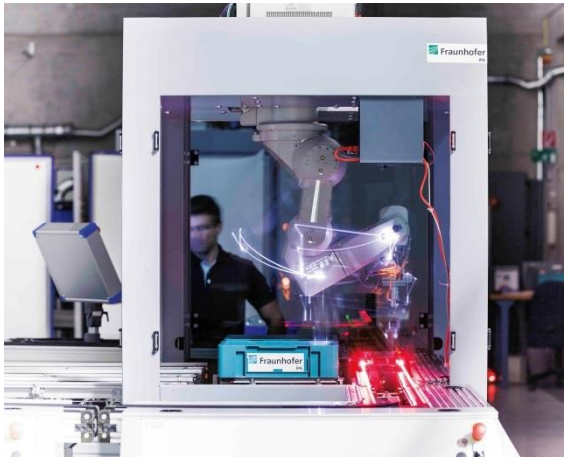
APPROACHES FOR THE INDUSTRIAL DEVELOPMENT AS KEY FOR COMPETITIVENESS AND SOCIO-ECONOMIC DEVELOPMENT



Simina Fulga

Fraunhofer Institute for Manufacturing Engineering and Automation IPA

SMART URBAN DEVELOPMENT CONFERENCE
Alba Iulia, 11-12.November 2015

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GROWTH FACTORS OF THE FUTURE

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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

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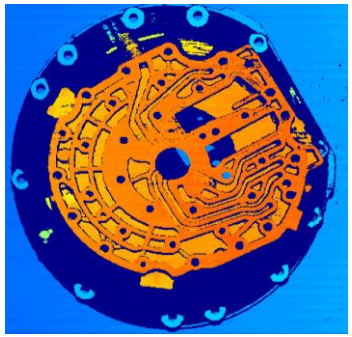
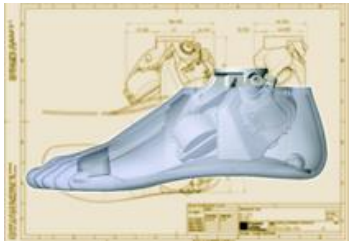
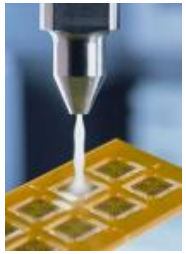
Thesis 2
Automation is inevitable in Europe

- 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**

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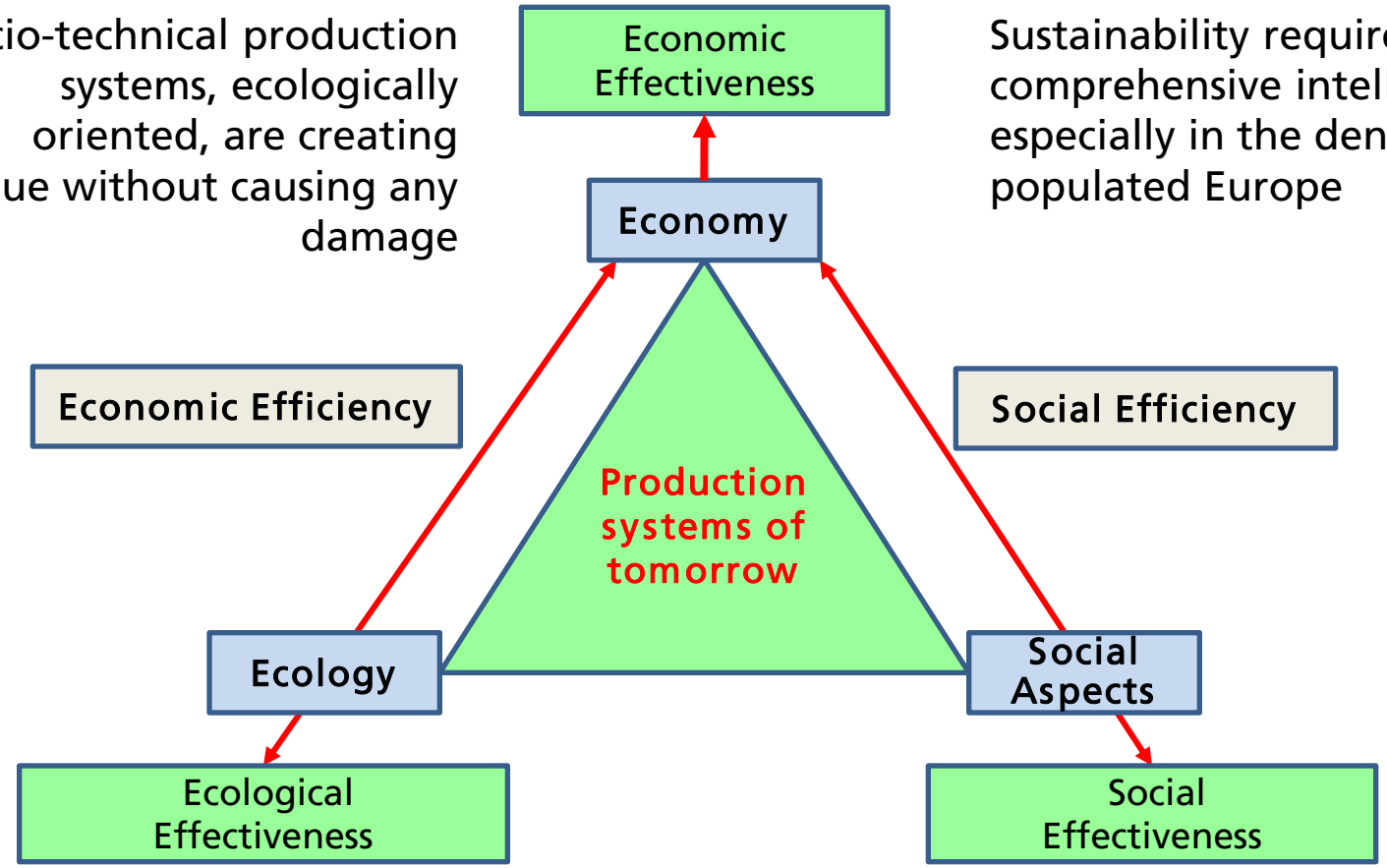
Thesis 3
Sustainability ensures the future of our children

