FACTON
INNOVATIVE COST MANAGEMENT

COST ENGINEERING IN PURCHASING

THE METHOD YOU NEED TO SECURE PROFITABILITY

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CONTENTS

1. SUMMARY

Proactive, targeted cost management is becoming increasingly important because businesses need to have a handle on their costs to successfully compete in the global market and achieve profitable growth. It is essential for all business divisions and locations to perform costing based on the same data and methods in order to achieve transparent, comparable product costs.

Enterprise Product Costing (EPC) is the management method that takes advantage of this form of cost management. It considers the value each business division contributes to effective product management.

For example, **purchasing** plays an **important role in effective design** due to the increased amount of purchased components in product manufacturing. Production changes and extensions require purchasing agents to quickly and flexibly compare and adjust prices. Today's suppliers are also involved in preliminary planning of production workflows in order to represent cost factors long before production begins.

Purchasing agents can take advantage of concepts developed in different departments (e.g. development) to satisfy these design requirements. To customize these concepts to meet the unique requirements of the purchasing department, there is a set of methods that puts procurement in a position to optimally respond to these new tasks, to make an essential contribution to cost optimization and to establish itself within the enterprise-wide cost management process with an eye towards EPC.

In practical applications, the EPC approach is best implemented with the help of a corresponding IT system. These EPC systems define standardized processes, calculation methods and calculation standards along with a calculation logic to promote a **uniform understanding of costs and ensure that it is possible to compare results**.

2. INTRODUCTION

At the very latest when José Ignacio López de Arriortúa introduced methods such as continuous improvement processes (CIP), benchmarking, global sourcing and process optimization in procurement as the chief purchasing officer for General Motors Europe beginning in the late 1980s, many corporate managers began to realize that **procurement is a keyfactor in business success**. Now procurement was no longer responsible for simply purchasing finished products in the marketplace, but would begin to play an active role in bringing key insights from the sourcing market into the enterprise as early as the initial product development phase and would **collaborate on innovations and define cost levers as early on in the process as possible**.

Many of the procedures introduced in procurement still yield impressive results today. But advances in the area of procurement cannot remain stagnant. For example, practices from other business divisions such as development, manufacturing or controlling should be observed and analyzed to determine whether they might also be suitable.

Cost engineering methods are indispensable in order to secure a company's competitive edge and freedom to innovate in the future. However, these methods have been very development-centric until now. A solid understanding of the cost structures for the procured volumes is the prerequisite for sustainable supplier management and negotiations conducted on equal footing. **It also builds the foundation for more advanced methods such as design to cost, value management and target costing.**

Cost engineering is a key method for analyzing processes and inferring ways to optimize them and for carrying out efficient change management; prices are not negotiated like they are at a "bazaar", but are evaluated from a cost analysis perspective from the bottom up. Put more simply, cost engineering is the difference between belief and knowledge. Cost engineering is designed to create transparency, offer options for action and make possible a balance between functions, values, costs and also extrapolate prices. The combination of technical and business methods and the consistent application of professional software and databases are guarantees for successful cost engineering.

A steady evolution from cost engineering to value engineering enables businesses to proactively design new products with a focus on customer-centric value maximization.

In recent years value engineering has developed into a **complex management system (value management)** and has now been incorporated into a variety of DIN and VDI standards and guidelines (e.g. the VDI 2800 "Value Analysis" Guideline). The relationship between functions and costs determines the value of a product.

The mix of different methods is the key to strategic procurement success. Cost engineering and value management cannot replace these methods. Instead, they act in a complementary way, offering an outstanding opportunity to resolve complex issues with the help of analytics and uncover new potential. Without a detailed understanding of cost structures along the various links of a supply chain, sustainability and innovative freedom are no longer possible.

3. PROCUREMENT METHODS THAT INCREASE BUSINESS VALUE

How do the various methods impact the individual procurement steps? What role can **value analysis** or **purchased part price analysis** play? The following section explains this in more detail. It also shows the role that selection processes and supplier sources as well as production variants can play in the overall calculation.

3.1 PRINCIPLES OF COST CONTROLLING AND REQUIREMENTS FOR PURCHASED PARTS ANALYSIS

The primary goal of procurement is to **efficiently realize external business value creation, thereby generating added value for the company**. Cost engineering offers procurement an analytical process to obtain detailed insight into product cost structures and manufacturing processes within the scope of a purchased part price analysis.

