4TH CONFERENCE ON LEARNING FACTORIES
Sustainable manufacturing in learning factories

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Sustainable manufacturing in learning factories

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- Research Assistant at the Chair of Quality Management at University of Kassel 2010

- Research Assistant at the Chair of Quality Science at Technische Universität Berlin since 2010

  - In charge of three lectures with 250 students a year
  - Topics of lectures: Six Sigma, Quality Methods and Lean

- Lecturer at Kassel International Management School

- Project member „Bayer Lean Factory"

- Project member „VDA 3.2 on reliability"

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Agenda

- Bayer Lean Factory

- Definition of sustainability
- Learning objectives
- Didactic concept

- Economic effectiveness
- Ecological effectiveness
- Social effectiveness

- Social efficiency
- Eco-efficiency
- Ecological Justice
- Sustainability

- Summary and outlook

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Bayer Lean Factory

Pharmaceuticals

Division Quality Management
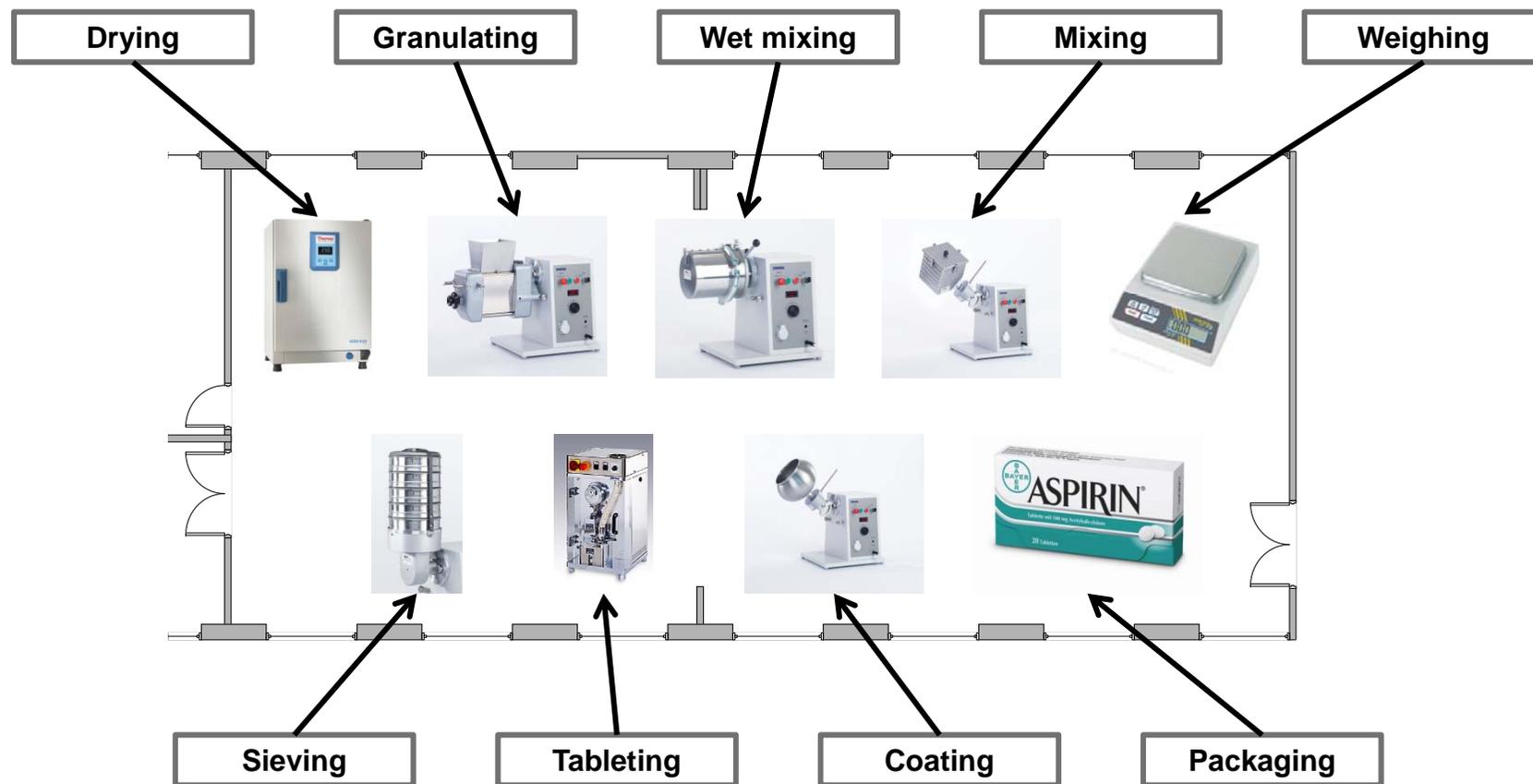
Division Corporate Management