Socio-technical production systems, ecologically oriented, are creating value without causing any damage



Sustainability requires comprehensive intelligence, especially in the densely populated Europe

Source: BMU econsense

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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**

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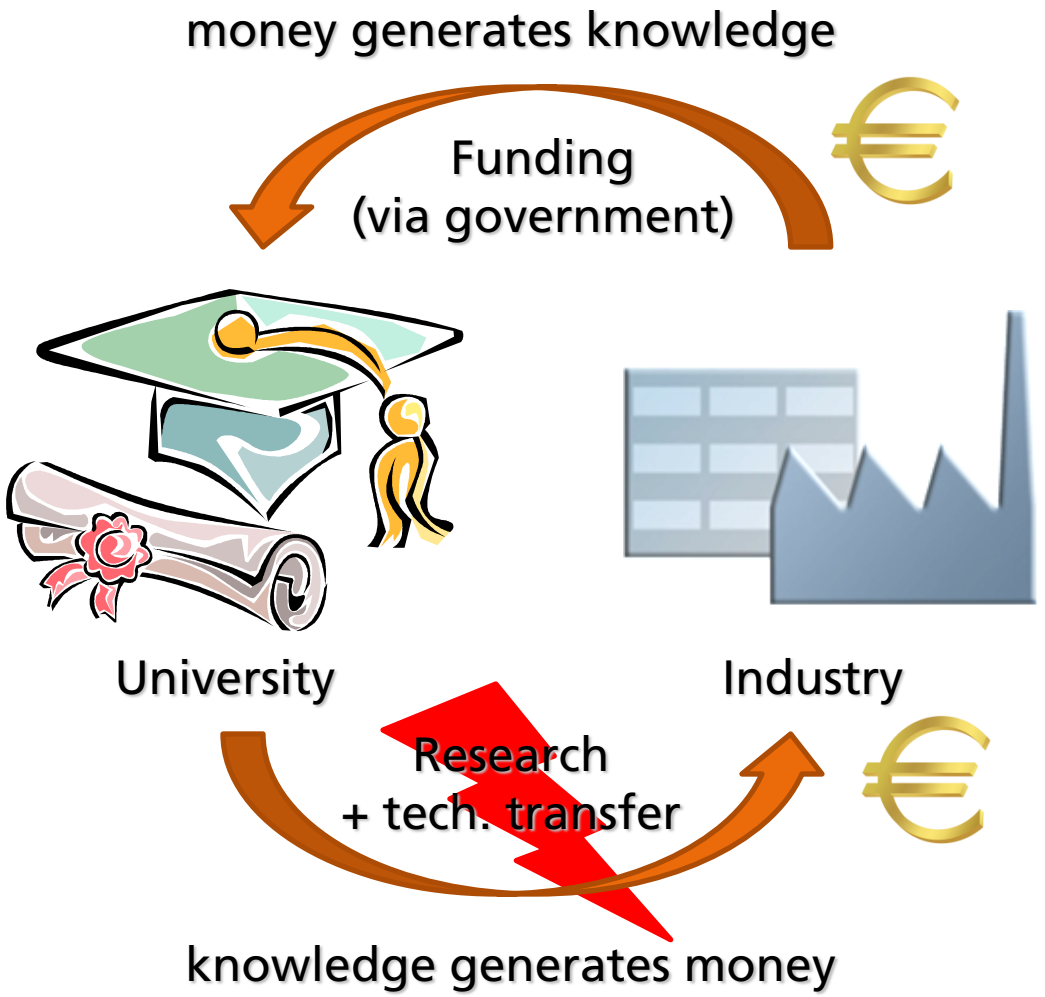
The socio-economic closed loop of prosperity increase

- **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 urban, regional and national prosperity increase**