Cost engineering methods are used to perform the purchased part price analysis, such as target costing or activity-based costing.

TARGET COSTING IN THE PROCUREMENT PROCESS

First, target costing is used as part of a supplier request to determine a suitable price for the product components. **This helps businesses understand what the product is allowed to cost – and not what the product will cost.** The planned product costs are first broken down into the individual product components using a "top-down" analysis. Then the product costs are calculated using an analytical, bottom-up process and compared with the target values. A standardized costing scheme (cost breakdown) with the supplier then becomes the basis for transparency and an understanding of how costs are incurred.

For deviations between target and actual values it is possible to use cost analyses and evaluations for different product and manufacturing variants to influence and control costs as early as the product evolution process. This is a decisive factor in procurement success. Defining cost levers simplifies targeted, value-oriented development and creates a balance between functions and costs.

ACTIVITY-BASED COSTING IN THE PROCUREMENT PROCESS

But this is not the end of the path to full cost transparency. Cross-sectional areas of the business and the associated costs to the analyzed manufacturing steps cannot be uniquely assigned, meaning that a significant amount of the product costs remain unclear even after target costing. **Activity-based costing** is designed to counteract this deficit. Processes that run in the individual divisions and the human and material resources needed to carry out these processes are entered. Then the corresponding cost rates are determined in order to settle them based on the principle of **cost object unit calculation**.

If you combine activity-based costing and target costing, the in-depth detail and transparency of this overall cost assessment makes it easier to understand all of the cost parameters (manufacturing and overhead costs). This helps companies create the ideal prerequisites for open book accounting or supplier workshops.

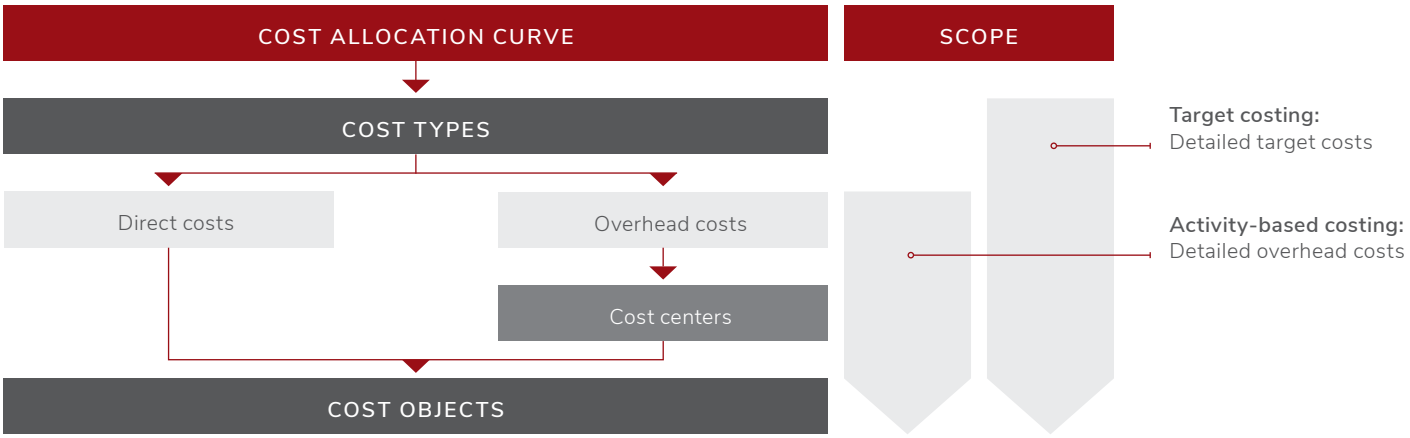

Figure 1: Application area for target costing and activity-based costing

The requirements for cost analysis and evaluation can be met with target costing and activity-based costing methods. **However, a comprehensive cost overview requires an overview of the entire production period along with the costs associated with acquiring the product.**

OVERALL COST ASSESSMENT IN THE PROCUREMENT PROCESS

Therefore, the **overall cost assessment** is the third key component in the purchased part price analysis. A low product price does not necessarily translate into the lowest overall cost level for the entire project duration. **The Total Cost of Ownership (TCO)** approach thus enables businesses to keep track of product costs along the entire product life cycle. In addition to incorporating monetary factors, the **main idea behind procurement management** based on the TCO approach also offers a further complementary option: **Qualitative characteristics can be incorporated into the assessment, making it possible to assess the supplier's overall performance capability.** Qualitative characteristics are quantified and weighted here and can be added to the calculation as multipliers or output as ratios. This method, when joined with the breakdown of all of the costs incurred across the entire lifetime of the product, offers a cohesive overview of the product costs – and not just for manufacturers, but also for users. However, since this approach varies from company to company and is not an integral part of the costing process, it is beyond the scope of this document.