Chair for Quality Science

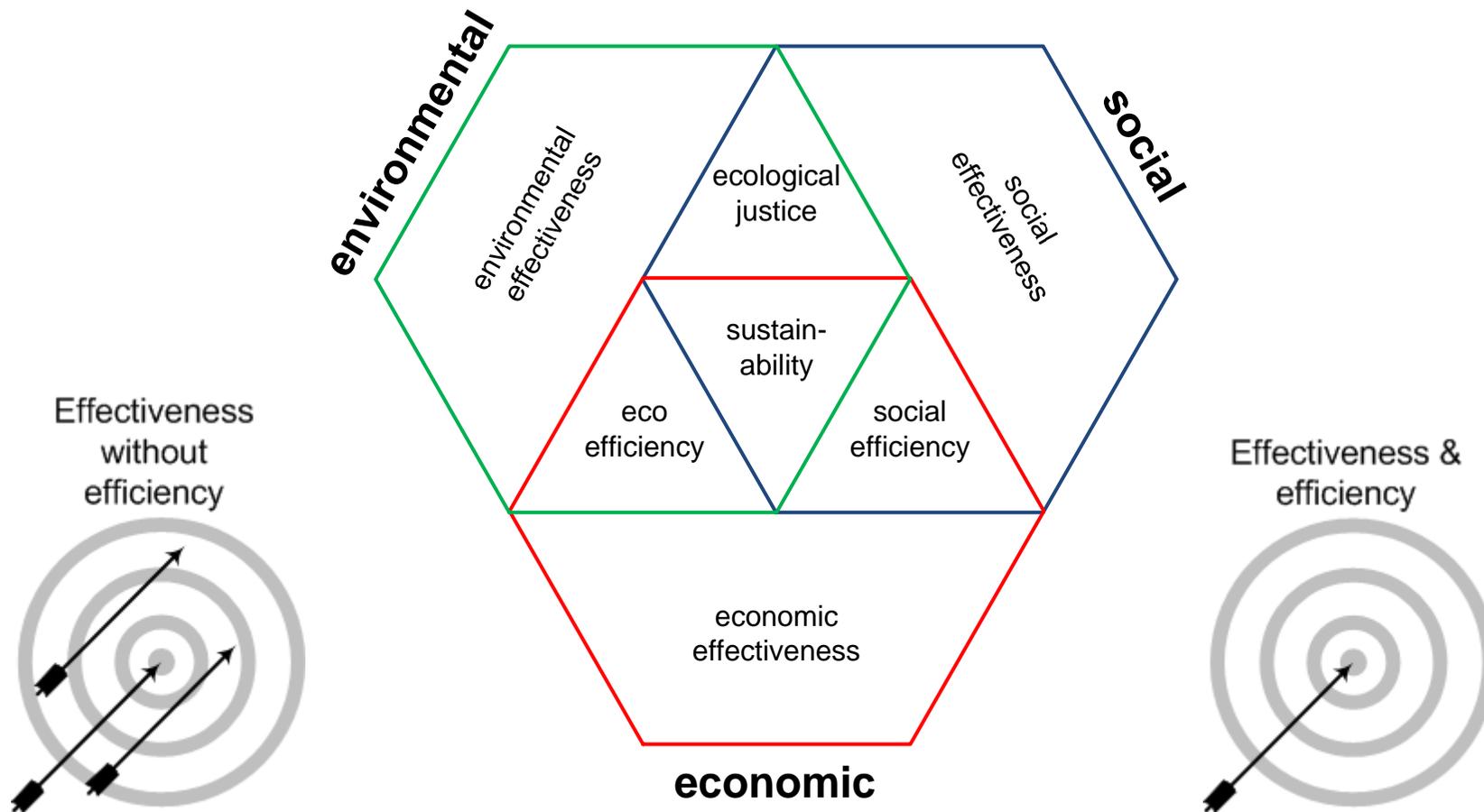Chair for Assembly Technology and Factory Management

