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Short Profile

SUSTAINABILITY VALUE-ANALYSIS

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LIGHTWEIGHT DESIGN FOR A LIGHTER WORLD





AMC - the Professional and Innovative Technology & Consulting House

- Founded in 2001 by Dipl.-Ing. (FH) Rainer Kurek
- Holistic, system-oriented management education and consulting
- Systemic, in-depth technological lightweight construction knowledge in theory and practice
- Leading at the interface between industry and science (including university lectures)
- Lightweight construction expertise, R&D and digitalization competence for "sustainability" (including "sustainability value" analysis)
- Internationally active company, local presence in Penzberg, Werdenfelser Land
- In-house, company-specific as well as inter-company, open further education
- German Innovation Awards, Chinese Lightweight Design Award, ENLIGHTEN AWARD, German Design Award 2021 in Gold, Styrian Innovation Award, ...
- Conscious and targeted linking of technical and methodological competence

LIGHTWEIGHT CONSTRUCTION – EDUCATION – SUSTAINABILITY

AMC Philosophy: Together We are Stronger and Achieve More

Most of the (experiential) knowledge (approx. 80%) is normally available within the company, but in the form of "distributed information": Knowledge management is an essential success factor!

INTERACTIVE
CONSULTATION PROCESS
STRATEGY - STRUCTURE - CULTURE

Knowhow in your company

Development of your »Managerial Effectiveness«

Concrete, company-specific knowledge, experience, judgment regarding

- Products
- Markets
- Customers
- Processes
- Competitors
- etc.

Combination of the two areas of knowledge

Technology- und Management-Knowledge regarding

- Sustainability
- Lightweight Construction
- Management Systems
- Management Methods
- Regularites
- Procedures
- etc.

Comprehensive management know-how as well as profound technology knowledge

Typically, companies have only part of the required management methods at their hands.

Sustainability Value-Analysis

Introduction 1 – Sustainability Value-Analysis

- The main approach of initiating the Sustainability Value-analysis is to improve the growth of the company by sensibilizing the importance of long-term business circumstances and to become stable in the upcoming competitiveness business activities.
- Implementing sustainable development strategies in companies facilitates the transition from unsustainable to sustainable production practices.
- In terms of both social and environmental impacts, sustainable solutions are very challenging. Science now also plays an increasingly important role in this, as it has become more significant for the assessment and implementation of technologies. To noticeably reduce annual global emissions, all faculties need to work together - between 2006 and 2019 alone, we have seen an increase in global emissions of almost 20 per cent. This trend must be stopped with all the forces at our disposal.Translated with
- In the real world, manufacturing companies, or the countries in which they are based, often have the biggest social and environmental problems. In many cases, far too little thought is given to the pollution and working conditions associated with the production process. It is time to develop new and modified strategies that enable companies to adopt sustainable business practices.
- It is now also the responsibility of governments to help reduce carbon emissions by introducing new regulations and taxes.

Introduction 2 – Sustainability Value-Analysis

- It is a misconception that climate action must go hand in hand with economic and environmental development and growth. Environmental action is rather a strategic choice for a new way of doing business for sustainable development and growth.
- More recently economic and ecological decision-makers have started to recognize the wider range of benefits from investments in the transition to zero-carbon and climate-resilient development and growth. It includes not just avoided damage and losses from climate change but also increased efficiency and productivity, better health, stronger biodiversity, more dynamic and creative innovation. But we must invest strongly to get there and manage the dislocation.
- Many environmental and economic assessments do not capture the full range of benefits and severely undervalue the lives and livelihoods of today's young people and future generations.
- Sustainability Value-Analysis helps us to gave the concrete value of the product in which it helps in saving the resources for the current and future generations, such as food, water, healthcare and energy, without stressing processes within the Earth system.

Strategy implementation for the Automotive industry: Sustainable Goals

Analysis Phase

- UN Sustainability development goals (SDGS)
- Mission of the company
- Technology Assessment
- Transition for Sustainable economy

How can we build an ecological and economical development that works for all?

How does the sustainable future looks like?

Why does the sustainability matters?

How can we steer companies towards sustainable business practice?

What do we really wanted to achieve?

Is our business model future-proof in sustainable business model?

"Where do we stand today?"

Evaluation - 1

Option Phase

- Science and technology
- Misconception/trend-off
- Economic assessment fails
- Economical decision-makers

»Where can we go?«

Evaluation - 2

Transformation Process

- Underestimated the risks
- Global GHS emissions
- Fossil fuels CO_2 emission
- Technology advancement and cost reduction
- “Race to zero”

"Where do we want to go?"

Sustainability Value-Analysis

Evaluation - 3

Top Results – long term value creation

- Low carbon and more circular economy
- Institutions and infrastructure
- Political economy
- Competitive advantages

“Sustainable Development”

“How do we get there?”