Supplier lifetime value (SLV) is another meaningful supplement to TCO. The term SLV is closely interlinked with **Supplier relationship management (SRM)** in the context of strategic supplier/procurement management because it considers the supplier's contribution to a company's own product over the entire manufacturing period. SRM encompasses all of a company's supplier relationships. The aim is to use the close collaboration with the supplier to develop, procure and manufacture products in a more efficient way. This meets the growing need to transfer supplier innovations to one's own company and impact and control costs early on in order to gain further competitive advantages. Moreover, this method of viewing results takes both cash-in and cash-out transactions in the customer/supplier relationship into account so that the supplier is viewed as an investment item. This approach simplifies entrepreneurial decisions while acknowledging the strategic significance of procurement.

The idea here: Every method is viable in its own right, but a multistep concept should be considered in order to achieve optimum results.

3.2 COST MANAGEMENT IN PROCUREMENT: DERIVING A UNIVERSALLY APPLICABLE APPROACH

The following section illustrates how the conceptual design of a four-stage process can help businesses carry out a purchased part price analysis and integrate the selected tools from cost engineering.

1 Information and interface management
Alongside **organizational aspects** such as team make-up, ensuring communication between the departments, etc., **building up a valid database** is the initial part of the purchased part price analysis. Companies can usually obtain fundamental basic data about products and processes quickly. Due to the fast pace of change in the early stage of the product evolution process, it makes sense to use a step-by-step, recurring data query process that can be refined during the course of the project. Data circuits from functional areas such as development, production, logistics and accounting are mainly used here.

2 Cost structure analysis
This data is used to **establish and analyze the product cost structure** in the second process step. It is set up in five steps using the target costing approach.

- The potential sales price of the product is determined and the corresponding quantities are planned. This price is either inferred from market research or a benchmark price for comparable products.
- Differentiation of product costs with a view towards cost centers and cost types.
- Determination of the envisaged return on product sales by inferring the target profit

based on the calculated market price. The result is the maximum cost allowed to create the product. These “allowable costs” present the upper limit of the original costs and are the maximum cost level that can be reached to ensure the planned profit margin. Since the allowable costs represent the target figure for the product as a whole, a further differentiation must be made for the examination of the cost type level. Basing this survey on the existing costing scheme for cost accounting with a function-oriented approach is advised.

- First the manufacturing costs of the product components must be calculated within this scheme. Special focus is placed on the technical analyses of the manufacturing processes used, which are essential in calculating the manufacturing costs. The manufacturing process costs must be evaluated starting with the calculation of the process times and machine hourly rates and determining the labor costs. Then the costs of the different components are broken down and shown in detail down to the component part level.

- The target cost comparison is performed in the final step. The estimated drifting costs (these are the planned costs for the development stage) are now compared with the allowable costs and target compliance is reviewed.

3 Activity-based costing

Combining target costing with traditional cost accounting builds a cost structure framework and already makes it possible to analyze material and manufacturing costs. Activity-based costing now deals with the overhead costs that are incurred. There are two steps to identifying these costs: **identifying and analyzing a cost center’s processes and calculating the process cost rates**. The processes carried out in the functional areas are documented using existing process organization charts, task descriptions and interviews with the employees there. Determining the core duties and the HR and material resources used to carry out these duties are the relevant tasks here. Then the cost drivers are documented. They should be viewed as the process initiators. The costs must be settled independently of the cost drivers based on the principle of cost object unit calculation.

4 Investment and life cycle cost assessment

A comprehensive assessment must include further **cost analysis of the product across the entire production life cycle**. The “investment and life cycle cost assessment” is first performed in the fourth process step via the TCO, which is mathematically based on the net present value method. Payment flows are achieved in the form of direct and indirect savings on the cash-in side. Direct savings are achieved either through a lower award value compared to the determined target costs or in terms of production through static and dynamic economies of scale. Conversely, indirect savings represent cost avoidance. This can be achieved via technical simplification or a change in concept. Supplier-specific technologies and innovations are important drivers here in order to achieve these savings.