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

The **Ultra Efficiency Factory**

Perspectives and chances for the production engineering

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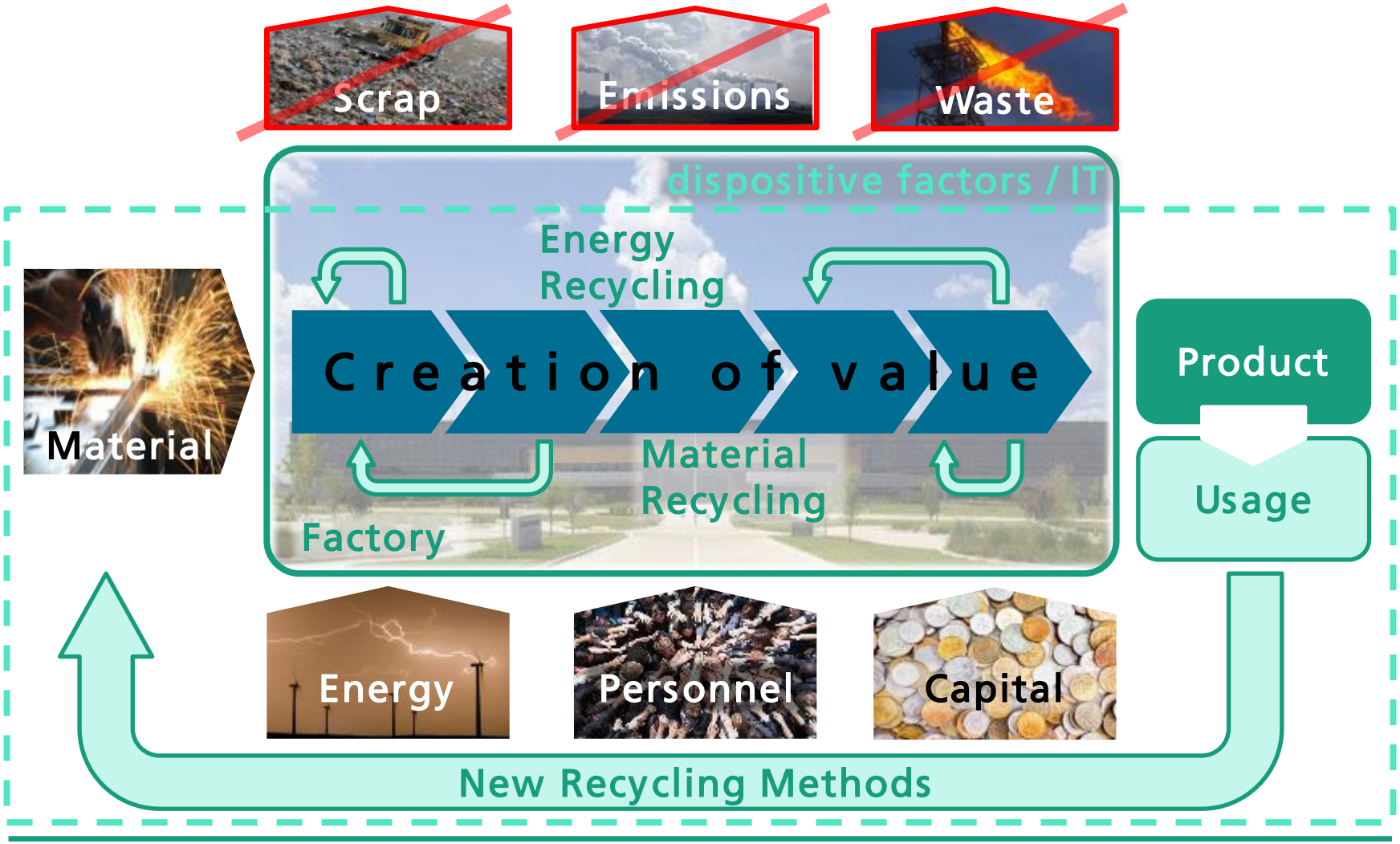
The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency



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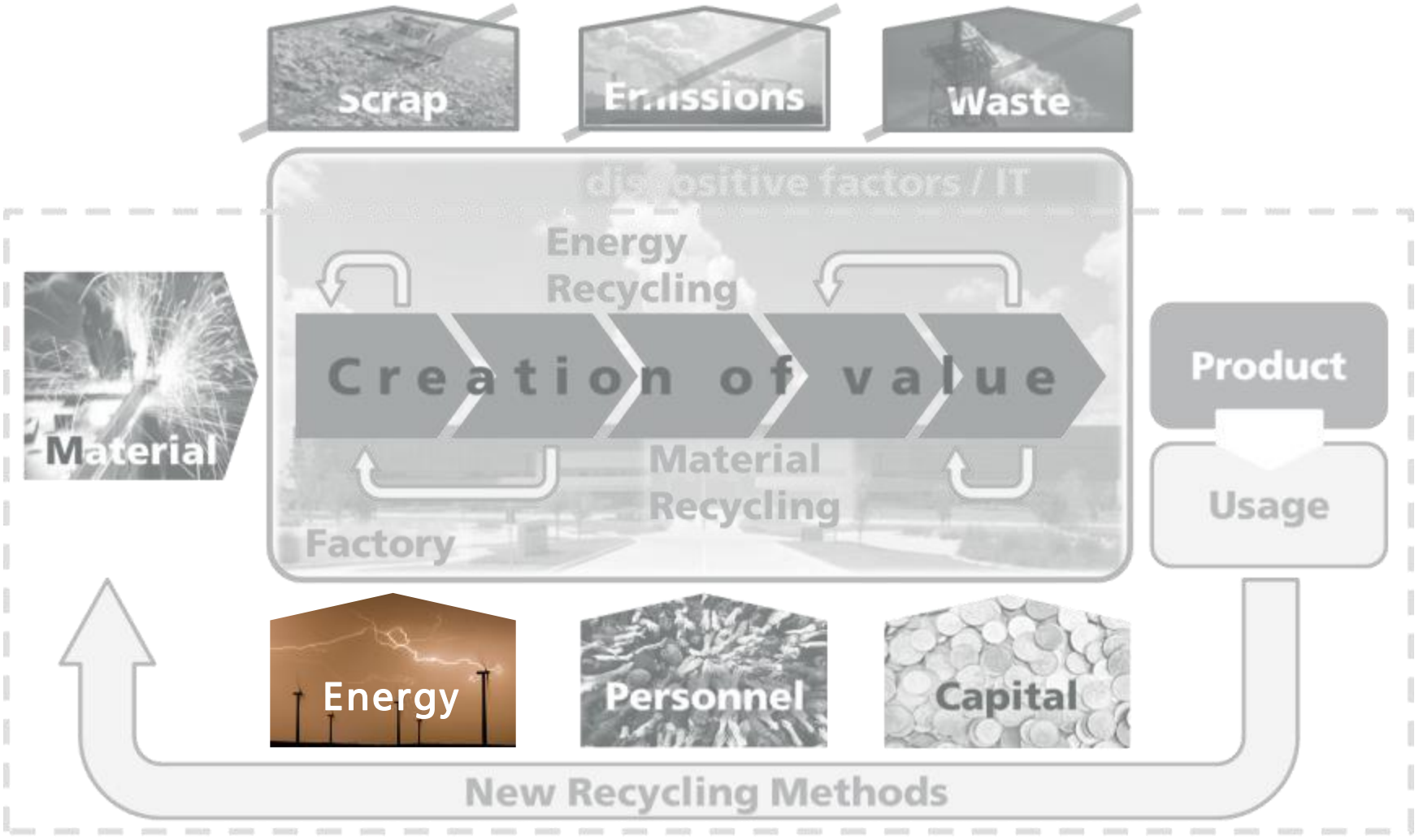

