
APPROACHES FOR THE INDUSTRIAL DEVELOPMENT AS KEY FOR COMPETITIVENESS AND SOCIO-ECONOMIC DEVELOPMENT



Simina Fulga

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

GROWTH FACTORS OF THE FUTURE

Thesis 1

Manufacturing creates value

- Agriculture and natural resources are the basis of the state's economy
- Services only accelerate the cash flow
- Financial transactions do not generate real value, just relocate the profit
- Sustainable value-added and an improved standard of living can be achieved only with the **manufacturing of goods**



Source: flowcrete.com

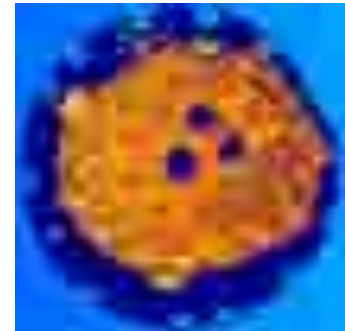
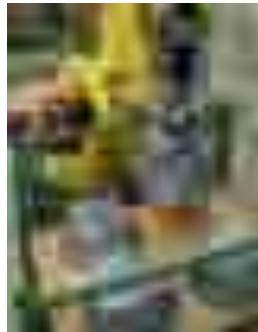


Source: images.businessweek.com

Thesis 2

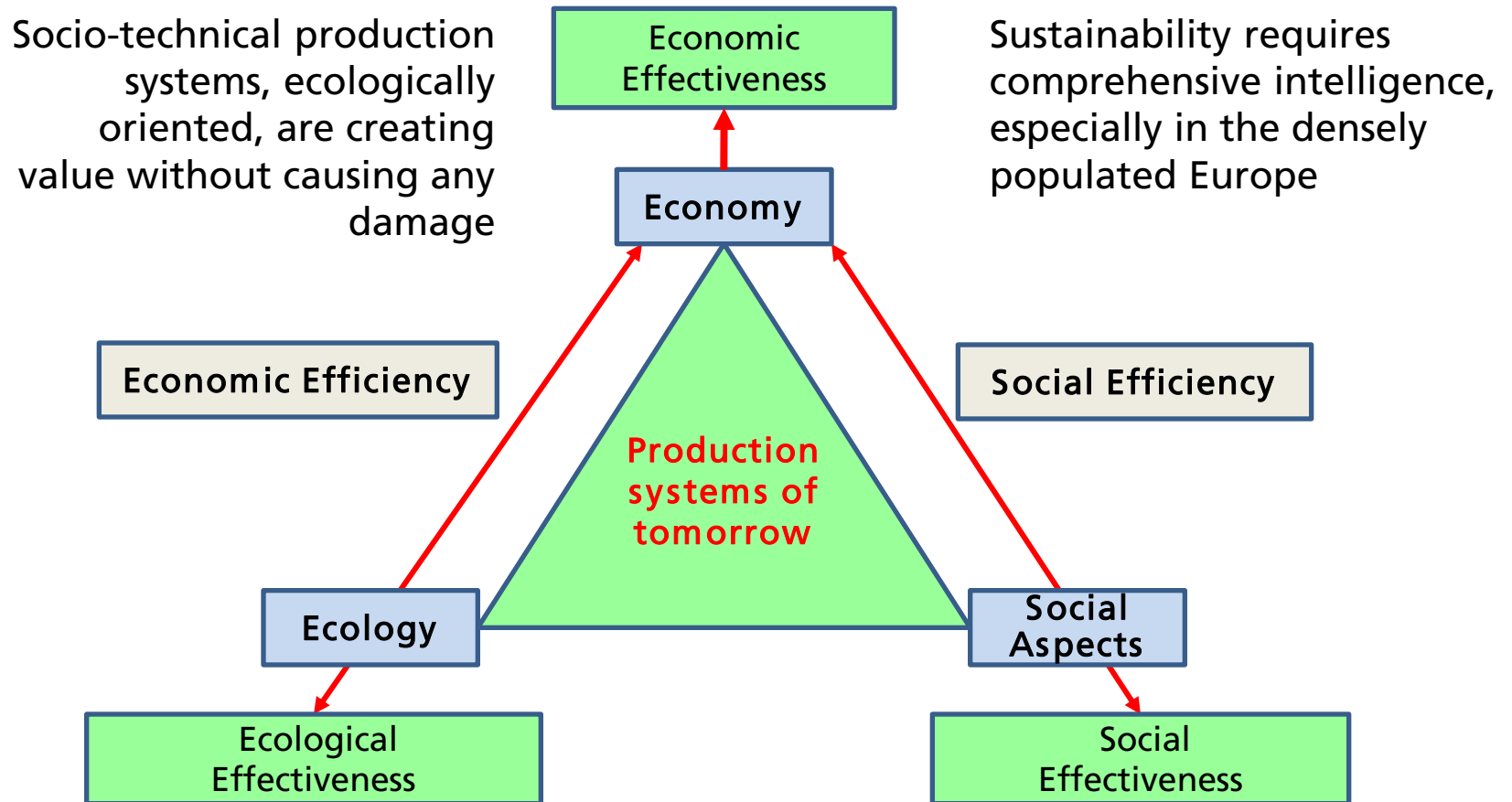
Automation is inevitable in Europe

- Globalisation shifts labour intensive production and thus value-added to low-wage countries
- European countries can maintain their living standards only through highly automated and high-qualitative, value-added Production
- Small and medium size enterprises (SME) create the intelligent solutions