Sustainability Value-Analysis

Cause and effect Criteria

Initial Situation

- In addition to the "Covid 19 pandemic" caused by viruses, the industrial effects of which are still not "finally" foreseeable, questions about "***CO_2, climate and energy turnaround***" dominate the local market structures, politics, science and media.
- Ecological and economic effects on the way to a low-CO_2 industrial landscape are analysed and evaluated for products, processes and services and independently qualified and quantified (calculated / determined) for the manufacturing, utilization and recycling (reprocessing) phases.
- The systemic qualification and quantification of material and energy use, greenhouse gas effects, product development and CO_2 avoidance costs represent a complex task in the cause-effect relationships of technology use.
- The present short profile "SUSTAINABILITY VALUE-ANALYSIS" was developed by AMC GmbH and shows **a systemic management toolkit for the holistic qualification and quantification of sustainability criteria and measures for an accelerated "CO_2-, climate- and energy turnaround"** in the local market structures.

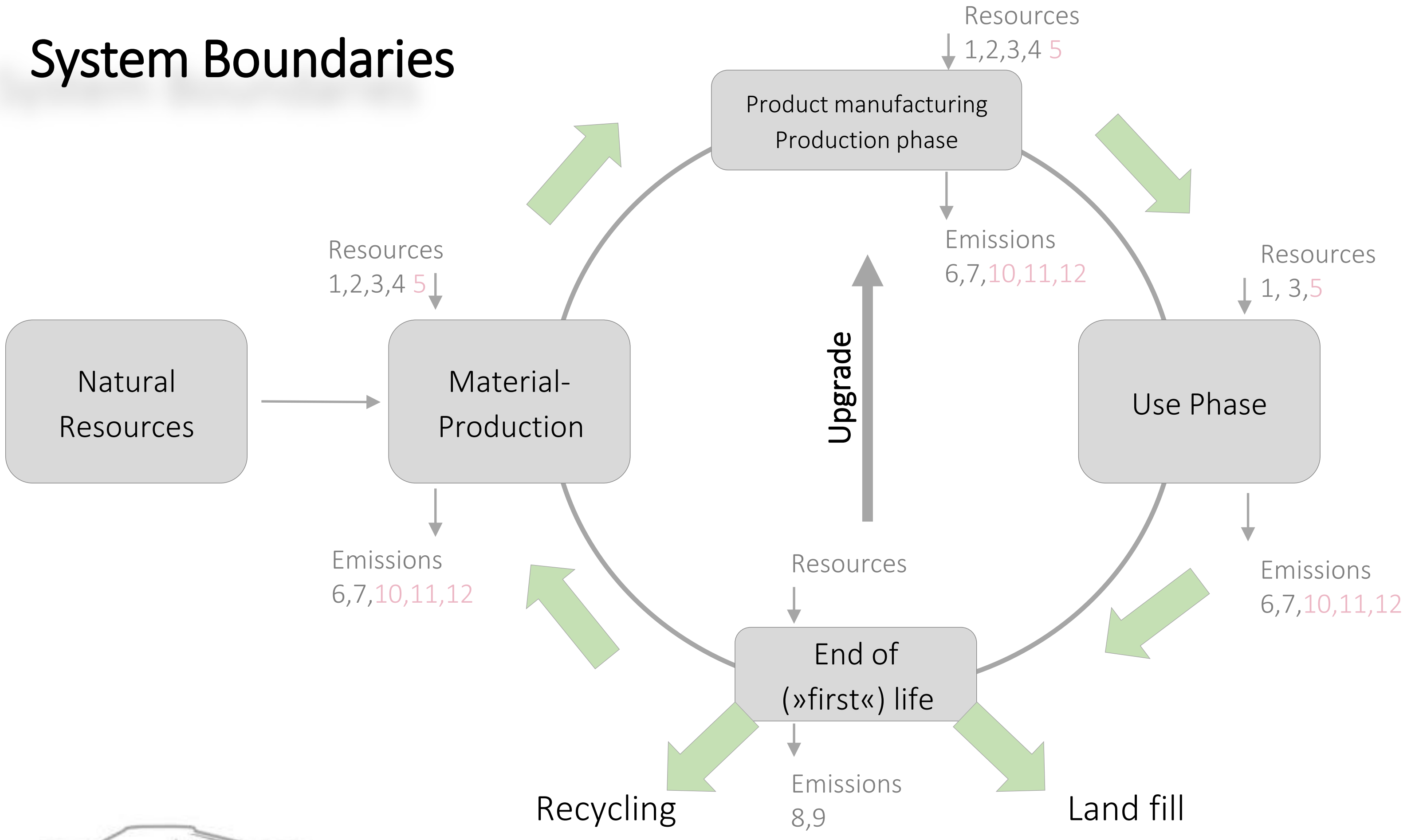
Ecological and Economical Criteria

Ecological causes	Effects
Climate Change	Atmospheric CO_2 concentration
Land-system Change	Deforestation and land erosion
Biodiversity Loss	Terrestrial and marine
Biochemical Flows	Nitrogen and phosphorus
Freshwater Use	Blue water consumption
Ocean Acidification	Average saturation of aragonite (CC) at the ocean surface
Stratospheric Ozone Depletion	concentration of ozone in the stratosphere
Air Pollution	Aerosol optical depth (AOD)
Chemical Pollution	No global control variable