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The energy turnaround in the factory
Systemic concepts are the solution

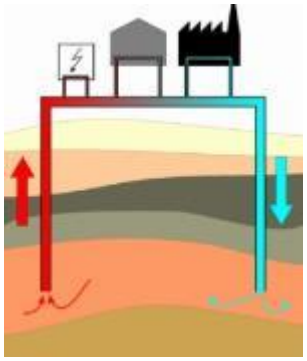

Image sources: elektro-ruehl.com; bgr.bund.de; muelacker.de; fit-for-energy.com

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)

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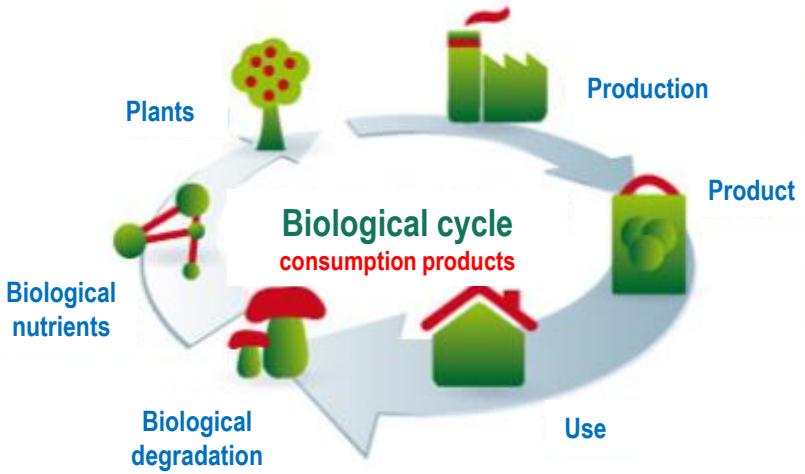
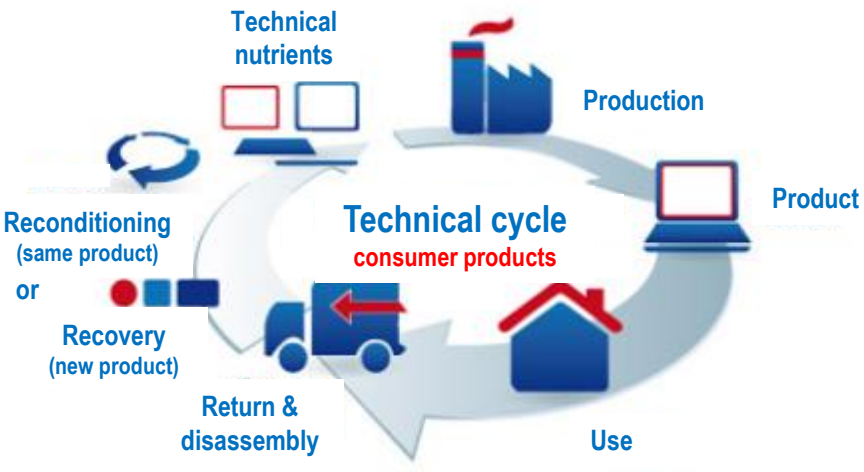
The material turnaround in production

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/

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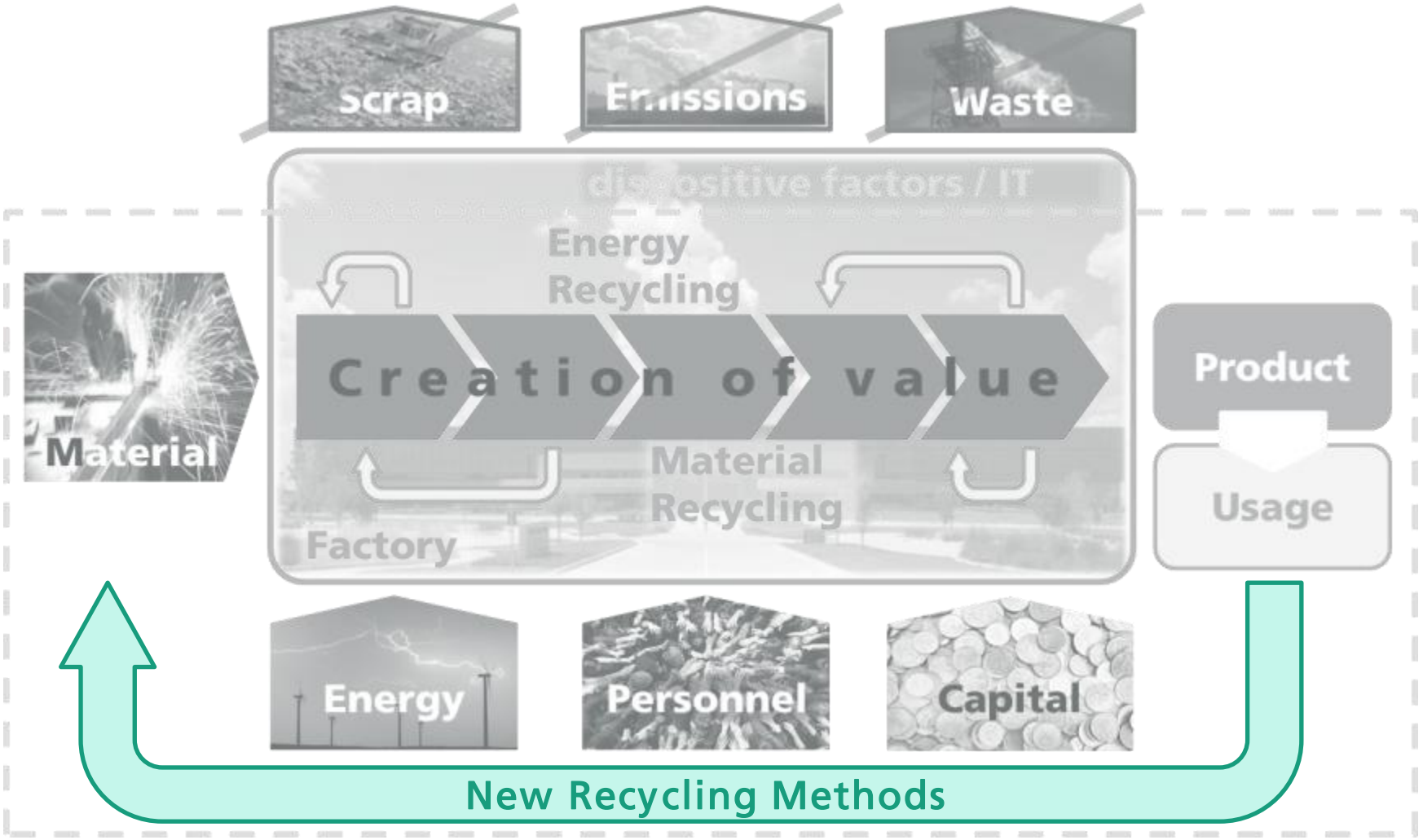