Thesis 3

Sustainability ensures the future of our children



Source: BMU econsense

Combined Thesis

The Manu*Future* Strategy – Factories of the Future

All developed countries can only achieve and secure a high standard
of living

with

competitive sustainable manufacturing

in

highly automated learning factories

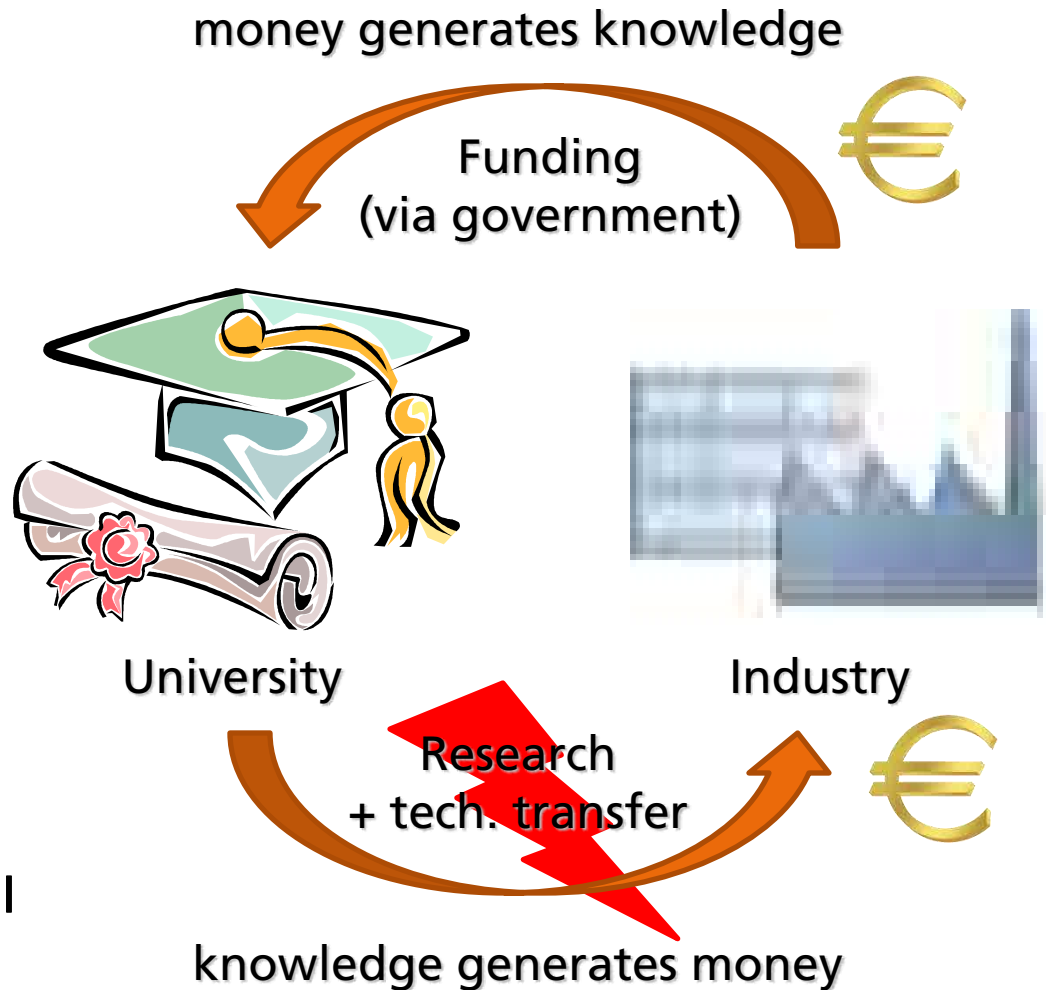
with a high degree of

man-machine cooperation

⇒ New technologies have continuously to be developed and
implemented into the industry

The socio-economic closed loop of prosperity increase

- Competitive sustainable manufacturing needs up-to-date knowledge
- Taxes are partly used for research and education funding (national, EU)
- Research, education and technology transfer increase productivity
- Increased productivity increases the taxes
- Fruitful funding and successful technology transfer and innovation are essential for regional and national prosperity increase



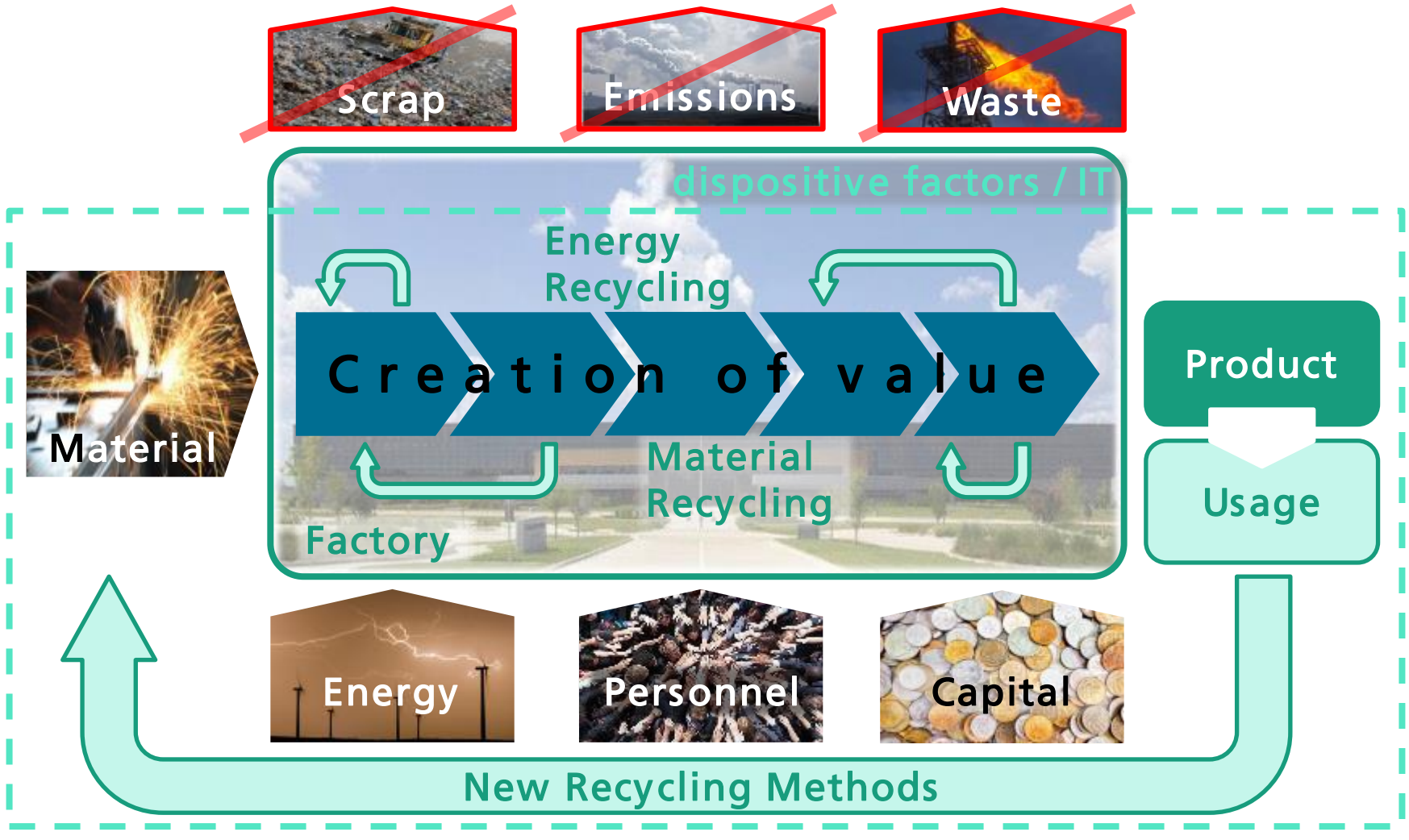
APPROACHES FOR THE INDUSTRIAL DEVELOPMENT AS KEY FOR COMPETITIVENESS AND SOCIO-ECONOMIC DEVELOPMENT:

The Ultra Efficiency Factory

Perspectives and chances for the production engineering

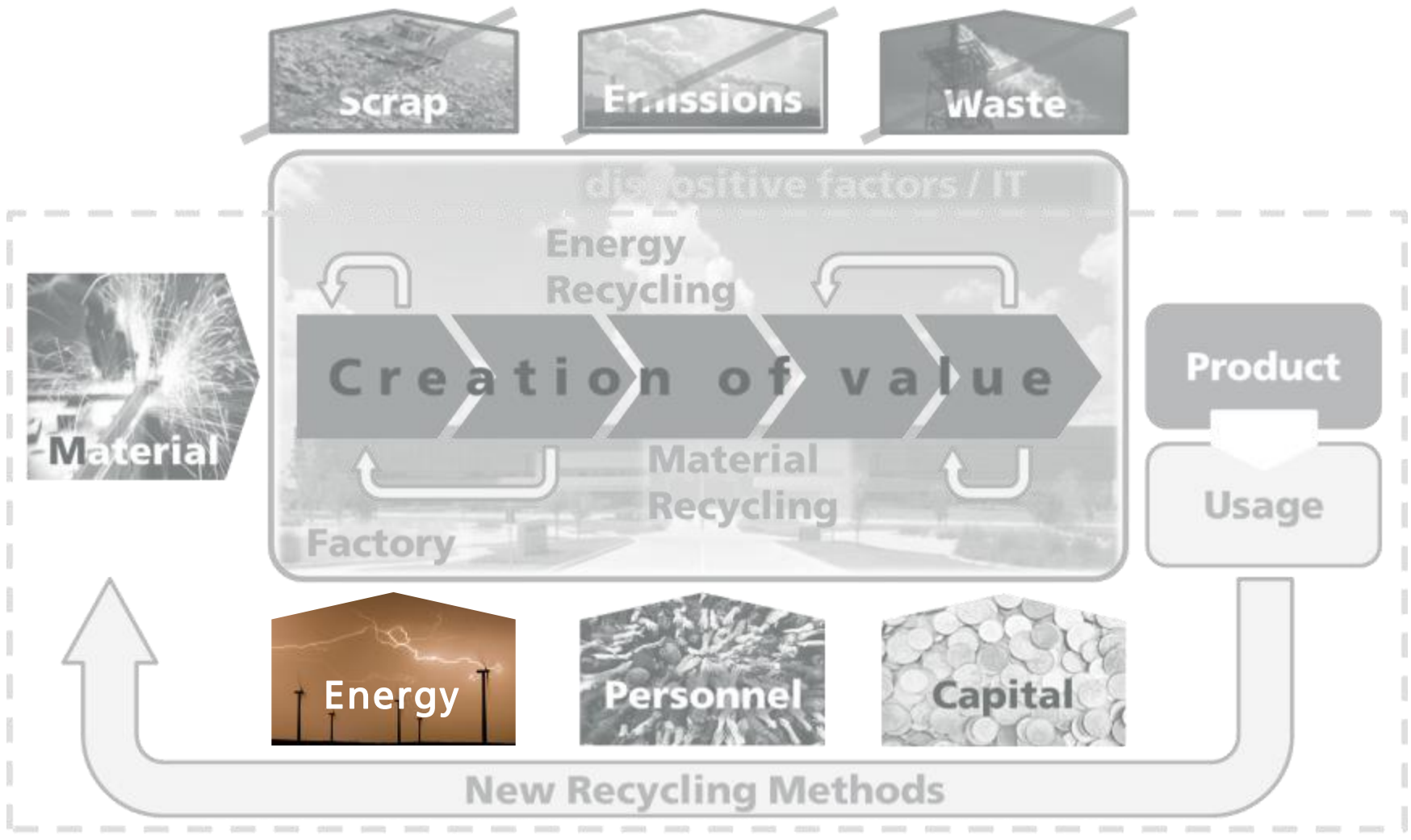
The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency



The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency



The energy turnaround in the factory

Systemic concepts are the solution



Energy production:

