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Material Efficiency

The reservoir of neglected savings potentials

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A QUANTUM LEAP AHEAD

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Material efficiency - the reservoir of neglected savings potentials

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In inventory optimisation projects, questions of material efficiency often have to be left out, because they go much further than the project envisages. Nevertheless, it is important to address material efficiency as well, because that way you can do the right thing even better.

Although the potential of material efficiency measures varies greatly depending on the sector, the potential for annual material savings across all sectors has averaged around 9% for many years. Depending on the industry, the annual material savings potential can even be up to 20% of the gross production value, as various independent studies by renowned institutions have shown over the past 10 years.

The sectors with the greatest potential are the chemical industry with around 20%, followed by the construction industry, the manufacture of plastic goods and electricity generation equipment. However, the manufacture of metal products, the processing of wood, medical technology, measurement and control technology and optics also offer continuous potential of 6%.

The payback period of the investments to recover this potential was less than 6 months in the majority of cases. Follow-up effects of the efficiency measures, such as economies of scale in distribution due to possible price reductions, have not yet been calculated here.

Awareness of material efficiency is lagging behind

Since the potentials are undisputed in most companies, it is surprising that about half of all German companies in the manufacturing sector have not yet implemented any far-reaching measures to improve material efficiency, as various surveys in the recent past have also shown. This is all the more surprising since, according to the Federal Statistical Office, the cost of materials in the manufacturing sector regularly represents the largest cost pool for companies, accounting for around 40-45% of total costs.

What does material efficiency mean?

Material efficiency" describes the relationship between the quantities of materials in manufactured products and the quantities used to manufacture these products. At a time when raw materials are becoming scarcer and more expensive, the efficiency of material use is an important lever for strengthening competitiveness; a lever whose importance will continue to increase.

In particular, due to increasing resource allocation, energy issues, innovative technologies and increased climate protection requirements, material efficiency is permanently in the focus of government support programmes; however, only for SMEs.

For example, the Federal Ministry of Economics and Technology BMWi promotes material efficiency projects via innovation vouchers in the "go-efficient" module (as of 2020), which cover part of the costs for external support for material efficiency projects.