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Waste is the best source for raw materials
Example: Recycling e-waste

- 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**

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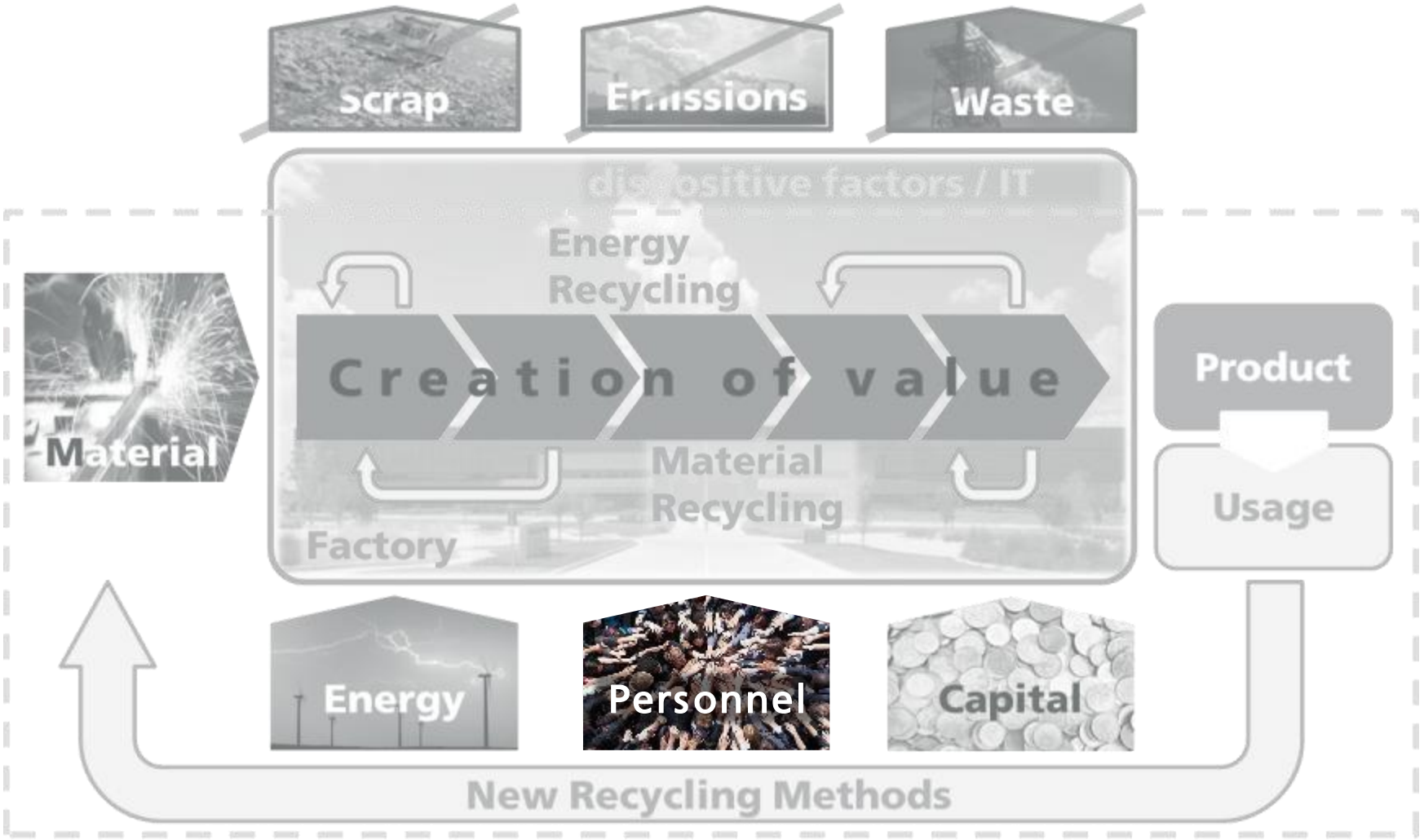

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Complexity causes waste of person hours