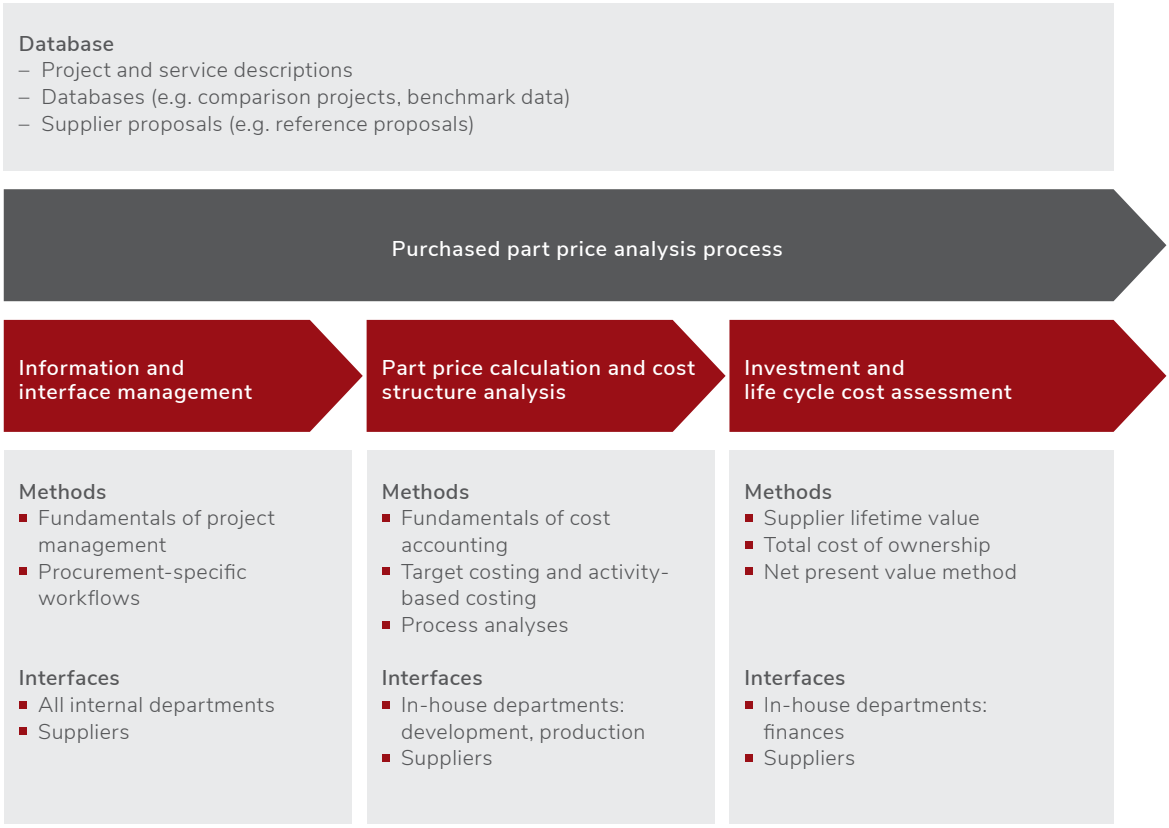

Figure 2: Overview of the purchased part price analysis process

The theoretical model introduced here describes a comprehensive, integrated approach for representing cost engineering in procurement terms.

Therefore, in real use cases a decision must be made on a case-by-case basis as to which method scope should be applied for this type of project. One frequently used method is to replace the activity based costing approach by using benchmark data, for instance.

The following section outlines how this approach is implemented in practice.

3.3 PRACTICAL EXAMPLE

The following scenario is a good example of this type of life cycle cost assessment: A purchased part price analysis must be conducted for a plastic part to be procured as part of **forward sourcing, the systematic preparation of processes for the procurement of future series material**. This should provide insight into the cost structure and, consequently, a starting point and options for action during negotiations before talks with the supplier begin.

The first step, analogous to the planned process, creates the **database** to be used for additional cost management analyses. The service description and initial concept drafts are the fundamental data sources for the technical aspects of the procurement project. The **financial and logistical framework conditions** must also be taken into consideration. The in-house database also delivers comparative data from past projects. The product structure (components and dimensions), material specifications (PA 66), manufacturing processes (injection molding or 3D printing), quantities, production time and the underlying financial planning assumptions (imputed interest rate) are absolutely essential here.

