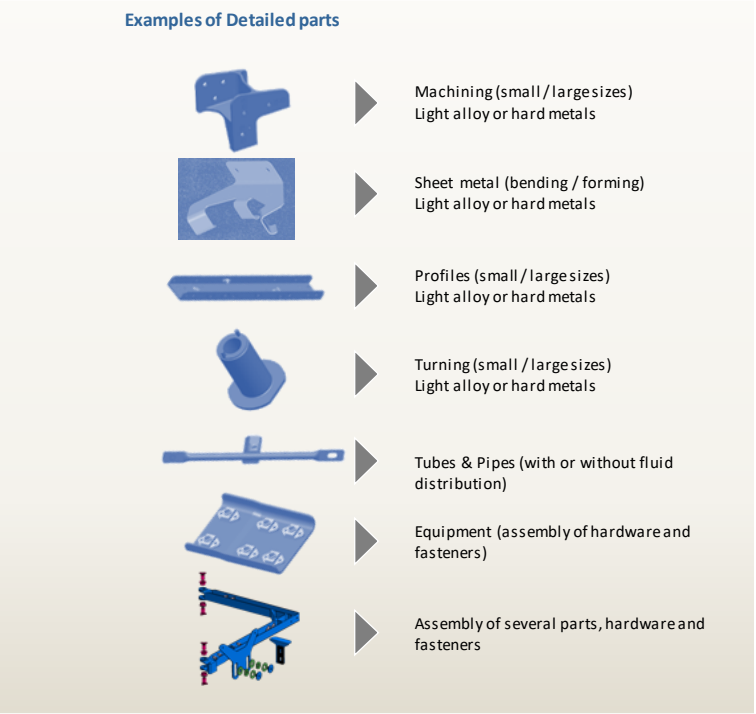
THE COSTING FUNCTION : AN ESSENTIAL INTERNAL EXPERTISE, AT THE INTERFACE OF DESIGN AND PURCHASING.

One of the main objectives of the costing function is to define target costs for purchasing and manufacturing departments. It requires to perfectly master the manufacturing processes of each technology, and to model them based on the knowledge of internal manufacturing units, or external experts if the technology has been outsourced. There are about fifty different manufacturing processes.



This strategic function brings together a small group of experts who can, for each manufacturing technology:

- Identify in the drawings the "drivers" of costs: dimensions, number of holes, folds, etc ...
- define unit times by type of operation
- combine them with hourly rates by technology and by country (e.g. Europe vs low cost countries), and with a fine evaluation of raw materials prices (Aluminium, Titanium …) and standard parts (rivets …)

The counterpart of such expertise is a relatively limited capacity regarding the volume of parts to be costed. The unwritten rule, but very strongly anchored, is that it is impossible to make a costing "at part number level " in the field of mechanical detailed parts. For a 1,000-parts Work Package, the traditional method is to evaluate a sample of a few dozen parts, and extrapolate a global negotiation target to the whole Work Package.

ANALYTICS TO BREAK THE VOLUME BARRIER: BIG DATA ALLOWS TO DRASTICALLY LEVERAGE BUSINESS EXPERTISE.

Convinced that the costing “at part level” was the key lever to change the paradigm in negotiation, STEP Consulting and D3S have developed two technologies which increase capacity limits that companies are used to:

- Automatic extraction of technical drivers on batches of thousands of parts;
- Modelling of cost formulas for each technology and parametrization of scenarios.

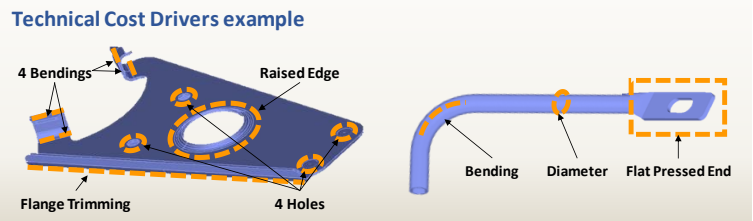
1. Drivers automatic extraction

This involves knowing automatically how to « read a plan », to extract the technical drivers that the experts identify « manually » when they perform a costing activity on a part.

Digitalizing the extraction of technical data allowed to divide by 100 the time devoted to this activity, with a better accuracy and reliability.

The developed algorithms are based on open source technology bricks and use 3D or 2D data. These algorithms are flexible enough to adapt to different engineering sources whatever the generation of design software used by companies (e.g. Catia):

- 3D recognition: processing of geometric shapes, detection of patterns defined in a library and spectral analysis of morphology;
- 2D recognition: image processing and vision algorithms.



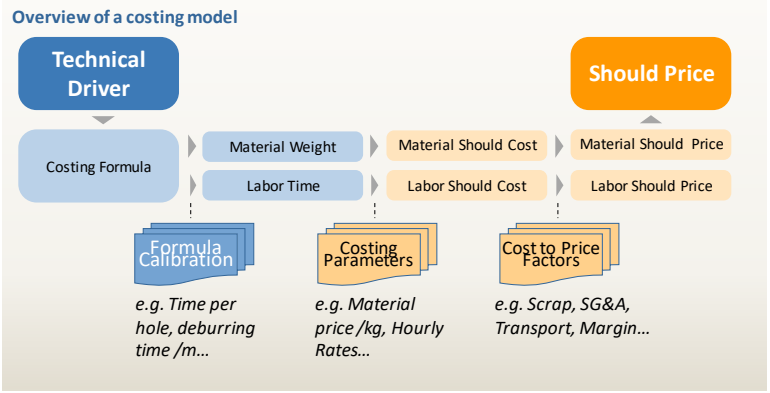
2. Cost models by technology

By creating libraries of formulas and input data (material costs, hourly rates, exchange rates, etc.), cost calculations are automated to apply them massively on thousands of parts.