Chair for Logistics

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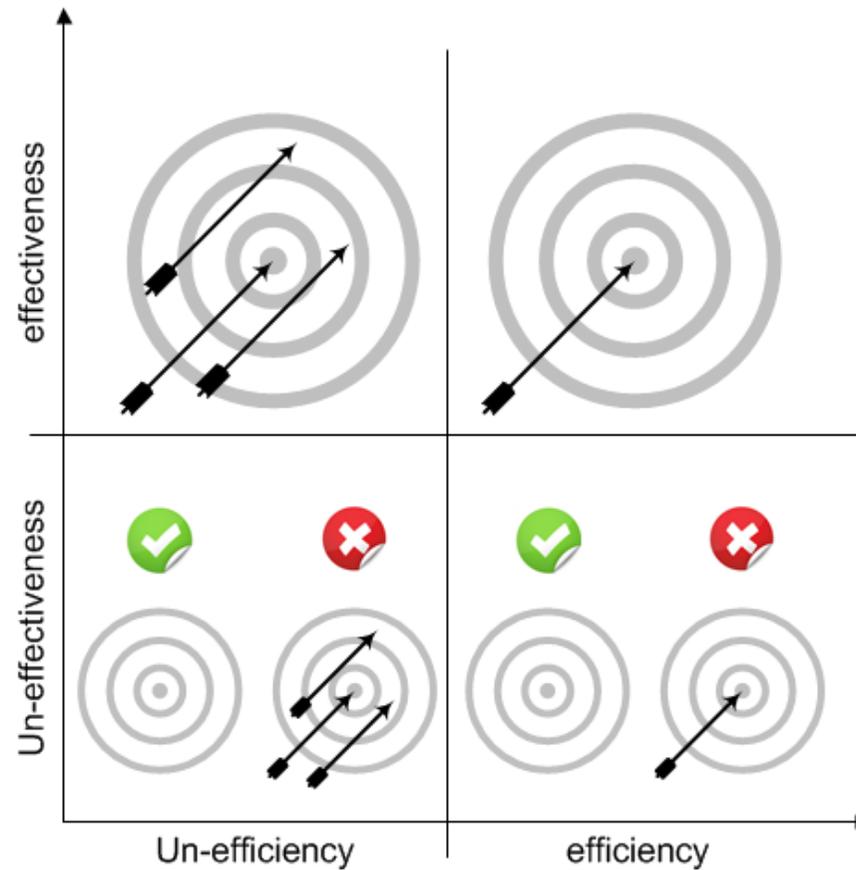
Set-up of the Bayer Lean Factory

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Definition of sustainable manufacturing

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Definition of sustainable manufacturing