Economical causes	Effects
Global production	Material selection
Technology Assessment	Energy Savings Innovation management
Diversification trading	Managing risks for long term
Mobilization and Logistics	Energy saving Resources saving
Use-case	More service life
Disposal and Recyclability	Secondary energy savings

Upstream and Downstream Impacts - Metal Structure Material Flow

System Boundaries



Supply chain

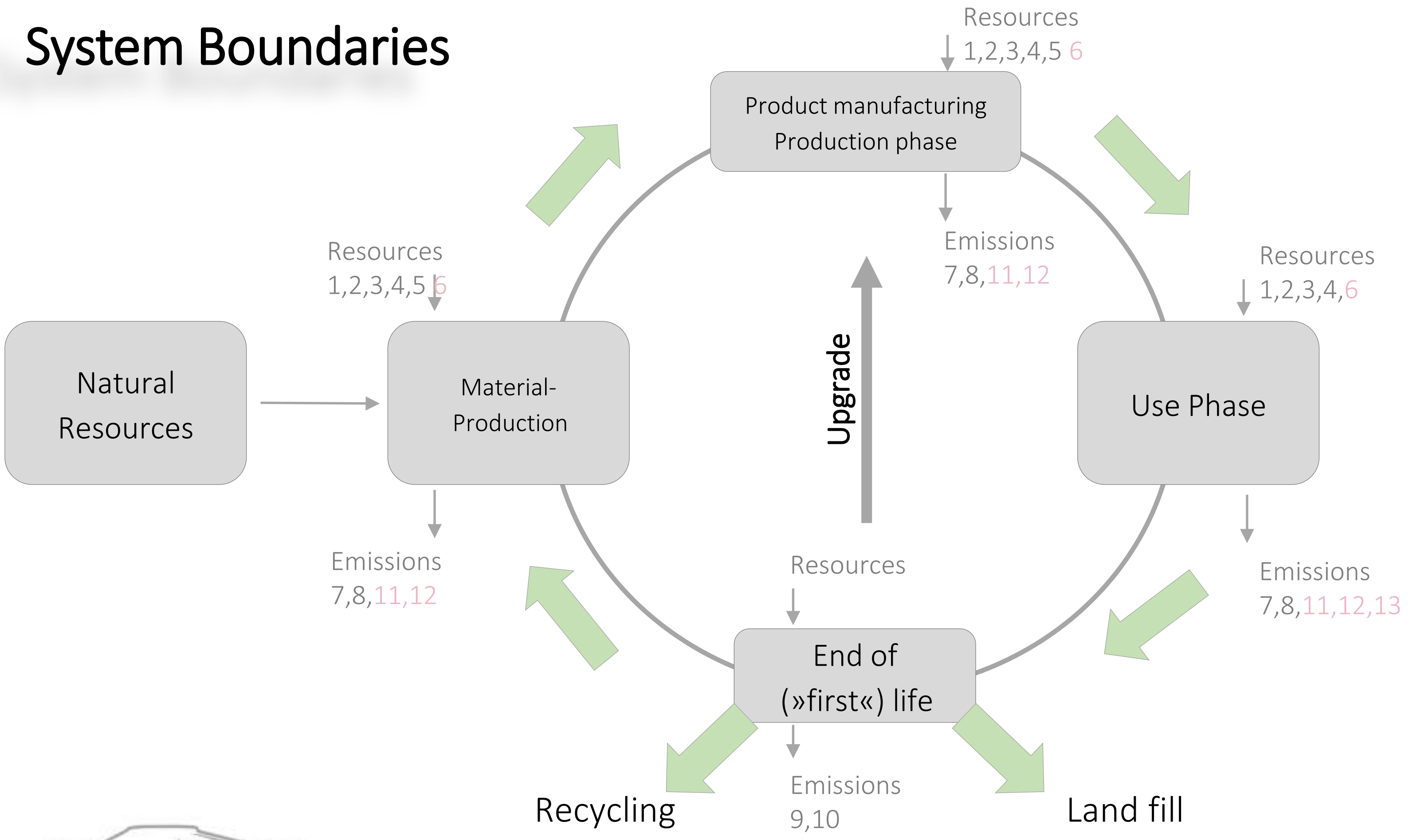
Resource: Upstream and Downstream	
1	Electricity, Fuel
2	Steel, Aluminum, PPE
3	Chemical substance
4	Land
5	Water

OEM's

Emissions: Upstream and Downstream	
6	Hazardous water waste
7	Hazardous waste
8	Steel for recycling
9	Solid waste to landfill
10	Air emissions
11	Water release
12	Noise