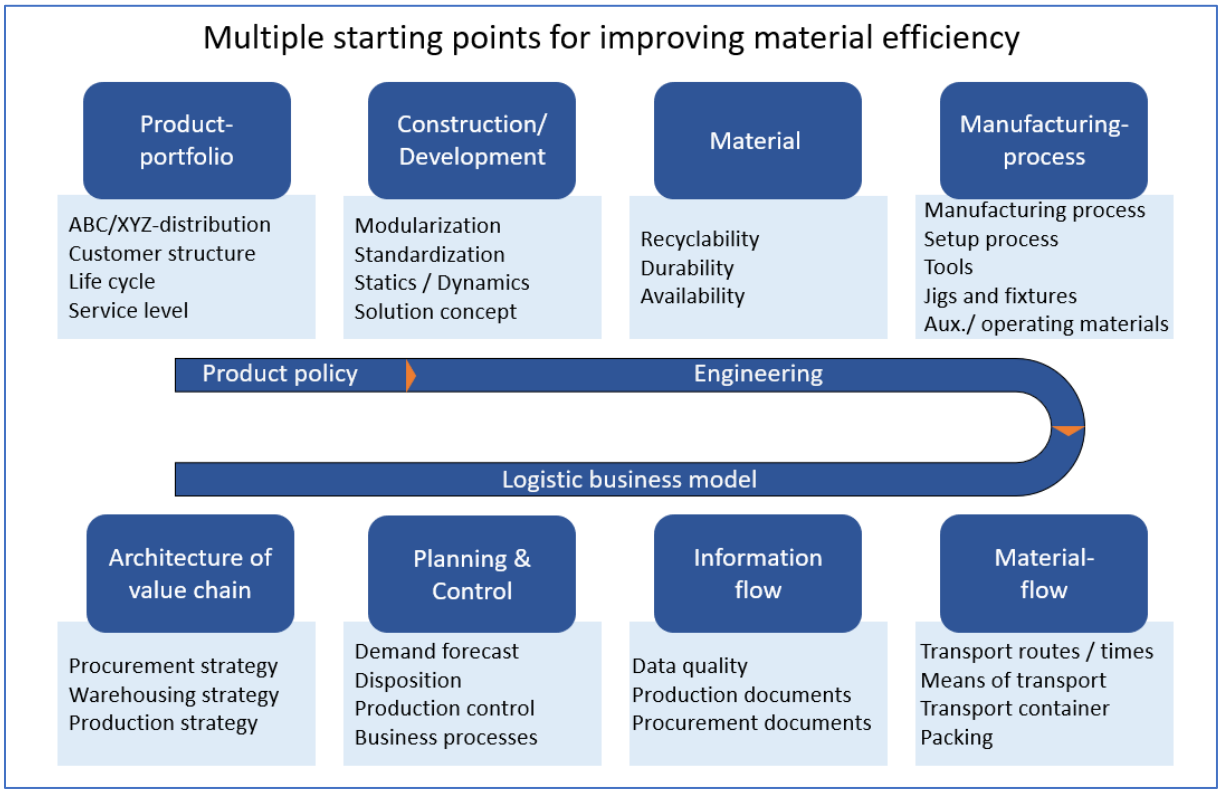

Figure 1: Various starting points for increasing material efficiency

How can material efficiency be increased?

There are many ways to increase material efficiency in the production of goods. Resources can be saved by designing products accordingly and by optimising industrial processes. In addition, raw materials that are classified as critical or problematic can be replaced by less problematic ones.

Therefore, all measures that reduce the use of material (including the auxiliary and operating materials used) in the production process are suitable for increasing material efficiency. This can be achieved, for example, through improvements in the design of products, by reducing scrap (quality scrap) or optimising offcuts (plan scrap).

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The main starting points for increasing material efficiency can be divided into the following sub-areas with exemplary starting points:

Product and manufacture

- Product design and dimensioning
  - Material selection (selection or substitution of materials used as well as cleaning agents and auxiliary materials)
  - Determination of geometries
  - Variant management (reducing internal complexity while maintaining external complexity)

- Production process
  - Process engineering and new technologies in machining
  - Checking the process parameters
  - Waste optimisation
  - Reuse of scrap / use of recycled materials
  - Time and type of cleaning of intermediate products
  - Quality measures for error identification in the processes

Internal processes

- Production environment
  - Disposition and warehousing
  - Packaging and transport
  - Cleaning agents and water consumption and treatment
- Planning
  - Entire process in the supply chain
  - Sales and demand planning as well as inventory planning
  - Production planning
  - Procurement planning
- Organisation
  - Formation of a task force on material efficiency

Staff

- Involvement of employees
  - Corporate culture for material efficiency
  - CIP processes for material efficiency
  - Implementation of suitable ideas
- Promoting awareness, qualification
  - Promote price awareness, cost understanding, sustainability
  - Internal information policy through, for example, information areas
  - Promoting cross-sectoral exchange, e.g. through workshops

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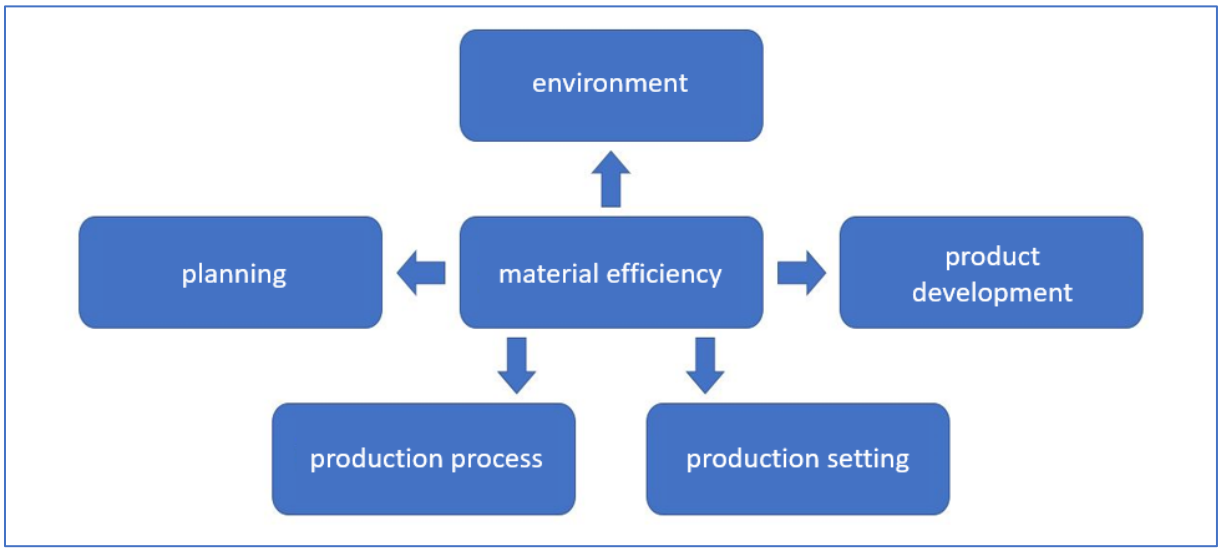