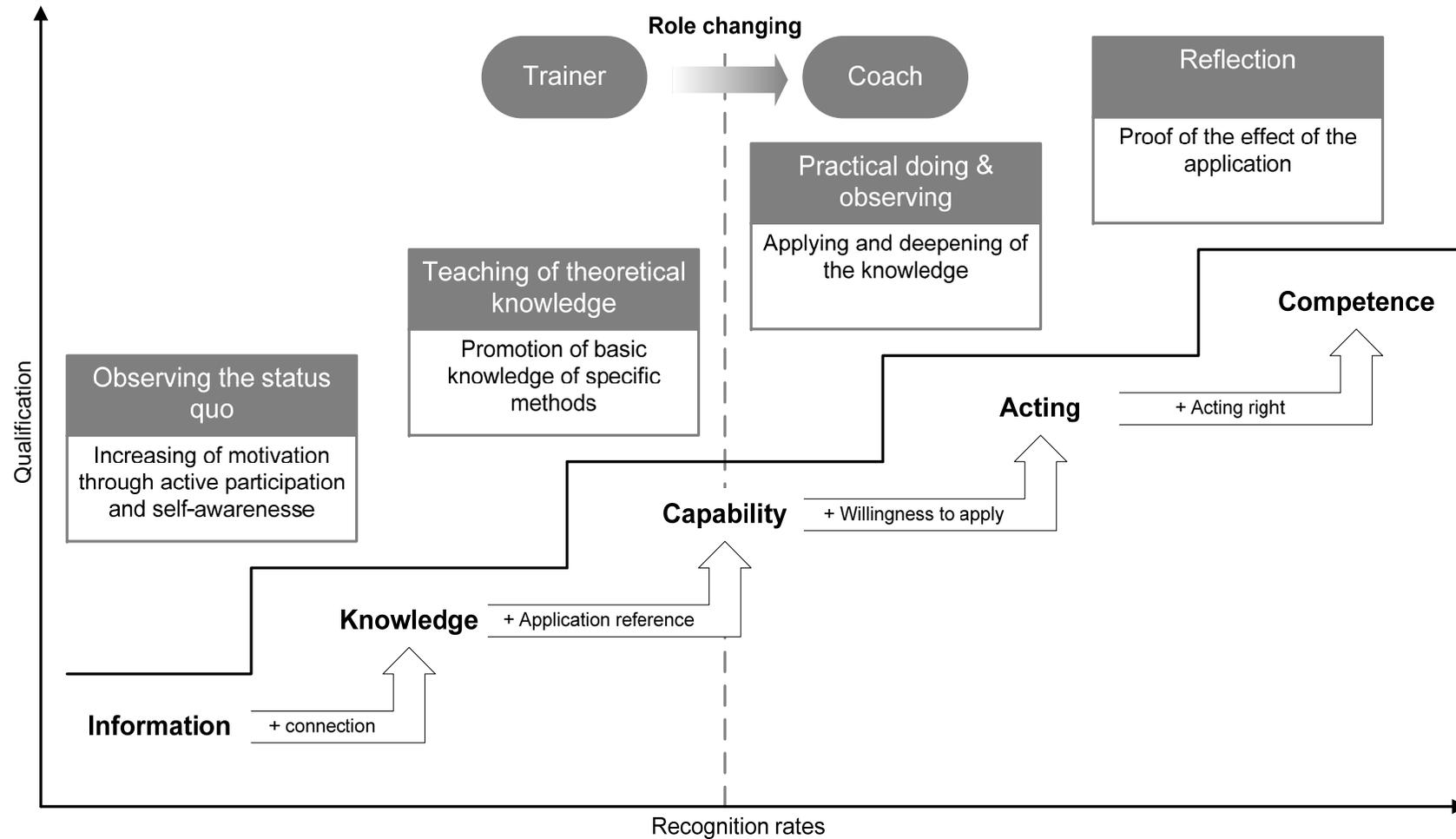# Sustainable manufacturing in learning factories

## Learning objectives

- **Environmental objectives:**
    - How to reduce harms to the environment
    - Connection between economical and environmental consequences

- **Social objectives:**
    - How to achieve positive societal development
    - How to reduce negative impacts in factory environments
    - The importance of communication
    - Safe and healthy work place

- **Economical objectives:**
    - Products need to be demanded by markets
    - Know the difference value-adding and non-value-adding processes
    - Acting of employees reflects on the economic goals of a company

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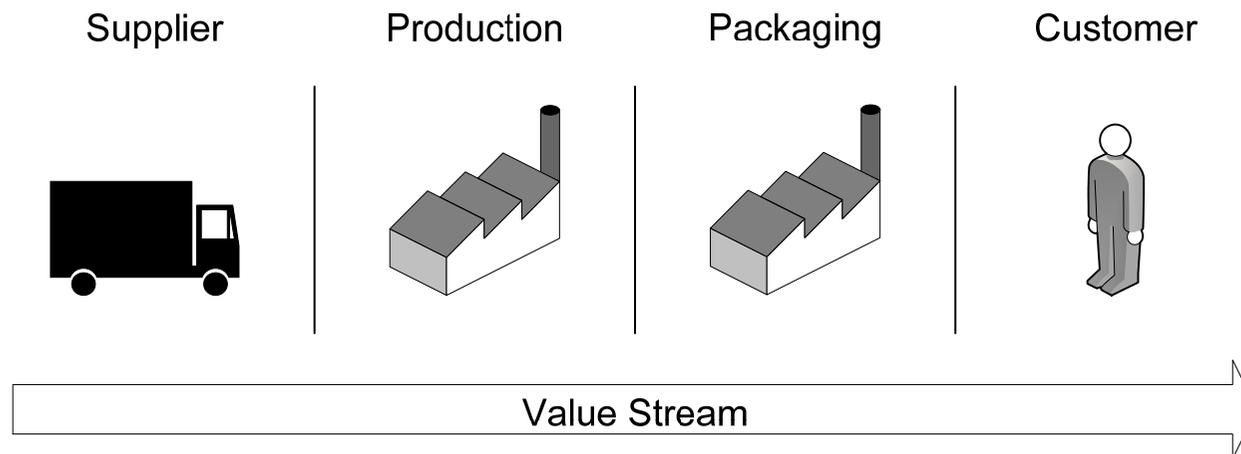
Didactic concept

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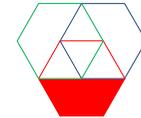
Economic effectiveness

– **Definition:**
Economics is the totality of equipment and actions that serves the planned covering of demand. Economic effectiveness describes the ratio between planned and realized output.