The part price calculation and cost structure analysis build on this database. Product costs are calculated from the bottom up, in the opposite direction of target costing analogous to the cost structure. The material costs are calculated from the product and material specifications and the underlying assumptions for the manufacturing process. Then the process times required to manufacture the product are determined. For example, it is possible to achieve an exact analytical calculation of the process time for injection molding due to the physical and technical correlations. This comprises the opening and closing time for the mold, the injection time and the cooling and holding pressure time, for example. Multiplying this information by the labor and machine hourly rates results in the manufacturing costs per unit.

The activity-based costing for material and manufacturing overhead costs and for the overheads consisting of the development, administration and sales overheads (see example Figure 3) completes the part price calculation.

PROCESS COST ANALYSIS SALES							
Sales							
Process	Labor costs		Process cost rate		Reference values	Quantity	Process costs
	Hourly rate/ costs per year	Working hours/ discount rate	lmi	lmn			
Customer meetings	€ 40.52	5 h	€ 202.60	–	Project	5	€ 1,013.00
Proposal drafting	€ 40.52	12 h	€ 486.24	–	Project	2	€ 972.48
Order processing	€ 40.52	1 h	€ 40.52	–	Ordering	40	€ 1,620.80
Change management	€ 40.52	15 h	€ 607.80	–	Project	2	€ 1,215.60
Manage department	€ 100,000.00	2.0 %	–	€ 2,000.00	–	1	€ 2,000.00
Total							**€ 6,821.88**

Figure 3: Example of activity-based costing

This product costing enables businesses to analyze and evaluate product and manufacturing alternatives alongside development during the product evolution process. In addition, as part of the open book accounting process, companies can compare alternatives with supplier calculations, analyze discrepancies and identify potentials.

In the final step, the total costs for the procurement project are calculated using the investment and life cycle cost assessment. The product costs are determined across the entire production time along with the service costs (development and logistics costs) and the resource costs (process-specific mold) and correspondingly discounted from the SOP (early 2016). The supplier-specific cash-in transactions (production-related learning-curve effects) are taken into consideration in the part price development. Figure 4 features a sample cost overview.

INVESTMENT ASSESSMENT FOR MANUFACTURING ALTERNATIVES								
Injection molding								
Project components	2016	2017	2018	2019	2020	2021	2022	Cash value project
Product price	€ 15,200.00	€ 13,622.64	€ 12,208.97	€ 10,942.00	€ 10,322.64	€ 9,738.34	€ 9,187.12	€ 81,221.72
Logistics costs	€ 1,600.00	€ 1,509.43	€ 1,423.99	€ 1,343.39	€ 1,267.35	€ 1,195.61	€ 1,127.94	€ 9,467.72
Service costs	€ 9,005.97	–	–	–	–	–	–	€ 9,005.97
Tool costs	€ 37,100.00	–	–	–	–	–	–	€ 37,100.00
Cash value periods	€ 62,905.97	€ 15,132.08	€ 13,632.97	€ 12,285.39	€ 11,589.99	€ 10,933.96	€ 10,315.05	€ 136,795.41
3D printing								
Project components	2016	2017	2018	2019	2020	2021	2022	Cash value project
Part price	€ 161,200.00	€ 144,475.53	€ 129,479.35	€ 116,042.82	€ 109,474.35	€ 103,277.69	€ 97,431.79	€ 861,381.53
Logistics costs	€ 1,600.00	€ 1,509.43	€ 1,423.99	€ 1,343.39	€ 1,267.35	€ 1,195.61	€ 1,127.94	€ 9,467.72
Service costs	€ 9,005.97	–	–	–	–	–	–	€ 9,005.97
Tool costs	–	–	–	–	–	–	–	–
Cash value periods	€ 171,805.97	€ 145,984.96	€ 130,903.35	€ 117,386.21	€ 110,741.70	€ 104,473.31	€ 98,559.72	€ 879,855.22

PART PRICE CALCULATION MANUFACTURING VARIANTS				
Injection molding				
Project components	2016	2017	2018	2019
Product price	€ 0.38	€ 0.36	€ 0.34	€ 0.33
Logistics costs	€ 0.04	€ 0.04	€ 0.04	€ 0.04
Service costs	€ 8,496.20	–	–	–
Tool costs	€ 35,000.00	–	–	–
3D printing				
Project components	2016	2017	2018	2019
Part price	€ 4.03	€ 3.83	€ 3.64	€ 3.46
Logistics costs	€ 0.04	€ 0.04	€ 0.04	€ 0.04
Service costs	€ 8,496.20	–	–	–
Tool costs	–	–	–	–