Upstream and Downstream Impacts - Composite Structure Material Flow

System Boundaries



Supply chain

Resource: Upstream and Downstream	
1	Electricity, Fuel
2	Steel, PPE
3	Epoxy resins and plastics substances
4	Chemical substance
5	Land
6	Water

OEM's

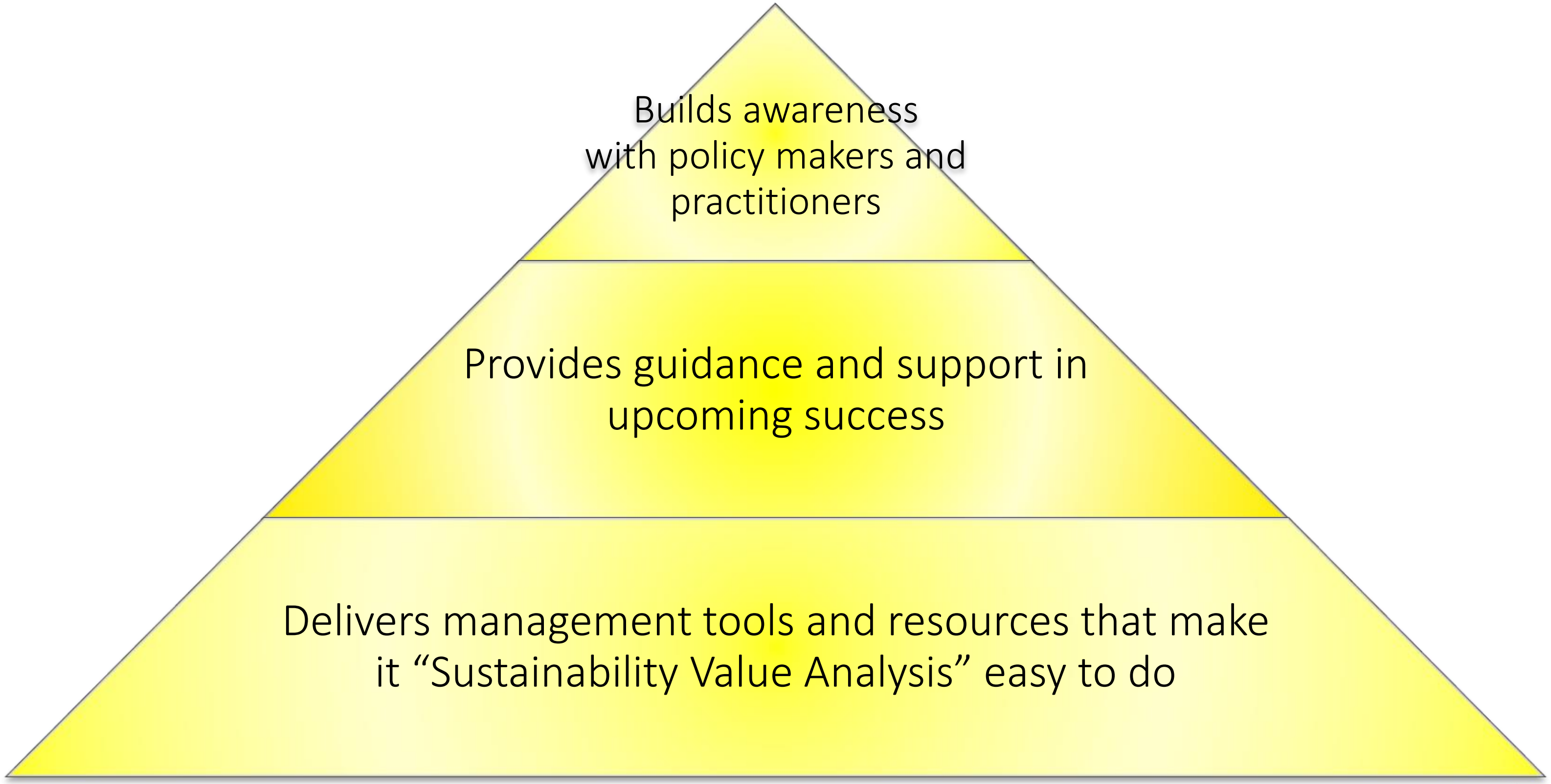
Emissions: Upstream and Downstream	
7	Hazardous water waste
8	Hazardous waste
9	Steel for recycling
10	Solid waste to landfill
11	Air emissions
12	Water release
13	Noise

Environmental and Social Impact

Name	Social Causes (Improve)	Environmental Causes (Reduce)
Improve waste management	Life expectancy	Blue water & Ecological footprint
Renewable energy	-	CO2 emissions
Recycling policies	-	Material footprint
Infrastructure programs	-	Material footprint
R+D+I policies	-	CO2 emissions
Increase health spending	Life expectancy	

Circular innovations	Name	Effects
Innovation 1	Friendly certified materials	Reduces material footprint
Innovation 2	Green electricity use	Reduces ecological footprint
Innovation 3	Waste management	Reduces ecological footprint
Innovation 4	Water cleaning	Reduces blue water consumption