Lean 2.0: Every second for added value

»Lean 1.0«	»Lean 2.0«

■ Added value
■ Standardization
■ Process capability
■ OEE optimization > 85%
■ Training
■ Synchronous production
■ Short cycle times
■ Minimal stocks
	■ 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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The Ultra Efficiency Factory

Effectivity x Efficiency = Ultra Efficiency

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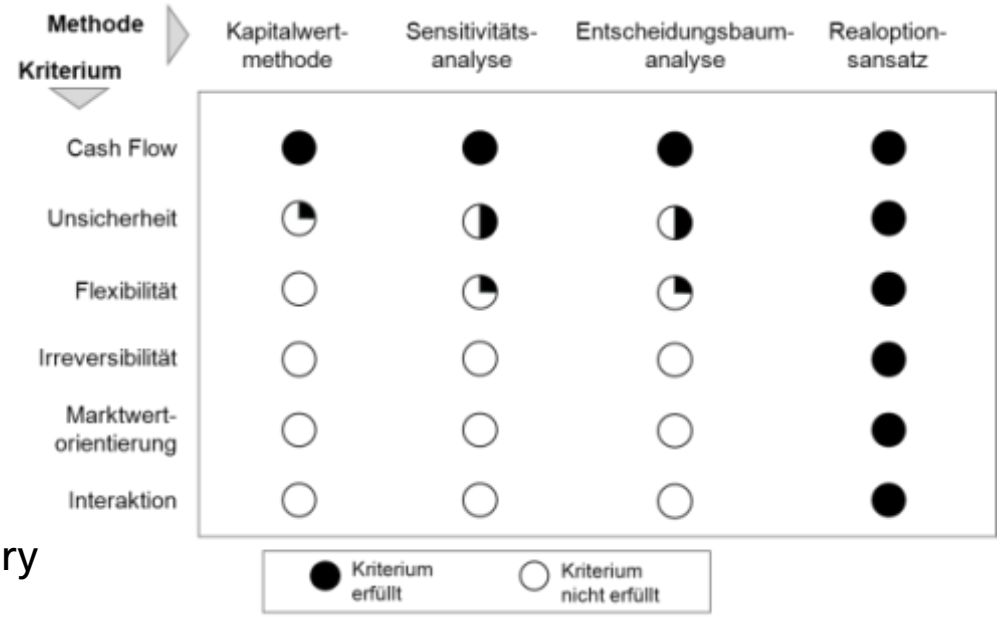
New approaches for capital budgeting
Example: Real option approach

- Possibility of supporting investment decisions under provision of timing, as well as investment decision-related flexibility and uncertainty
- Types of real options[1]:
  - 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)



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

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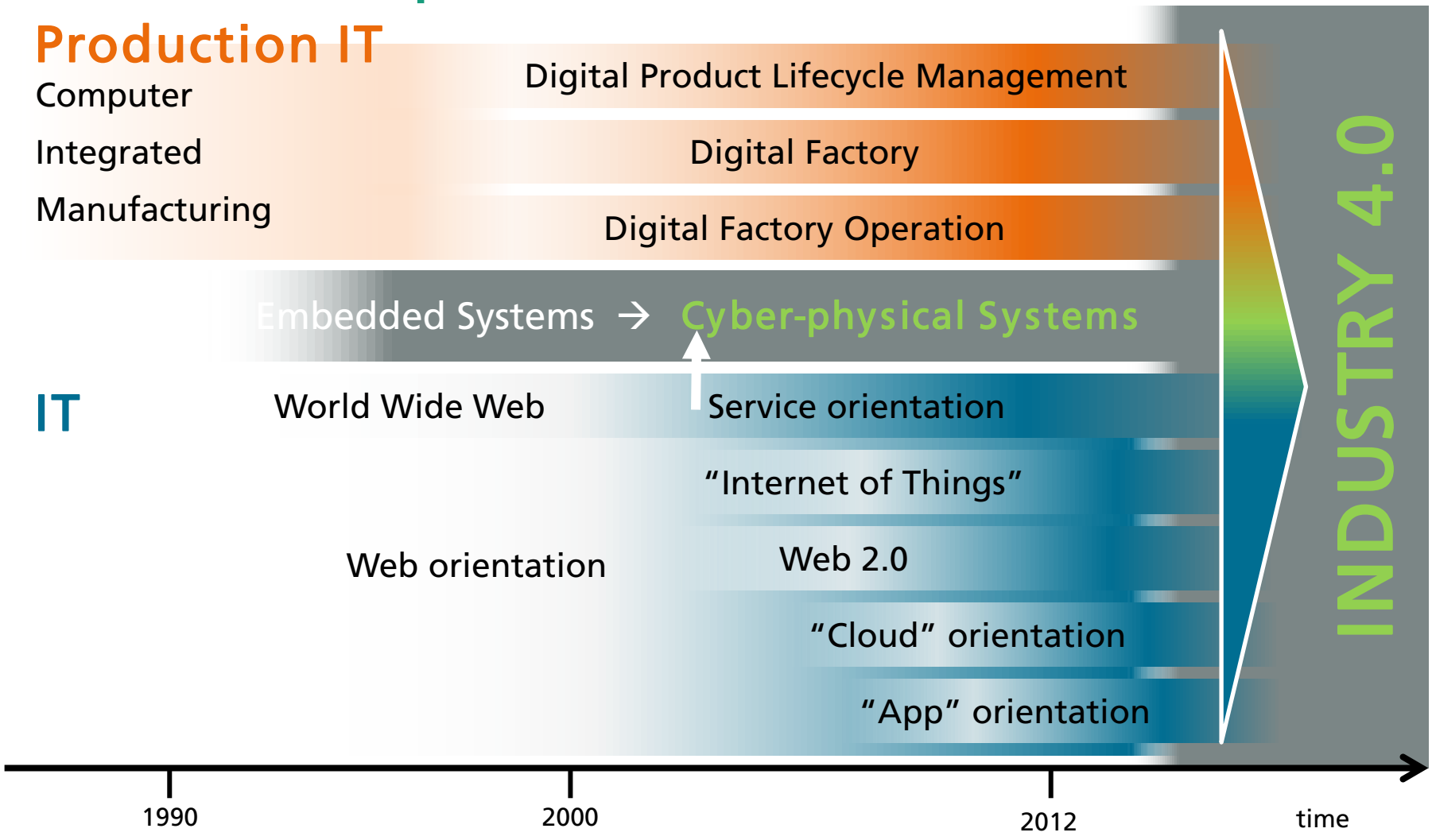
The principles of network economics change everything