- Regenerative energy sources (e.g. solar, wind energy, tidal wave)

Energy distribution:

- Smart Grids (e.g. local micro grids)
- Storage technologies (e.g. redox flow)

Energy recovery:

- Converting waste heat into electricity (e.g. ORC)
- Recuperation (e.g. Supercaps)
- Energy Harvesting (e.g. Thermo electrics)

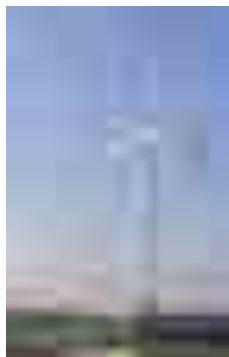


Image sources: elektro-ruehl.com; bgr.bund.de; muelacker.de; fit-for-energy.com

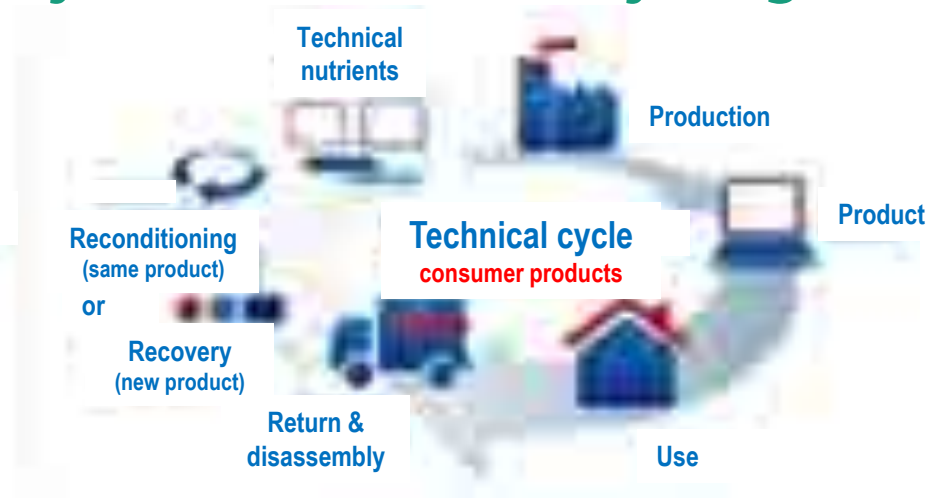
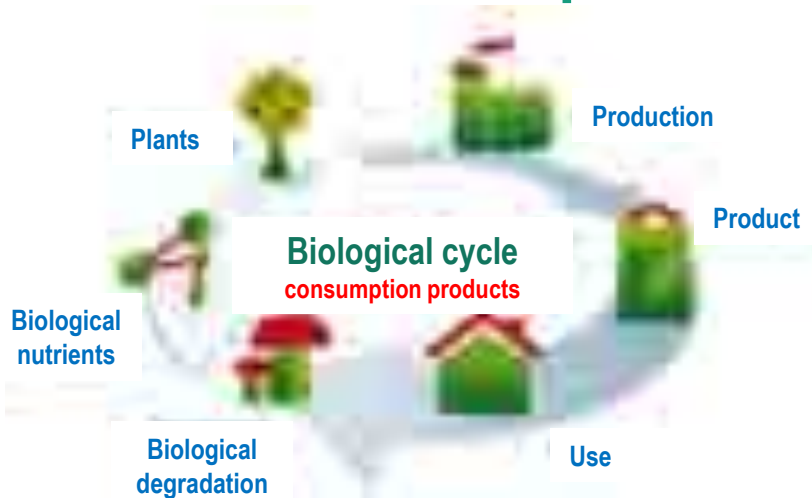
The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency



The material turnaround in production

Circular closed loop economy instead of downcycling



Utilisation of substitute materials

- inexhaustible
- renewable

Value creation within cycles

- technological
- ecological

Holistic design of product life cycles

- planning of utilisation cascades
- extension of use phases

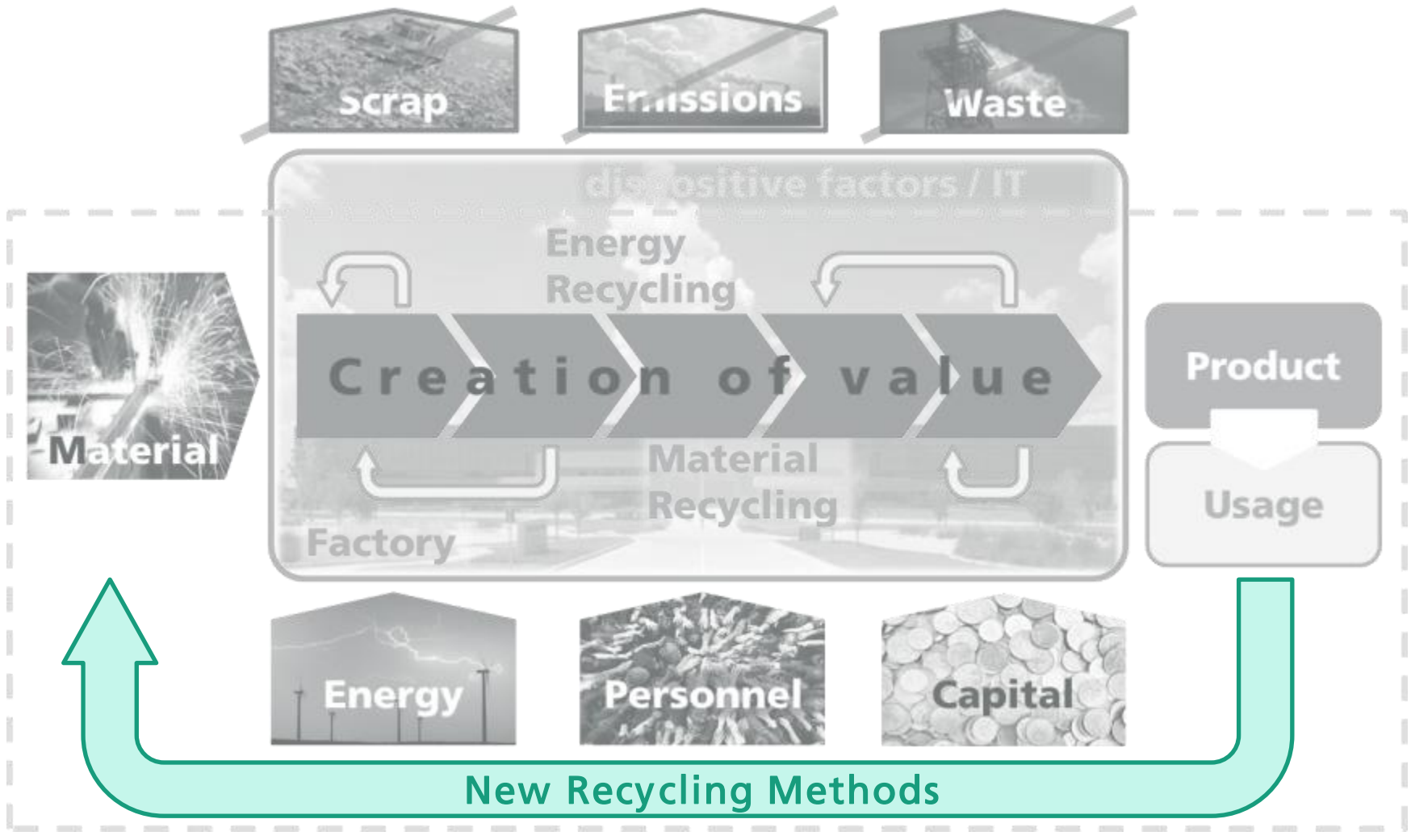
Zero waste production technologies

- 100% of material in product
- short, hybrid process chains

¹ Image source: www.rittweger-team.de/

The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency



Waste is the best source for raw materials

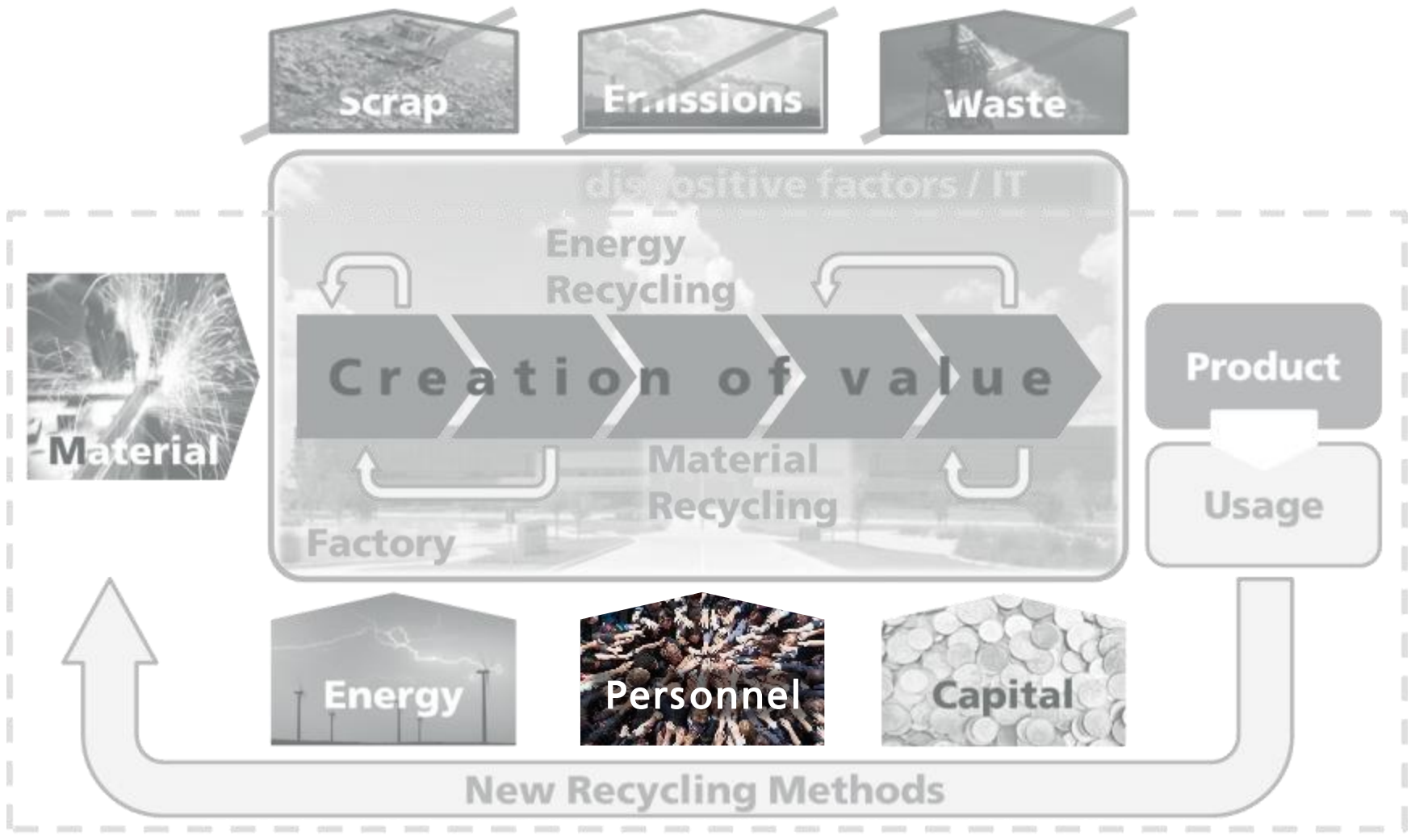
Example: Recycling e-waste

- Worldwide amount of e-waste:
 - 2008: 40 mil. tons
 - 2016: est. 93,5 mil. tons
(yearly growth 17,6%)
- Reutilization today in Europe: 40%
→ 60% of e-waste goes into illegal exploitation, in 3rd world countries or to dump sites
- The extraction and especially the machining of ores brings damage to the environment and to living conditions
- Future requirements in Europe: reutilization of 65% from the materials in use or 85% of all waste electrical equipment