DATABASE	
Assumptions	
Assumptions	Quantities
6 %	40.000

Figure 4: Overall cost assessment and part price development for the manufacturing alternatives

The data calculated and compiled here can now be presented in reports or ratios to facilitate business decisions. For instance, the break-even report for the product and manufacturing variants enables businesses to map cost curves for the variants via the quantities, thereby presenting the information across a specific period. This makes it possible to determine the quantity to which a certain product or manufacturing variant is less expensive. For example, the product price for a 3D printed plastic component is quite high, but there are no resource costs associated with the part. In injection molding the costs for molds are high, while the product costs are low. The logical conclusion therefore is that the 3D printing process is more advantageous for small quantities as a result of the overall costs; the injection molding process becomes more profitable as quantities increase.

BREAK-EVEN ANALYSIS MANUFACTURING VARIANTS

Break-even calculation					
Quantities	2,500	5,000	7,000	10,000	12,500
Injection molding variant	€ 38,050.00	€ 39,000.00	€ 39,760.00	€ 40,900.00	€ 41,850.00
3D printing variant	€ 10,075.00	€ 20,150.00	€ 28,210.00	€ 40,300.00	€ 50,375.00

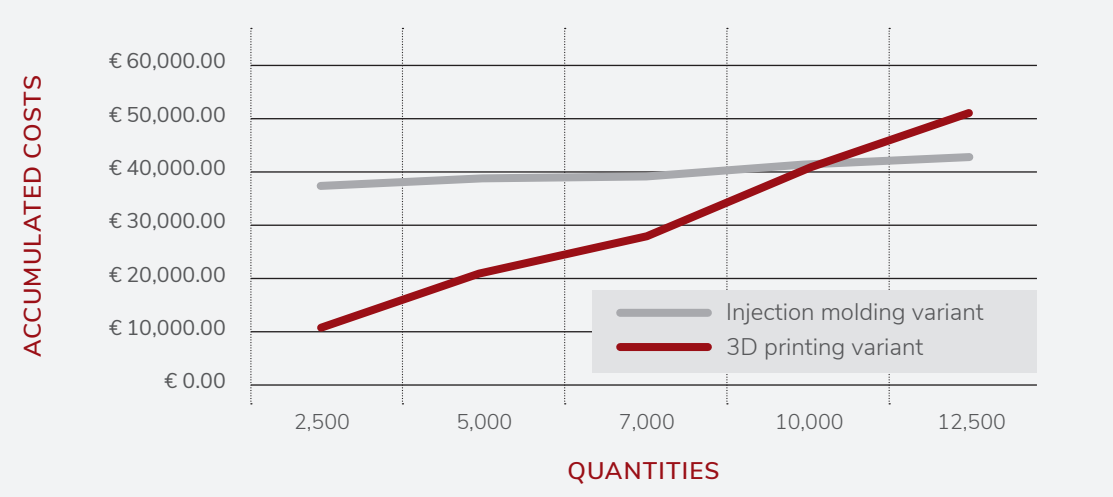

Figure 5: Break-even analysis for the manufacturing variants

4. COST ENGINEERING AS A COMPONENT OF ENTERPRISE PRODUCT COSTING

In order to implement approaches like cost engineering in procurement, businesses need a **comprehensive management method** that meets all of the requirements outlined in section 3. **Enterprise Product Costing (EPC)** fully meets these requirements.

EPC is a method that is designed to achieve consistent enterprise-wide cost control throughout the entire product life cycle. The aim is to control costs early on, starting from the development phase, through cross-departmental collaboration. This makes it possible to actively engineer product ideas and innovations while keeping an eye on costs right from the start.

EPC incorporates all of the key areas of business – from development, production, purchasing/procurement and sales all the way to controlling and executive management. Potential for optimization becomes readily identifiable when development, product and manufacturing costs are shaped in a transparent way across all phases of the product life cycle.

In concrete terms this means that all business processes in the company must be evaluated to determine their contribution to product costs: e.g. development as a share of development costs, manufacturing as direct manufacturing costs or administration as a share of administration overheads.