Legal Regulation Impacts



Principal Criteria for the Sustainability Value Analysis Tool Development

	Selection Criteria's	Sustainability Criteria's	Challenges
Materials	Bio-composites / Biodegradable Material efficiency Material for lower carbon power	Material availability Ethical manufacturing	Is supply chain secure?
Energy	Green energy solution	Energy consumption Energy storage Energy efficiency	Energy consumption value?
Environment	Lightweight design Circular material economy	Resource consumption Water availability Emissions Global and local impact	What is relative environment impact? Does one have lower CO2 footprint? Recyclability?
Legal regulations	Environmental regulation Carbon taxes Aggregate taxes	Government Standards Laws and regulations	Government Standards Laws and regulations
Society	Investment in technology Knowledge networks	Quality of life Security and equity	Product usage? Environmental responsibility?
Economics	Eco-friendly material selection, Cost effective solutions, robust manufacturing		Cost efficiency? What are the benefits in scaling? Do they justify the cost?

Relevant targets for the Automotive Industries: Sustainability Value Analysis

- Production volume (units per year): Min 50,000 parts per year
- Process cycle time (time per unit)
  - 5 minutes to 30 minutes, depending on volumes (Class A surface finish)
  - 1-2 minute per unit, more likely less 1 minute (Mechanically suitable performance and relevant application making use of a Composite system's advantages, such as lighter weight and corrosion resistance
- Percent cost reduction (relative to current)
  - Cost neutral would be sufficient for the conversion to a composite part given a reduction in weight
- Percent weight reduction (relative to current)
  - 50-75%
  - 10% weight reduction compared to current carbon fiber parts, over 60% reduction versus steel and 40% versus aluminum (Class A surface finish)
- Other important properties?
  - Friendly certified materials – lower GHG emissions, made from sustainable renewable resource
  - Recycling/Downcycling/Recover
  - Eliminate and reduce the use of solvents and toxic materials

Only Essential Criteria Decide on the Sustainability = Business Success

Natural Resource Use

- Material availability (global Production)
- Water availability
- Biodegradabiliity, Recycling and reprocessing
- »Circular Economy«

Sustainability = Business Success

Material- / Energy comsumption

- Mass
- Material processing and CO_2-Footprint
- Energy utilisation in the Manufacturing Process and CO_2-Footprint
- Energy Sources and CO_2-Footprint
- Use Phase and CO_2-Footprint
- Recycled content, -energy and CO_2-Footprint

Technology parameters

- Intensity of Investment
- Relative Productivity
- Relative Production Costs
- Capacity Utilization
- Innovation rate
- Market price and share

» It is of high importance to know, analyse and actively manage the strategic success factors of the sustainability criteria. Focusing on the few and the essential ensures sustainability = Business success. «

