geometry

Proposal: Use the same radius or equivalent tangent contour on both sides of the surrounding interfaces permit it.

HYBRID

Concept 1: Low-risk drawing cleanup

- Preserve all nominal functional geometry.
- Standardize both transition definitions where possible.
- Remove redundant dimensions.
- Widen non-functional tolerances.
- Limit tighter roughness requirements to critical areas.

Expected character: lowest technical risk, moderate savings.

Concept 2: Recommended symmetric waist

- Retain Ø25 initially.
- Retain the effective waist length.
- Introduce identical tangent transitions.
- Remove unnecessary intermediate tools or diameter changes.
- Manufacture the contour in one continuous pass.

Expected character: best balance of cost reduction and manageable validation effort.

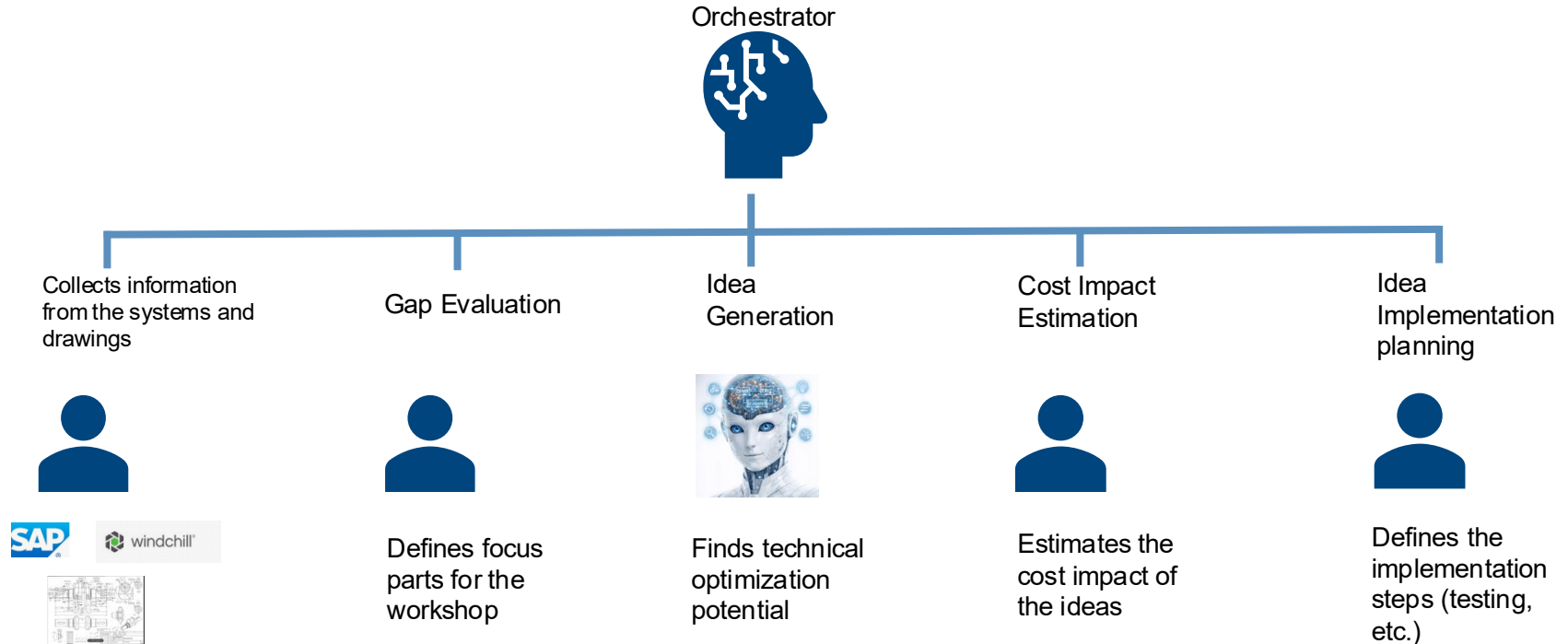
Concept 3: Near-net formed version

- Create a formed precursor close to the final shaft geometry.
- Finish-machine the waist and critical transitions only.
- Preserve the existing thread and interface requirements.
- Review the complete manufacturing sequence with the fastest supplier.

Expected character: highest potential savings, but dependent on volume, tooling cost and supplier capability.

Lever 6: Multi-agent system

Smart system enables cost engineers to focus on value-adding activities



Automation, genAI, ML, agent, or MAS? Guide to choosing tools

The best solution is the simplest one that solves the problem reliably.

Tool	Use when...	Typical cost engineering use cases	Technical complexity	Not ideal if...
Automation	Rules are clear, stable and deterministic	Data transfer, report creation, approvals, Excel/SAP workflows, file processing	 Low	content must be interpreted or decisions must be made under uncertainty
GenAI	Unstructured content is to be understood, summarized or generated	Reading drawings/data sheets, understanding requirements, generating ideas, formulating reports	 Low-medium	Result must always be exactly the same and completely rule-based
Machine Learning	To recognize patterns in larger structured data sets	Similarity parts, clustering, cost outliers, forecasts, classification	 Medium-high	there is little data available or the problem can be solved by simple rules
AI Agent	several work steps have to be planned independently and tools have to be used	Analyze drawing → search for data → generate ideas → build a business case	 Medium-high	only a single, clearly defined step should be completed
Multi-Agent System (MAS)	multiple specialized AI roles are to work together on complex tasks	Drawing Agent + Cost Agent + VAVE Agent + Risk Agent + Orchestrator	 High	A single agent or workflow reliably delivers the same value

When Good AI Tools Aren't Enough: Implementation and Its Pitfalls



Optimind

Lack of workflow fit

The tool exists, but it is not part of the daily process



Integration into existing systems and routines

Lack of trust

Results are not used



Transparency about sources and reasoning processes. Co-development with key users

Threat to one's own role

AI is perceived as competition, not as support



Redefining the role: Decision power and accountability remains human



Thank you for your attention

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