In practical applications, the EPC approach is implemented with the help of a corresponding IT system:

EPC systems unify all of the enterprise's cost information in a centralized database. This ensures that every employee works with the same data.

This includes information from Enterprise Resource Planning (ERP), Product Lifetime Management (PLM), Product Data Management (PDM), Computer-Aided Design (CAD), Excel and **external benchmark data**. Cost data is collected, edited, processed and clearly presented in the application. This gives users access to the **valid, standardized and comparable basis of data** they need in order to make solid product and investment decisions.

EPC systems also define standardized processes, calculation methods and calculation standards along with a calculation logic to promote a **uniform understanding of costs and ensure that it is possible to compare results**. As shown in the previous section, product costs are broken down based on a bill of material (BOM) in an EPC system. All direct product costs or costs from manufacturing such as material, process costs or additional costs are thus shown as they build on one another in a transparent, logical manner. Moreover, modern

EPC systems can map or simulate existing overhead cost structures, making it possible to calculate overhead cost factors and incorporate these into the component calculation or the BOM structure. **Ultimately, users thus have access to an evaluated costing BOM from the initial manufacturing BOM.**

Depending on the status of information, values calculated for assessment, real values identified through audits or benchmark data (ideally supplied by the software) may be used.

Users can then take advantage of this cost structure, which is broken down in detail, to compare the customer's calculation from procurement component by component and thus quickly identify components or processes that are too expensive (cf. section 3.1. Target costing). This target/actual comparison can then be used as the basis for a supplier workshop to mutually define savings potential and thus comply with cost targets and boost Supplier Lifetime Value (SLV).

Ratios such as SLV, target compliance, cost savings, return on investment (ROI) or net present value (NPV) for the individual projects can be quickly computed thanks to the transparent, system-backed calculation and made available for in-house planning purposes.

Since this is usually database-supported software, it is also possible to generate analyses that span multiple projects, meaning that the SLV can be determined not only for one project but for all projects a company works on with the selected supplier.

Thus, the Enterprise Product Costing approach offers procurement and other departments and business processes an analysis tool that evaluates all costs, supports modern cost management strategies (see section 3) and consequently offers a solid foundation for sustainable business decisions.

5. CONCLUSION

Procurement is a strategic, in-house partner and an integral part of successful businesses today. It is absolutely imperative to expand its area of responsibility from a purely operational unit to a strategic department. However, this also means that business processes will need to be adapted and expanded in a meaningful way.

Here businesses should make sure that their processes meet the latest standards and ensure **enterprise-wide collaboration**. It would be too short-sighted to merely adapt processes and tasks within the department only to have to revise everything again in the medium term when the company recognizes the added value of enterprise-wide, interdisciplinary collaboration.

A key element of these changes – leading from operational to strategic purchasing – is **involving employees in enterprise-wide costing processes, in particular the purchased part price analysis as preparation for supplier workshops or price reduction negotiations**.

The process presented here describes an approach that purchasing can use to prepare for these types of workshops and meetings in a comprehensive, transparent way. A detailed, coherent breakdown of all costs enables businesses to engage in discussions with their suppliers on equal footing, protects them from surprises and delivers fair results for all of the parties involved. Identified potential can be mutually leveraged and, ideally, shared. This allows enterprises not only to achieve their own financial objectives, but also builds trust and improves collaboration with suppliers.

The Enterprise Product Costing method supports this precise approach and enables sustainable, enterprise-wide collaboration within one's own company and beyond. The basic prerequisite here is a suitable EPC software package that fully addresses all of the users' requirements and processes.

FACTON
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ABOUT FACTON

The FACTON EPC Suite is the leading Enterprise Product Costing (EPC) solution for the automotive, aerospace, mechanical engineering and electronics industries. Its specific solutions offer robust answers to the requirements of executive management and individual departments within the enterprise. FACTON EPC enables standardized, enterprise-wide costing independent of location and department for maximum product cost transparency throughout every phase of the product lifecycle. Businesses accelerate their costing, achieve pinpoint cost accuracy and secure their profitability.

FACTON was founded in 1998 and has locations in Potsdam, Dresden, Stuttgart and Detroit. Hasso Plattner, founder and chairman of the supervisory board of SAP SE & Co. KG, has supported this innovative company since 2006. The international portfolio of customers includes Ford Motor Company, Henniges Automotive, DURA Automotive Systems, Airbus, Mahle Behr, MANN+HUMMEL, Porsche and other renowned manufacturers.