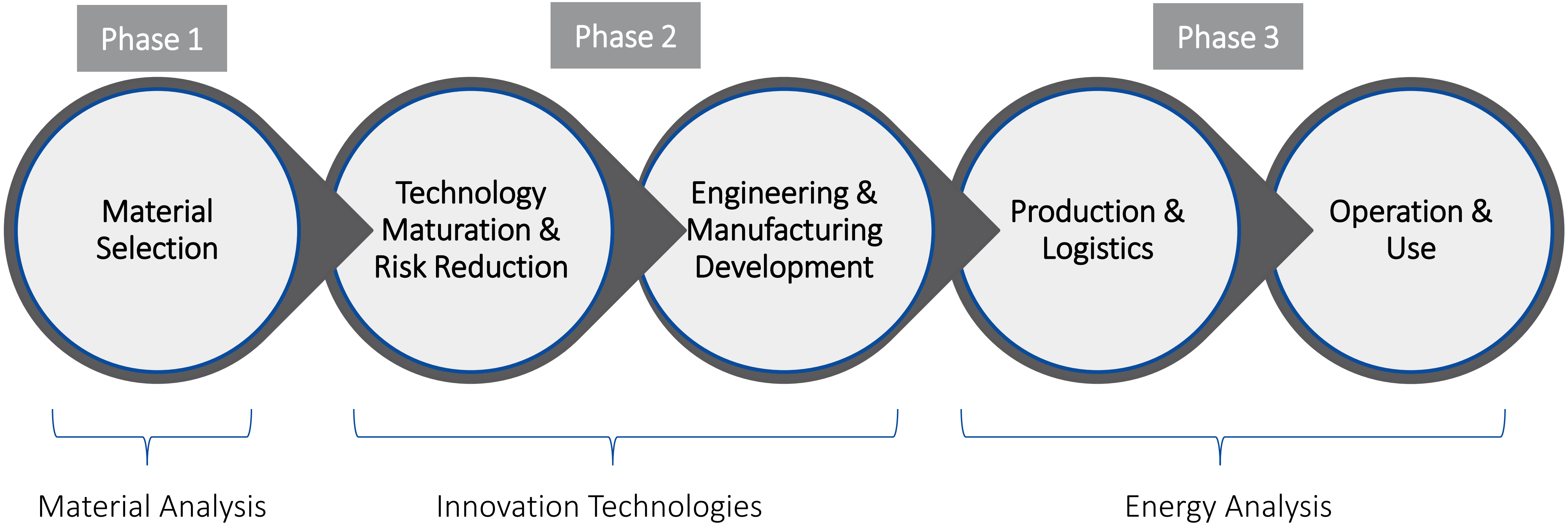
Sustainability Value-Analysis

Procedures

Sustainability Value

- Natural resource/material and energy consumption is characterized by various technical criteria, product specifications, manufacturing and use parameters, quality requirements, standards, reuse criteria and laws.
- The complexity is "relatively pronounced", so that a differentiation of significant "sustainability criteria" from less significant "sustainability criteria" is "relatively complex", and the decision for or against a technology application for the implementation of a product appears "at first glance" quasi-impossible.
- The "SUSTAINABILITY VALUE" is oriented towards all essential and relevant sustainability criteria in the phases of production, use and recycling with regard to the use of natural resources as well as the consumption of materials and energy. All criteria to be analysed can be measured and thus assessed. This results in a software-based reduction of complexity.
- The "SUSTAINABILITY VALUE" is not only oriented on all essential and relevant sustainability criteria (natural resource input and material/energy consumption), but also on the relative price when using a technology for product realization. Consequently, the required database is multidimensional.
- Thus, the "SUSTAINABILITY VALUE" is one of the key success factors in the decision for or against a technology application in the context of product conception, development and realization - "sustainability in frontloading".

Overview of Sustainability Value Analysis Framework



Phase 1: Methodology for Material Selection

Material Selection Criteria’s

- ✓ Eco-informed design: The need for eco-informed decisions early in the design process
- ✓ Modelling to identify the material indices
- ✓ Light weighting opportunity
- ✓ Choice to minimize embodied energy
- ✓ Choice to minimize cost
- ✓ The trade-off between embodied energy and cost
- ✓ Materials for strength requirements
- ✓ Static barrier: the index as bar chart
- ✓ Mobile barrier: the index as bar chart

Impact Criteria's

- ✓ Cost
- ✓ Mass
- ✓ Volume
- ✓ Thermal Loss
- ✓ Resource Depletion
- ✓ Energy Consumption
- ✓ Carbon Emissions
- ✓ Waste
- ✓ Environmental Impact
- ✓ Water Use

Phase 2: Methodology for Technology Assessment (NFK in 3D)

Technology Assessment Criteria's

- ✓ Sustainable Manufacturing
- ✓ Altering material approach: Critical material substation, Biomass substitution, Energy intensive material substitution
- ✓ Use products for the longer: Property improvement for increased productivity or longer life, Resale, Design for longer life, Modularity, Re-use, and Lightweight
- ✓ Do without or with less products or resources: Dematerialization, Yield improvement, Recycling / recovery
- ✓ Use products more intensity: Products as service

Other Considerable Assessment

- ✓ Electric Power
- ✓ Infrastructure - Recycling & Materials Substitution
- ✓ Fuels – Biofuels & Renewable Resources
- ✓ Transportation – Lightweight Materials, Batteries & Recyclability

Phase 3: Methodology for Energy Consumption Calculation

Energy consumption phases	Parameters	Process name	Manufacturing methods
Material Phase	Material Name and embodied energy (MJ/Kg)	- Forging (Primary machining and finishing) - NFK in 3D	- Conventional manufacturing - Additive manufacturing
	Percent of engineered scrap recovered and recycled onsite	Materials: Primary (MJ/Kg) and Recycled (MJ/Kg)	
Manufacturing Phase	Primary manufacturing or shaping process and embodied energy (MJ/Kg)	Metals - Rough rolling, forging Composites – NFK in 3D	
Freight and Distribution	Primary mode for Freight and distribution and embodied energy (MJ/Kg/Km)	Long-Distance Truck, Rails, Shipping	
Use Phase	Typical life-span of the product:	15 years	
	Fuel and mobility type (embodied energy) (MJ/Kg/KM)	Automobile segment	
Disposal Phase (End of Life)	Disposal method for material (embodied Energy, MJ/Kg)	Recycling methods	

Sustainability Value-Analysis

Overlook of Tool and Conclusions

»Sustainability Value«- Evaluation (Data Bank)