Web-Tec meets production IT



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The turnaround of the dispositive factors
Decentralized, transparent and self organizing

„Factory of the future organizes itself“

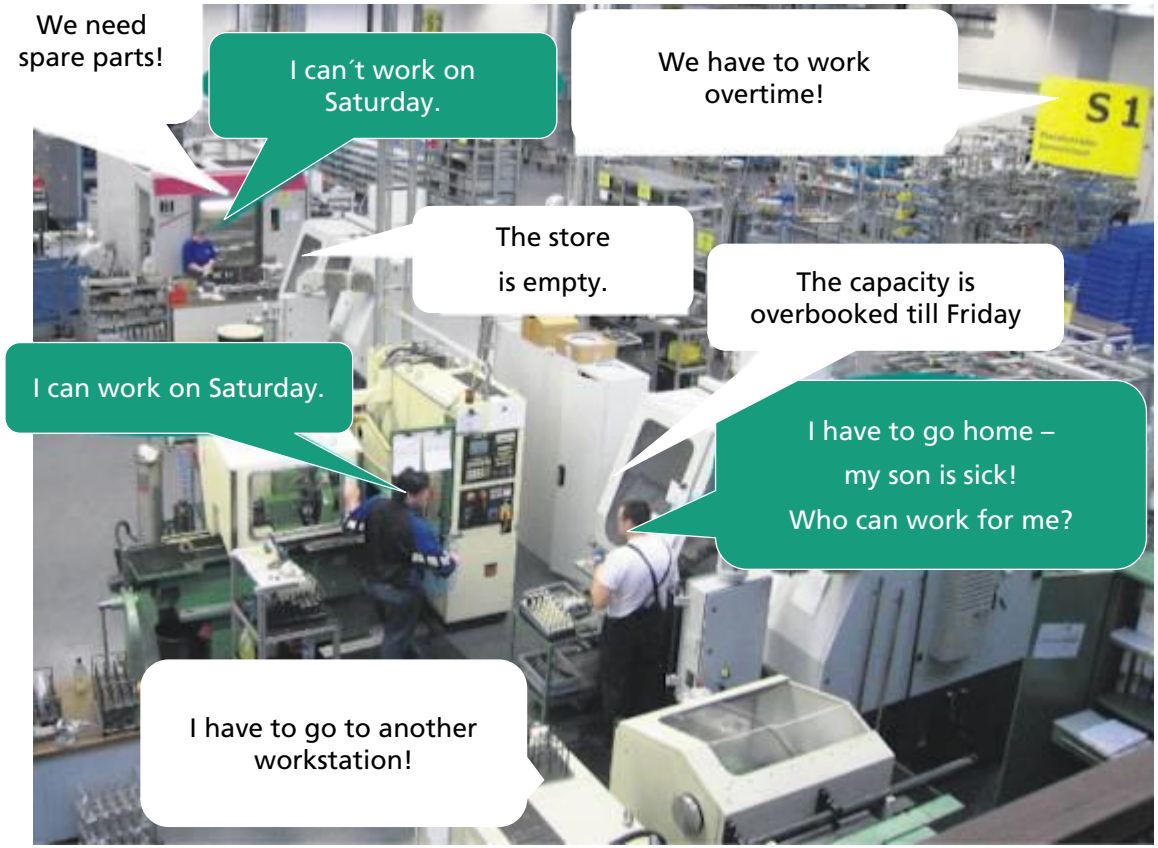

Image source: VDI

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

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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**
- Newly **developed systems can only be developed interdisciplinary** and lead to new market and competition situations

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HOW CAN YOU ACHIEVE GOOD PRACTICES IN SHORT TIME ?

TEEM - Total Energy Efficiency Management -

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Eco-Efficient Manufacturing and Products

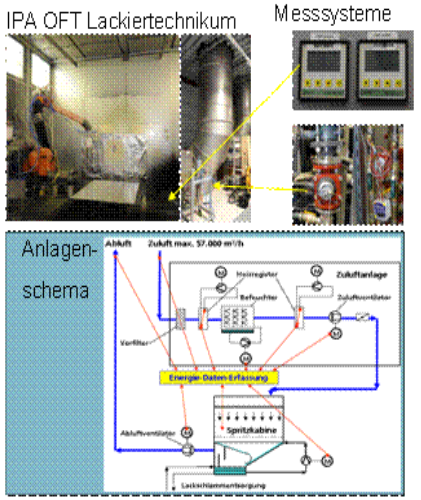
Total Energy Efficiency Management on the factory floor

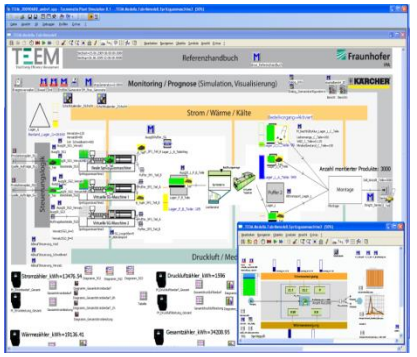
Why?