– **Method:** Value Stream Method

Supplier	Production	Packaging	Customer

Value Stream

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Environmental effectiveness

– **Definition:**
Environmental effectiveness focuses mainly on awareness for material flows and their transformation within the value creation process.

– **Method:** Ecological Rucksack

$$ER = W - MI$$

$$ER = Ecological\ Rucksack$$
$$W = weight\ of\ Product$$
$$MI = Material\ intensity$$

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Environmental effectiveness

– **Application example:**

Abiotic raw materials	Biotic raw materials	Moved Soil	Air	Water

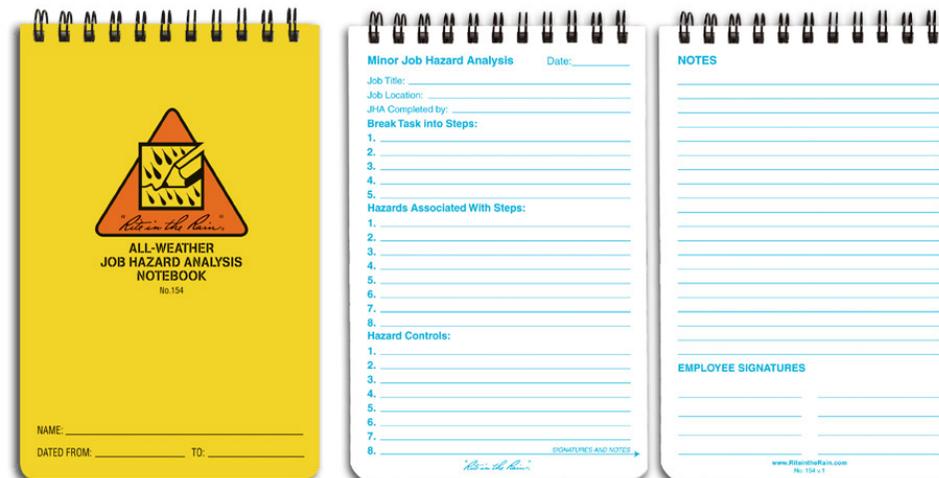Recycled Aluminum
Rucksack 3.5:1

Aluminum from Bauxit
Rucksack 85:1

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Social effectiveness

– **Definition:**
The term social describes the relation between people and groups of people and also includes aspects of safety, health, compliance with law, respecting human rights and fairly treating of suppliers.
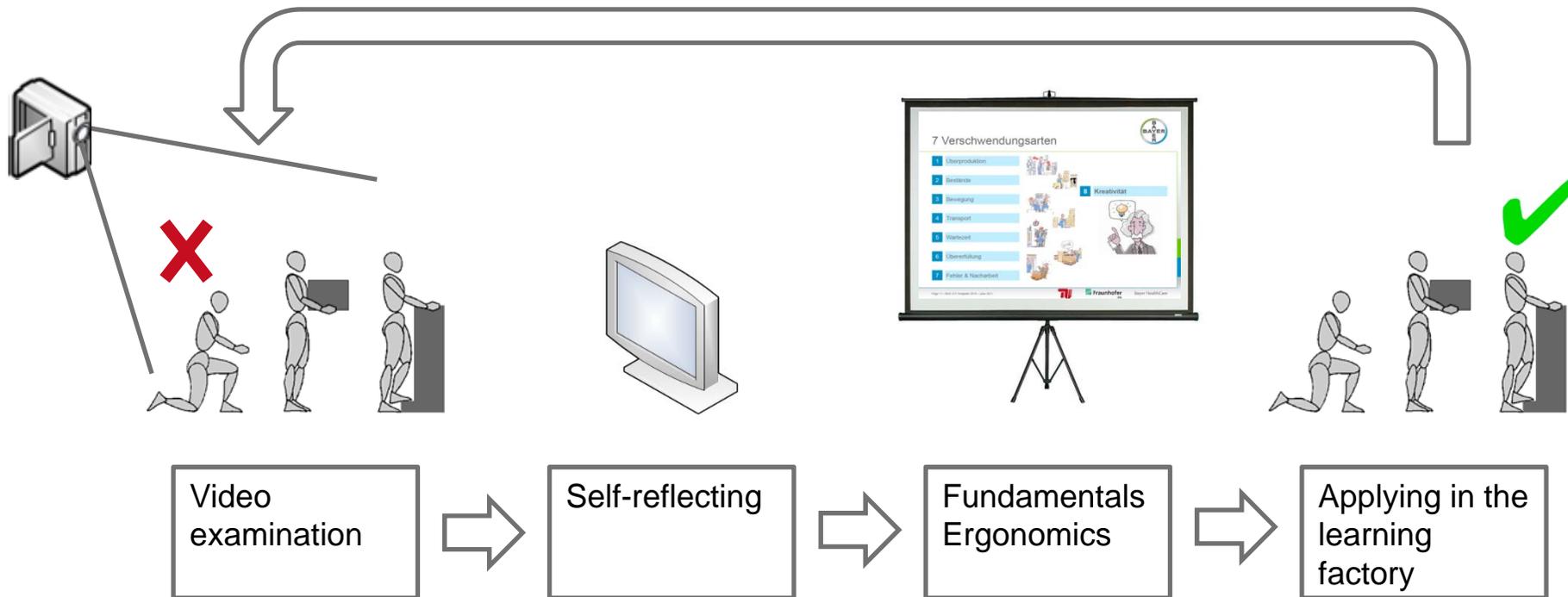
– **Method:** Job Hazard Analysis