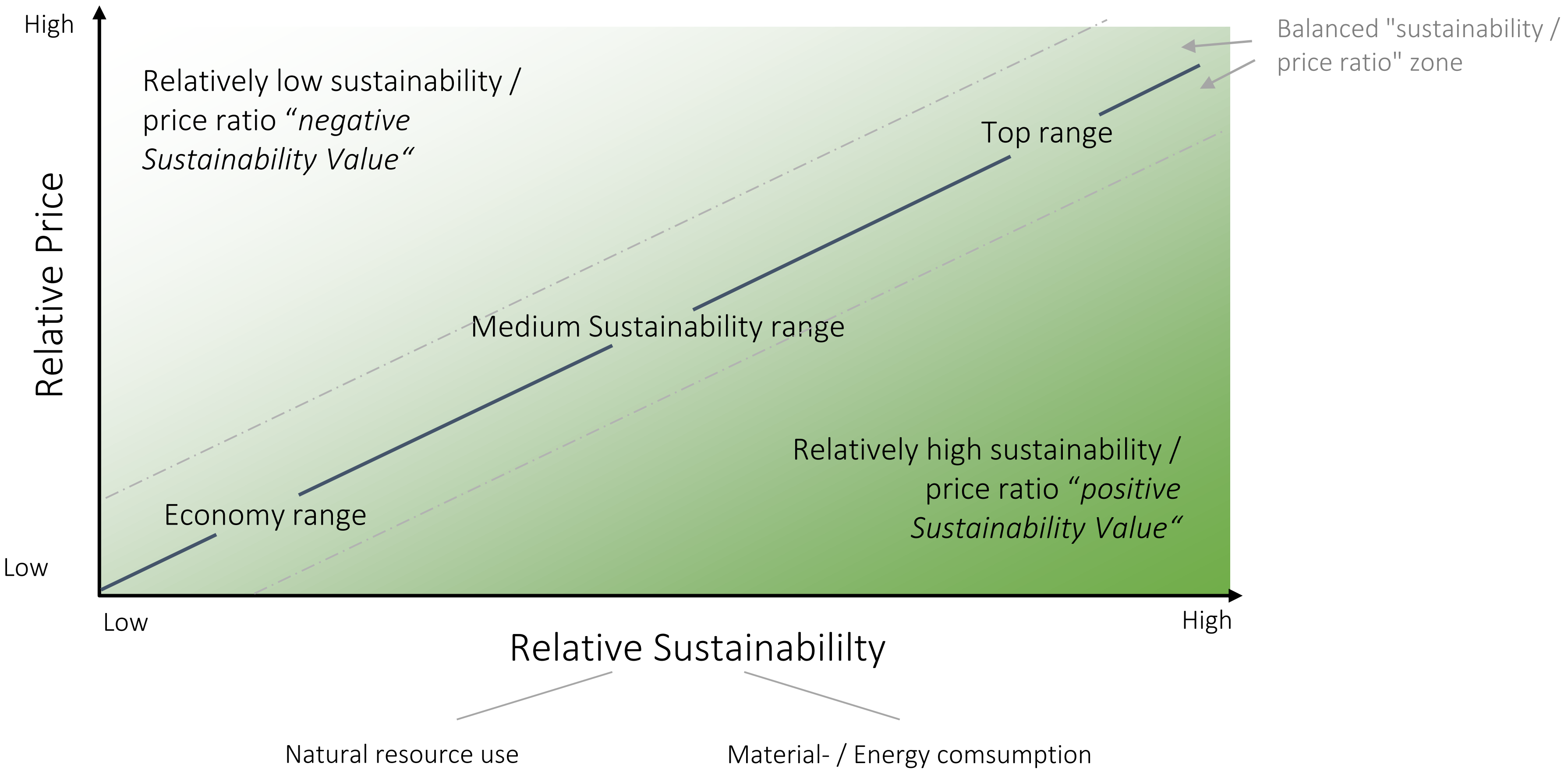
The SUSTAINABILITY VALUE evaluation is based on the following facts and figures (units):

A. Natural Resource Inputs	
M1	International Material Availability (global Production)
M2	Water availability
M3	Biodegradabiliity, Recycling and reprocessing
M4	»Circular Economy«

B. Material- / Energy Comsumption	
M5	Mass of Component
M6	Energy input in material processing (MJ/kg) and CO_2 footprint (kg / kg)
M7	Energy input in the manufacturing process (MJ / kg) and CO_2 footprint (kg / kg)
M8	Logistics parameters / energy carriers (J / kg.km) and CO_2 footprint (kg / kg)
M9	Use phase (J / kg.km) and CO_2 footprint (kg / kg)
M10	Recycling fraction and energy (MJ / kg) and CO_2 footprint (kg / kg)

The criteria mentioned are weighted and evaluated for the use of technology in the conception, development and realization of a product - based on data and facts that can be (mathematically) determined and are available as a database. In some cases, approximate empirical values provide a comprehensible and reliable result.

»Sustainability Value« - Value Chart
resulting from the relative sustainability / price ratio



»Sustainability Value«: Acting Chart

Analysis of these sustainability criteria and clarification of the resource issue in conservation (cost efficiency / pricing).