The first level of a cost model is to isolate the material and the labour part.

The labour part is determined according to the sequence of the manufacturing processes to transform the raw material into a finished product.

Fine modelling of manufacturing times must be combined with robust hourly rates to maintain the accuracy of cost calculations. It is essential to use an hourly rate in native currencies, related to each activity, and taking into account the economic conditions of each manufacturing country.



The combination of manufacturing times per machine type and hourly rates per country allows a "Digital Costing" solution to simulate all the desired scenarios according to the different interesting industrial schemes.

By modelling costing expertise and automating low-value tasks, Digital Costing has broken the barrier of cost-per-part. But digital technologies can go even further.

MACHINE LEARNING, EUCLIDIAN DISTANCE : WHEN ALGORITHMS EMPOWER EXPERTS TO SEE FURTHER

80% of the cost of an aircraft is frozen at the design phase. So, it is essential that the costing function can analyse parts via formulas based only on design office data. What to do when such formulas do not exist internally? More broadly, how can we reduce costs from the design phase by identifying parts at excessive costs among tens of thousands of parts?

To meet these challenges, two other technologies have been successfully developed and tested:

- Automatic learning of costing model, without expert formulas;
- Automatic matching of technically similar parts.

3. Automatic learning

In addition to automating the extraction of technical cost drivers, the learning algorithms (Machine learning) allow direct correlation of design characteristics with manufacturing processes to determine the cost of each part.

These "supervised learning" algorithms are trained on a large sample of parts for which we provide:

- 3D or 2D design;
- Manufacturing routings validated by a reference chamber guarantying the reliability of the learning data.

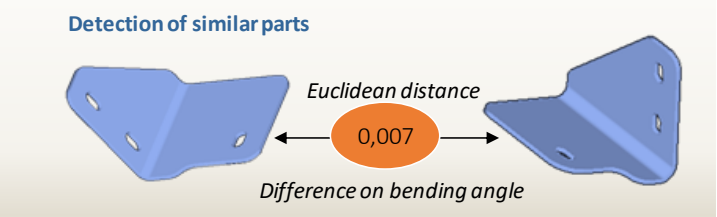
The algorithm will then automatically detect the drivers, and correlate them with the times induced by the industrial processes. Thanks to this method, the complexity of the parts (e.g.: dynamic elements with high tolerances, manual bending, etc.) is automatically captured and integrated in the correlations, provided that the learning sample is sufficient.

The algorithms are then capable of estimating the manufacturing times of a new part, outside their initial learning sample.

4. Recognition of similarity

In addition, an innovative algorithm has been developed to automatically identify similar parts based on their technical definition (Euclidean distance-derived measurement). This feature allows you to:

- Detect costs inconsistencies between two similar parts;
- Gather similar parts in purchasing bundles to develop suppliers specialisation and increase volume effect;
- Rationalize the design by indicating to engineers the technically similar parts already existing in the ecosystem.



A TRANSFORMATION THAT BRINGS SAVINGS

THROUGH RATIONAL NEGOTIATION LEVERS

The revolution of “part level” costing literally changes the game for buyers in their negotiation with detailed parts manufacturers.

Negotiations are based on a detailed gap analysis at part level for labor and material. The levers provided to purchasing department are based on tangible elements (technical drivers) and on a calibration close to industrial reality.

A Digital Costing tool can also simulate the impact of an industrial footprint on recurring costs to get closer to the scheme proposed by the suppliers:

- Location of production (hourly rates)
- Financial assumptions: exchange rate, etc…

Savings on programs in development are about 40% and 15% on a serial program.

Released from their tasks with low added value (drawings opening, calculations ...), costing experts can refocus their business on the technological and commercial watch to control the impact of market evolution on suppliers costs:

- Machine performance improvement;
- Technological breakthrough (e.g. 3D printing, friction welding, robotization, …);
- Opening of new markets and impact on hourly rates;
- Geopolitical or financial events leading to major changes in exchange rates, etc…

CONCLUSION: DIGITALIZATION, A MERE QUESTION OF TOOL ?

THE FACTORS OF A SUCCESSFUL TRANSFORMATION

Several “Off the Shelf” costing software are available on the market. They consist in modelling step by step the manufacturing process of each piece. While the results are accurate, their use is time consuming, requires an industrialization of the part, and relies on external expertise.

Conversely, the "Digital Costing" approach developed by STEP Consulting and D3S has enabled the definition of a "tailor-made" solution that meets the three specific challenges of our clients:

- Only work with the design office data;
- Process the data in mass and quickly, to break the volume barrier and allow a “part level” costing approach;
- Keep strategic expertise “in house” to protect commercial negotiation assets .

By combining the expertise of a consulting firm and the technological expertise of an innovative start-up, this original approach enables to put the latest "open source" algorithms at the service of a business transformation at the crossroads of three activities: Design, Purchasing and Costing.

The availability of new digital technologies offers each industry the possibility to reinvent their business. It is not about choosing between "Off the Shelf" tools, but about reflecting on the desired transformation and making it possible, with the appropriate support.

Thus, to anchor a digital culture and facilitate the transformation, we recommend an implementation based on operational pilot cases, generating quick savings, such as support for a major call for tender, the development of a new product or a project of Design-to-Cost.

CONTACTS

STEP Consulting and D3S have teamed up to create digital breakthroughs and accelerate business transformation. The combination of analytical approaches (data science) and business expertise allows us to develop tailor-made solutions with significant added value.

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