- 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
- Monitoring, analysis and simulation system for the systematic assessment and optimization of production processes





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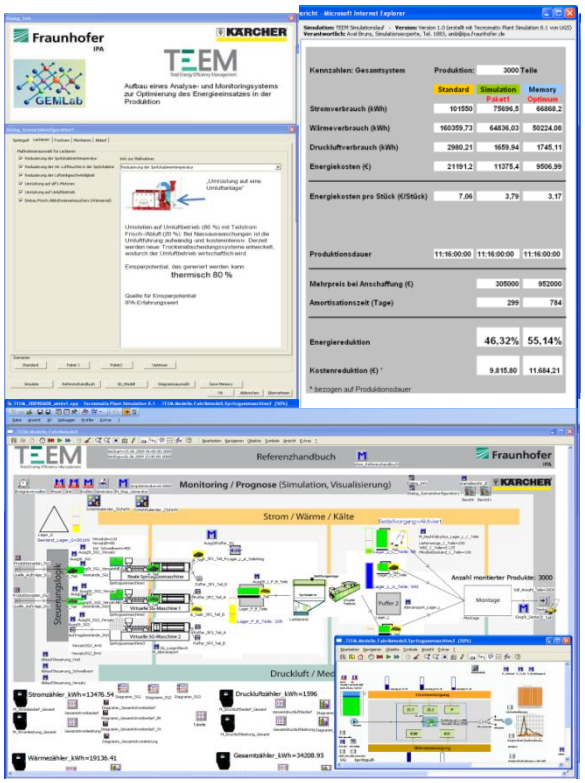
Eco-Efficient Manufacturing and Products

TEEM - Benefit of Total Energy Efficiency Management

- **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**



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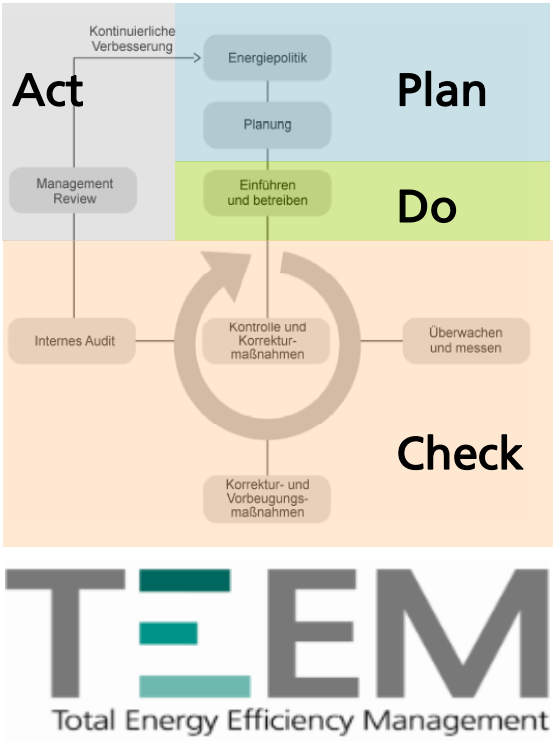
Total Energy Efficiency Management TEEM

Good practices in short time…

- 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



=> your direct benefits: reduction of energy consumption and energy costs in production

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Summary

- **Sustainable value-added** and **an improved standard of living** can be achieved only with **competitive sustainable manufacturing** ⇔ **the key of successful socio-economic development**
- Competitive sustainable manufacturing **needs up-to-date knowledge** ⇔ successful **technology transfer and innovation** are essential for **prosperity increase**
- The way: **Ultra Efficiency Factory**
- **Start now** with e.g. the **TEEM**

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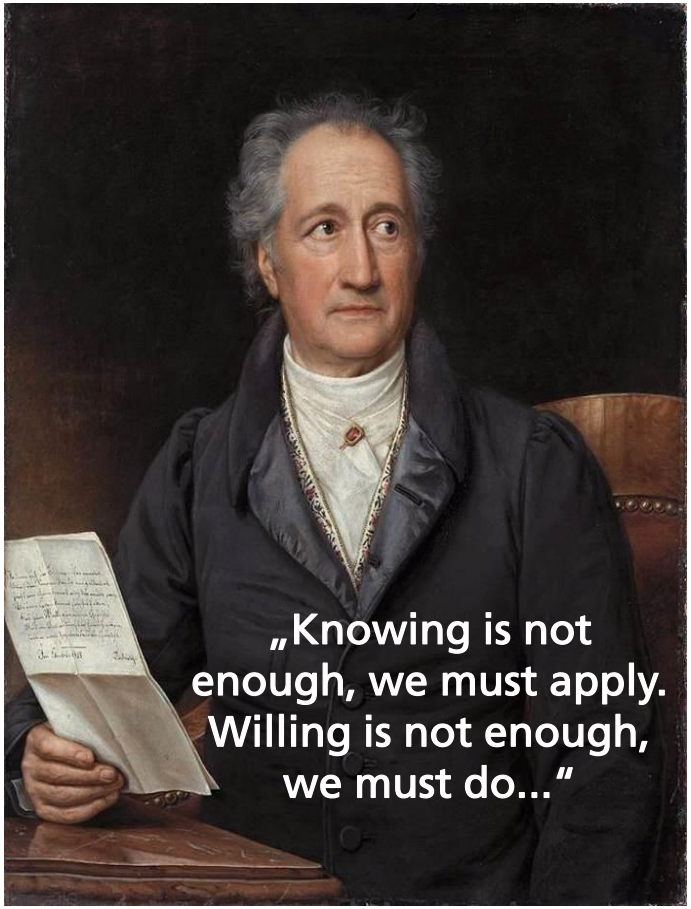

Towards a good cooperation !

Looking forward to your questions and interesting conversation

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