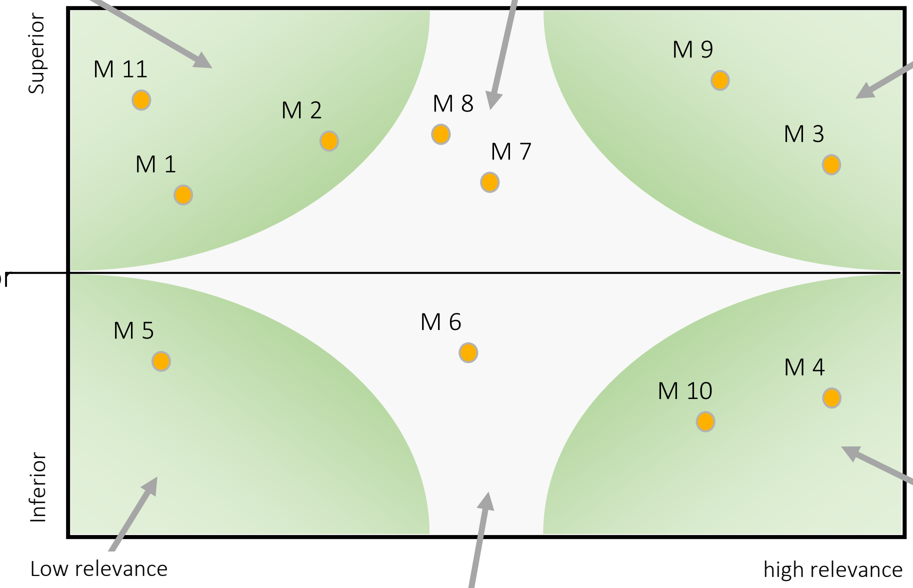
Holding and marketing of the differentiating features with regard to the medium-relevant sustainability criteria

Expanding, maintaining and securing the superiority of these highly relevant sustainability criteria

Zone of competitive advantages

Evaluation difference to the average of competitor technologies

Zone of competitive disadvantages



High priority in improving these highly relevant and underperforming sustainability criteria.

Relevance of the sustainability features

Observation of sustainability relevance and evaluation difference to competitor technologies

Improvement of these medium-relevant sustainability criteria to at least average values

Management-Summary: »Sustainability Value«-Analysis

- The software-based SUSTAINABILITY VALUE-ANALYSIS is a systemic management tool that makes it possible to measure and evaluate the sustainability of the use of different technologies in the context of product development and manufacturing.
- USP, IP and innovative power of the SUSTAINABILITY VALUE-ANALYSIS lie, among others, in a systemic and holistic evaluation option for the use of technologies in the manufacturing, use and remanufacturing phases of a product: in a qualifiable and quantifiable way.
- The determination (calculation) of the ecological and economic effects of the use of technology for the realization of a product is oriented towards all essential and relevant "sustainability criteria" and thus serves to reduce complexity in the product development process.
- With the qualification and quantification of sustainability criteria and measures for an accelerated "CO_2 and energy turnaround", the SUSTAINABILITY VALUE ANALYSIS answers central technological, political, sociological and social questions on the topic of "sustainability" in times of increasing digitalization from practice for practice.

Management-Summary: »Sustainability Value«-Analysis

- Sustainability Value Analysis results should be interpreted and analyzed to support the goals of the sustainable development. The software-based interpretation of results could help decision-makers understand the relative importance of right material selection, affective energy savings, ecological and economical decisiveness, activities that drive cost and impact, the level of confidence in the results, and important limitations.
- A Sustainability value Analysis is an iterative process depends on the components-to-components application for any industries. The results in later steps often reveal data gaps that can be re-addressed in earlier steps. Within time and resource constraints, the Sustainability Value Analysis should be updated when new data become available. Such updates may include altering the system boundary for improved comparability between alternatives, updating life cycle activity and cost profiles, and refining environmental impact and economical results.
- Overall, the results of this sustainability value analysis services an important to be a part of transforming economics, business, and management prospectuses into powerful sustainable management tool to achieve real sustainable change.

20 Years of Experience: AMC Competence Profile »at a Glance«

Management Consulting, Technology and Training House

20 YEARS OF EXPERICENCE

STRATEGY – PROCESS – STRUCTURE

MANAGEMENT

- Instruments
- Coachings
- Higher / Further Qualification
- Symposia / Professional Events
- Testimonials from Industry and Science

References:

- Dual Technical School
- Lightweight Symposium
- University Lectures

USPs

- Sustainability Value
- Customer Value
- Technology Value
- Market Study
- Technology study
- Strategy Development
- Corporate Manage-ment Check

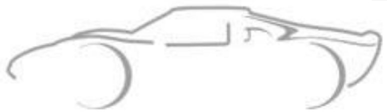
TECHNOLOGY

- xFK in 3D-Lightweight Construction
- Smart Textiles
- Al-/Mg-Hybride
- Polycarbonate
- Highly Renowned Brand Ambassadors

Referenzen:

- Thermal Management
- Protoype Kurek GT1 – GT8
- xFK 3D

Publications:



Merci beaucoup   Many thanks   Vielen Dank

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