Figure 2: Material efficiency affects many factors

Especially in the development of new products, the potential for improving material efficiency is very high. Here it is required, as the automotive industry has been practising for a long time, to save material in principle (e.g. lightweight construction) without limiting the requirements of the overall product. In addition, products should be repair-friendly and ultimately easy to recycle.

Not to be neglected in this early phase of the product life cycle is also the reduction of internal complexity while maintaining external complexity. Customers should be able to choose from a wide variety of products. However, the goal must be to keep internal diversity as low as possible through a high proportion of multiple-use parts, since a high diversity of variants influences the number and quantity of raw materials, production and assembly parts and assemblies required and also has an impact on the efficiency of the production machines used.

Reducing the number of variants within the company also improves the plannability of products and minimises the risk of rejects and scrapping due to omitted requirements or incorrect planning. Incidentally, the effort required for master data creation, disposition, transport and handling is also reduced.

While these aspects are reflected in the *design-to-cost* method *or in later standardisation projects*, the *zero-loss management* method is particularly effective in the life cycle phases of growth, maturity and saturation. In addition to the consideration of the entire supply chain, the production processes and the design of material flows are given particular attention. In zero-loss management, all cost elements that are not used by the customer in the form of end products and are therefore not paid for by the customer as a product are referred to as losses.

Avoiding losses as much as possible is the goal of optimisation. The focus of a material efficiency project therefore includes "losses" such as raw material waste or rejections, losses in intermediate products, finished products and packaging materials as well as consumables such as water.

In addition to the often existing problem of waste optimisation, the increased recycling of materials also offers great potential for increasing material efficiency. In the field of lubricants, for example, a

large part of the waste oil produced can be recycled more and more effectively thanks to advanced recycling methods.

The central question is:

- Where are material efficiencies eaten up or potentials for increasing material efficiency not utilised in the design of products, production processes, the production environment and end-to-end supply chain planning?
- The identified material efficiency deficits are then not only attacked in the next step with the design of an overall concept, but should be sustainably resolved. Here, the effective linking of all measures from material procurement to the distribution of the manufactured products is required.
- The continuous planning of the supply chain with regard to demand and inventory as well as the determination of optimal stocking strategies form the indispensable basis for increasing competitiveness with a low level of scrapping and thus in a resource-saving and cost-effective manner.

Errors in these planning domains inevitably lead to unnecessary consumption of raw materials, misuse of materials (and energy, although this is not counted as material efficiency) in production, and the manufacture of unneeded intermediate and finished products. This, in turn, often leads to scrapping or discounted sales promotions that put undue strain on the material balance and thus on material efficiency. Consequently, the strategic lever of increasing material efficiency can only be used efficiently if the disposition processes are optimised at the same time.

Hurdles in projects for improved material efficiency

The reasons for this are complex: lack of personnel capacity and the investment requirements associated with the project are at the top of the list of obstacles. It is therefore important to raise awareness of the great opportunity that material efficiency projects hold and to question and eliminate obstacles to the implementation of measures.

Tip 1: Secure time slots for the responsible employees

When deciding on projects to improve material efficiency, it is important to give the responsible employees a binding and reliable time frame. The holistic relevance of material efficiency must also be made clear.

- Time is a critical factor for all concerned in everyday working life
- Short lead times place high demands on scheduling and ordering processes
- The planning and control effort should not be unnecessarily burdened

Tip 2: Question customer requirements

Customer requirements not only have an impact on your own material efficiency but, depending on the product portfolio, may also require communication with or involvement of suppliers in order to achieve joint advantages in material efficiency.

- Requirements of the specifications often offer room for material efficiency

- Discuss with subcontractors your objectives with regard to customers
- Communicate sustainability with the same quality as an alternative

Tip 3: Dissolve "it has always been like this

Material efficiency is a "change process". As with all change management projects, the overall economic benefit for the individual must be demonstrated and the necessity and relevance for the affected area of work must be worked out.