The Ultra Efficiency Factory

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Complexity causes waste of person hours

Lean 2.0: Every second for added value

»Lean 1.0«

- Added value
- Standardization
- Process capability
- OEE optimization > 85%
- Training
- Synchronous production
- Short cycle times
- Minimal stocks

»Lean 2.0«

- Lean structures:
 - Versatility vs. Flexibility
 - Complexity reduction
 - Low Cost Investments
- LCIR – Low Cost Intelligent Robotics
 - Teachable, flexible robots
 - Cost-optimal robots
- Lean Manufacturing Processes
 - Optimizing technical production time / non-productive times
- Lean IT
 - Decentralization of development
 - »Market Pull« (User Pull)

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New approaches for capital budgeting

Example: Real option approach

- Possibility of supporting investment decisions under provision of timing, as well as investment decision-related flexibility and uncertainty

- Types of real options¹:

- delay an investment (wait option)
- interrupt an already started investment project – temporary (discontinuation option)
- expanding an investment project (expansion option)
- refer an activity/service externally, instead of own investment
- reduce or abandon an investment project (reduction option)
- change the type of utilization (change option)

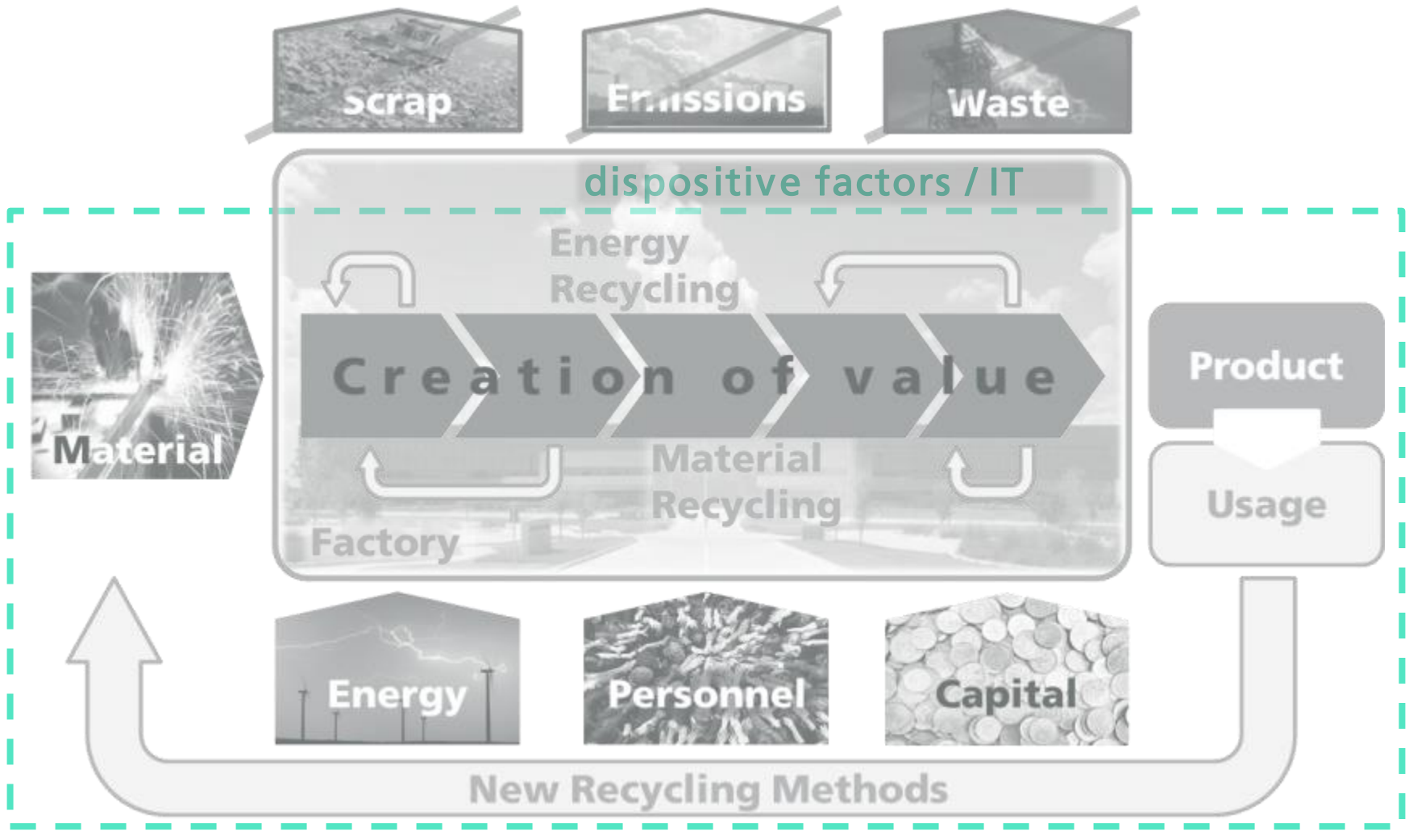
Methode Kriterium	Kapitalwert- methode	Sensitivitäts- analyse	Entscheidungsbaum- analyse	Realoption- ansatz
Cash Flow	●	●	●	●
Unsicherheit	◐	◐	◐	●
Flexibilität	○	◐	◐	●
Irreversibilität	○	○	○	●
Marktwert- orientierung	○	○	○	●
Interaktion	○	○	○	●

● Kriterium erfüllt ○ Kriterium nicht erfüllt

¹ E. S./Trigeorgis, L. (Hrsg.): Real Options and Investment under Uncertainty: Classical Readings and Recent Contributions. Cambridge/MA 2001, S. 192

The Ultra Efficiency Factory

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The principles of network economics change everything

Web-Tec meets production IT

Production IT

Computer

Integrated

Manufacturing

Digital Product Lifecycle Management

Digital Factory

Digital Factory Operation

Embedded Systems → Cyber-physical Systems

IT

World Wide Web

Service orientation

"Internet of Things"

Web orientation

Web 2.0

"Cloud" orientation

"App" orientation

INDUSTRY 4.0

1990

2000

2012

time

The turnaround of the dispositive factors

Decentralized, transparent and self organizing

„Factory of the future organizes itself“



Image source: VDI

Cyber-physical systems
(machines or facilities)

- have an identity
- communicate with each other and with the environment
- configure themselves (plug and produce)
- store information

decentralized self-organization

Turnaround of all production factors as chance for Romanian regions as industrial locations

- The paradigm change of production factors covers all markets and sectors
- Previous approaches don't cover the decoupling of growth from resource consumption
- **Efficiency technologies must finance effectivity technologies, whereat the ICT acts as an enabler**
- **The concept of the ultra efficiency factory can serve as regulation framework for the implementation**
- Mechanical engineers must reevaluate current technologies and introduce technology leaps in due time
- **Newly developed systems can only be developed interdisciplinary and lead to new market and competition situations**

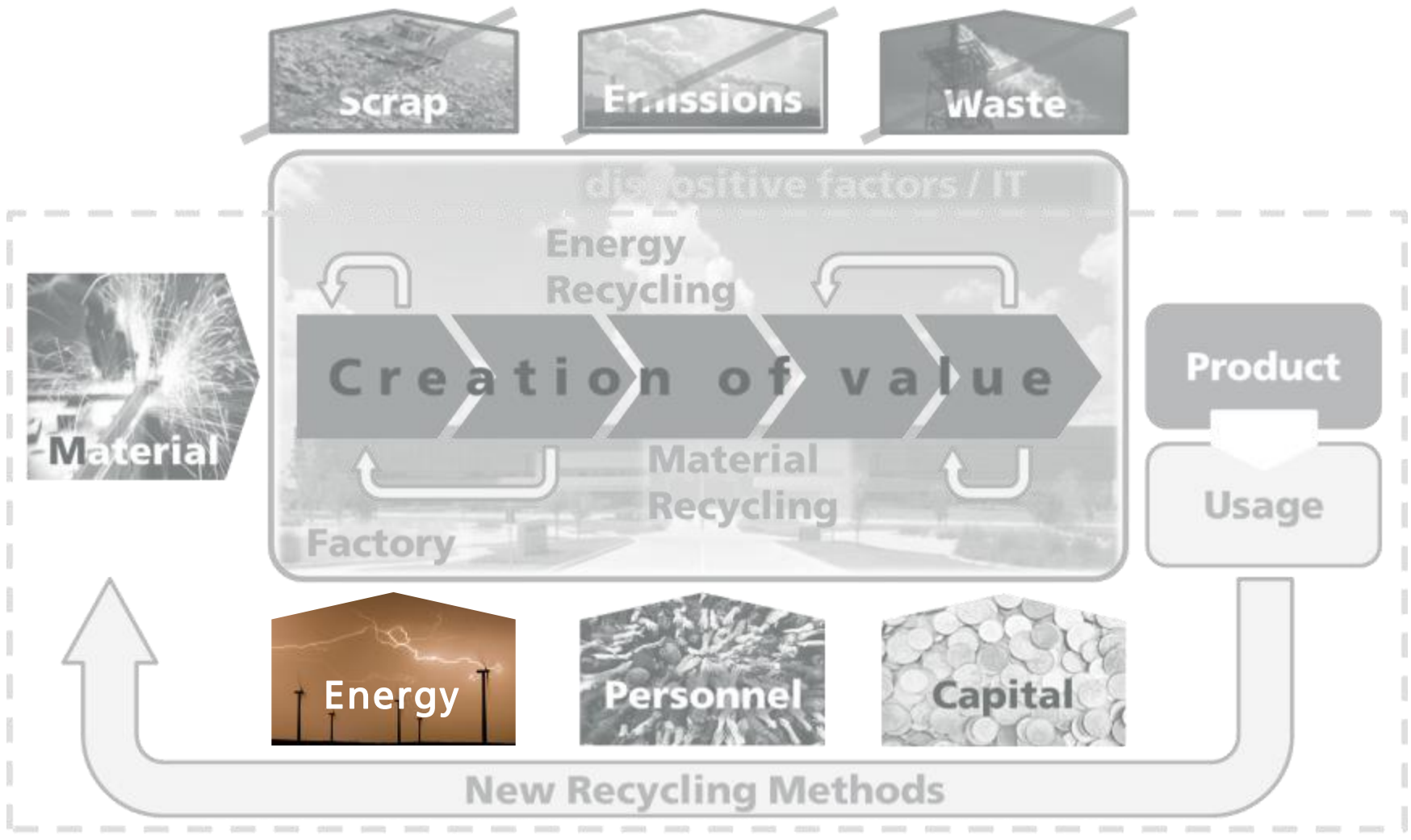
HOW CAN YOU ACHIEVE GOOD PRACTICES IN SHORT TIME ?