- Trying to soften old patterns of thinking and working based on facts
- Create cross-divisional transparency to upstream departments
- Try to overcome operational blindness through information exchange

Tip 4: Costs and benefits

Basically, companies feel it is necessary to deal with material efficiency from a profitability, cost and environmental point of view, as long as ongoing projects are not negatively affected (cf. Tip 1). If you have already implemented internal projects, have you asked again whether there is further potential?

- Regularly check implemented measures for effectiveness
- Get external support facilitated through funding programmes, e.g.:
    - Time management for implementation with internal resources
    - Facilitating workshops, changing mindsets
    - Control of as-is surveys and analysis of measures
    - Prioritisation and controlling of measures

Design and implementation of material efficiency projects

Wherever you see the main starting points: It is important that in material efficiency projects all the areas mentioned above are embedded in a comprehensive and holistic design approach. Individual actions are of little use here because they are not sustainable.

Within the framework of a potential analysis, the first step is therefore to draw up a complete material balance of the company and its processes. The material balance compares the quantities of material input with the quantities of material output in a productive system. The entire material flow is identified according to type and quantity, losses are disclosed.

In the second step, we analyse the correlations with the methods of constraint management. In doing so, we break down the network of cause-effect relationships in order to uncover the core causes that stand in the way of improving material efficiency. In this way, we arrive at the core causes of material losses by analysing them.

In the last step, measures to eliminate the core causes are jointly sought, defined and anchored in an implementation plan. This implementation plan can then be continuously worked through and monitored.

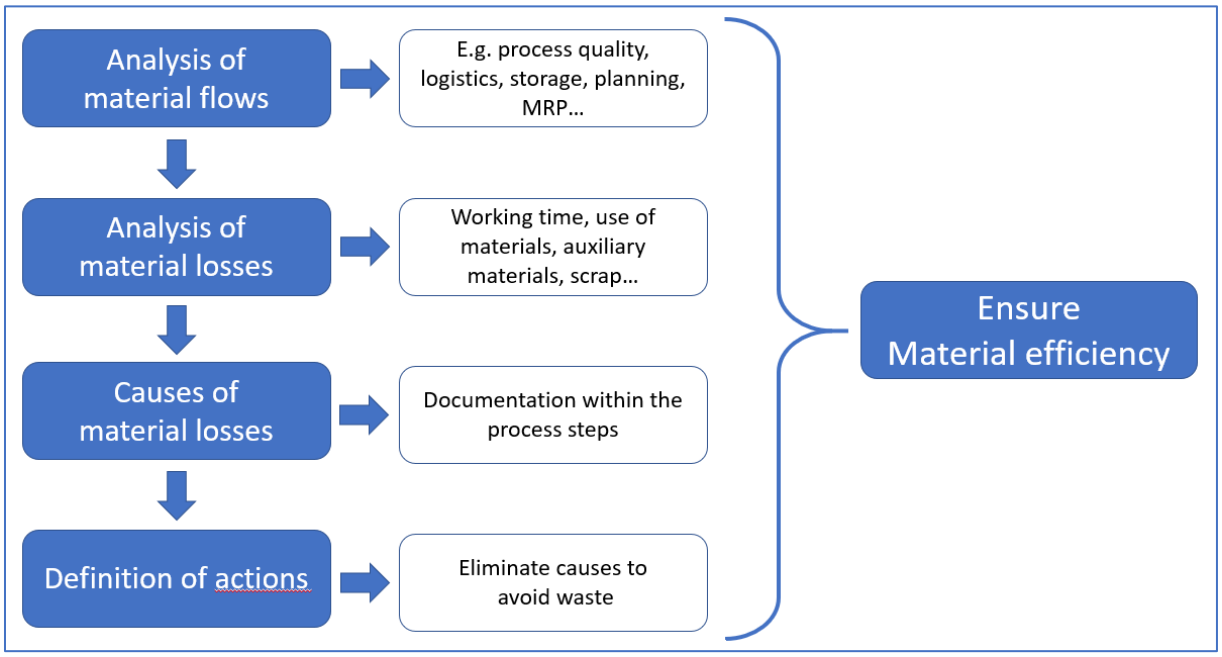

Figure 3: Analysis of material efficiency in the supply chain