TEEM - Total Energy Efficiency Management -



The Ultra Efficiency Factory

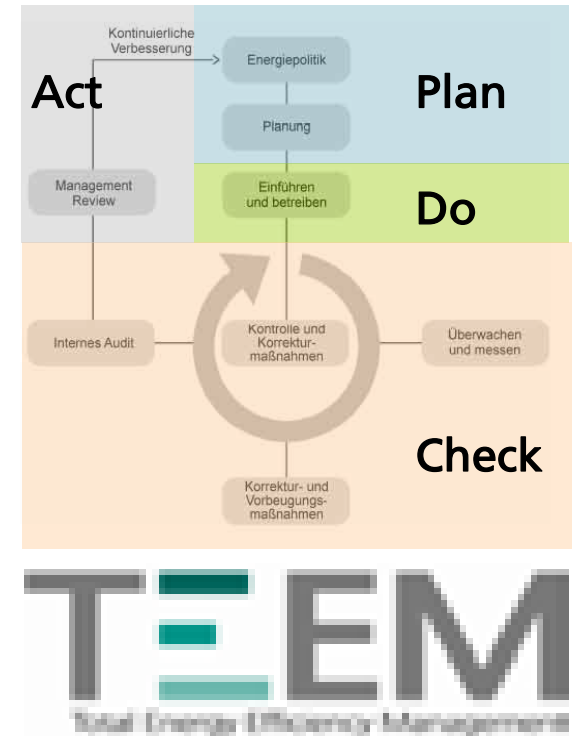
Effectivity x Efficiency = Ultra Efficiency



Total Energy Efficiency Management TEEM

Energy efficiency in production

- Task: systematic determination of energy efficiency potentials in production
- Let's...
 - ...apply the TEEM method kit of Fraunhofer IPA
 - ✓ energy data collection and monitoring
 - ✓ energy value stream mapping
 - ✓ evaluation of energy efficiency measures in parallel with the ongoing manufacturing
 - ...implement energy management systems
- Benefits for you: reduction of energy consumption and energy costs in production



Eco-Efficient Manufacturing and Products

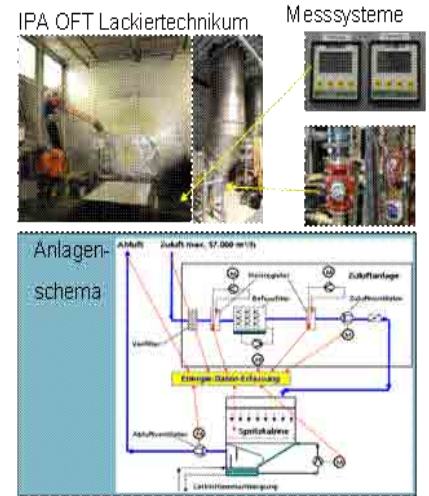
TEEM on the factory floor

Why?

- The amount of energy consumed by specific process chains on the factory floor is usually not known
- There is no integrated approach for planning and optimizing the use of energy on the factory floor

How !

- Evaluation, supply and consolidation of information of energy consumption and derivation of potentials for energy efficiency in specific process chains
- Development and implementation of a monitoring, analysis and simulation system for the systematic assessment and optimization of production processes



Eco-Efficient Manufacturing and Products

TEEM – An Analysis Model to Map the Factory Floor

Requirements

- Identifying and exploiting the potential for energy efficiency on the factory floor
- Pragmatic as-is analysis to identify improvement opportunities
- Allocation of the energy consumption data to causes



Solution

- Acquisition of energy consumption data at process level
- Definition of measures to increase energy efficiency
- Economic and energetic evaluation of the defined energy efficiency measures

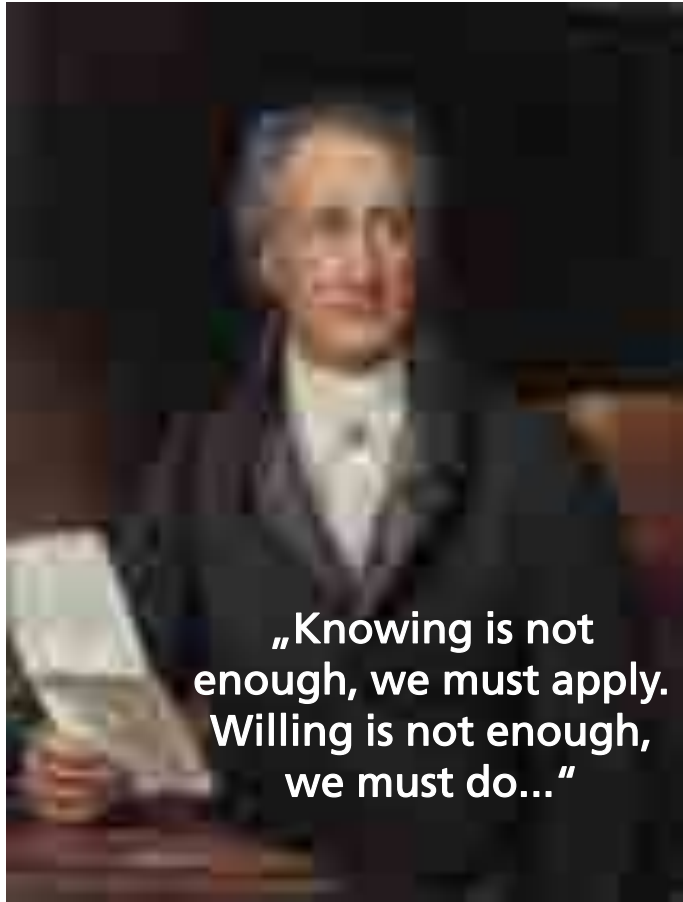
Eco-Efficient Manufacturing and Products

TEEM - Benefit of Total Energy Efficiency Management

Evaluation of equipment- and order-related energy data

- Collection of product-related energy consumption data, complementing previous production data
- Data basis for optimization by EDA integration and simulation
- Simulation how different production flows affect energy consumption and production logistics
- Evaluation and benchmarking of energy consumption data
- Allocation of energy costs to causes
- Streamlining of production flow and derivation of energy efficiency measures
- Visualization of energy consumption to better control peak loads





Towards a good cooperation !

Looking forward to your questions
and interesting conversation

Fraunhofer Institute for
Manufacturing Engineering
and Automation IPA

Simina Fulga

+49 711 970 1856

Simina.Fulga@IPA.Fraunhofer.de