http://derbycitysafety.com/

Social effectiveness

- **Application example:**

Video examination	→	Self-reflecting	→	Fundamentals Ergonomics	→	Applying in the learning factory

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Social efficiency

– **Definition:**
  Social efficiency not only describes the relation between people and groups of people but also ratio between interacting (used resources) and outcome.

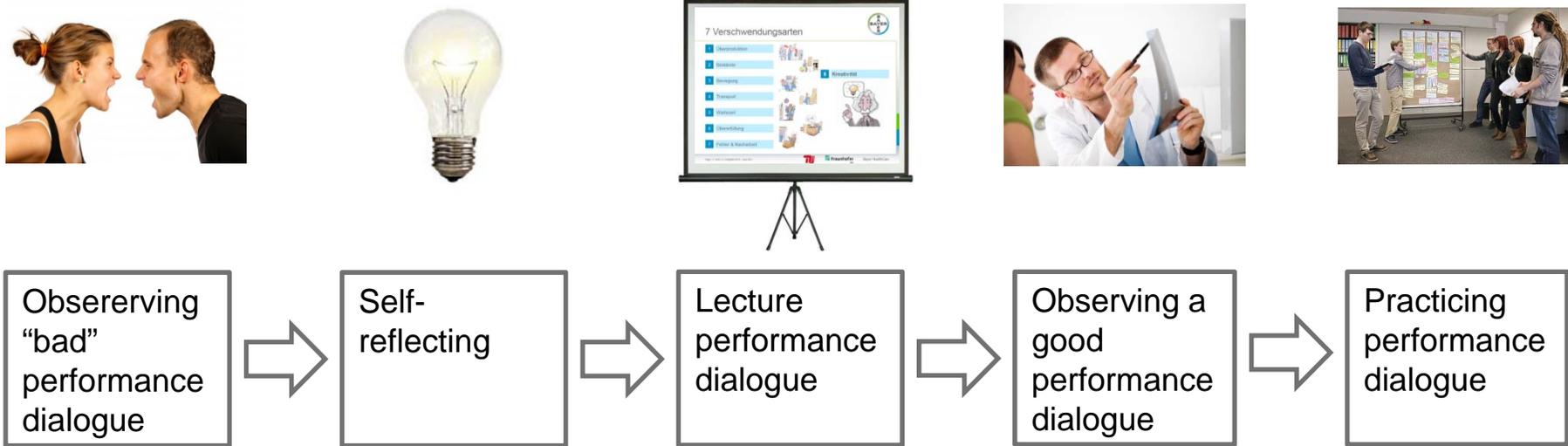– **Method:** Shop Floor Management

http://autogramm.volkswagen.de/

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Social efficiency

– **Application example:**

| Observing "bad" performance dialogue | ⇨ | Self-reflecting | ⇨ | Lecture performance dialogue | ⇨ | Observing a good performance dialogue | ⇨ | Practicing performance dialogue |

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Eco-efficiency

– **Definition:**
Eco-efficiency is the combination of economical and environmental efficiency and shows the mutual dependency of both sustainable factors.

– **Method:** Energy Analysis
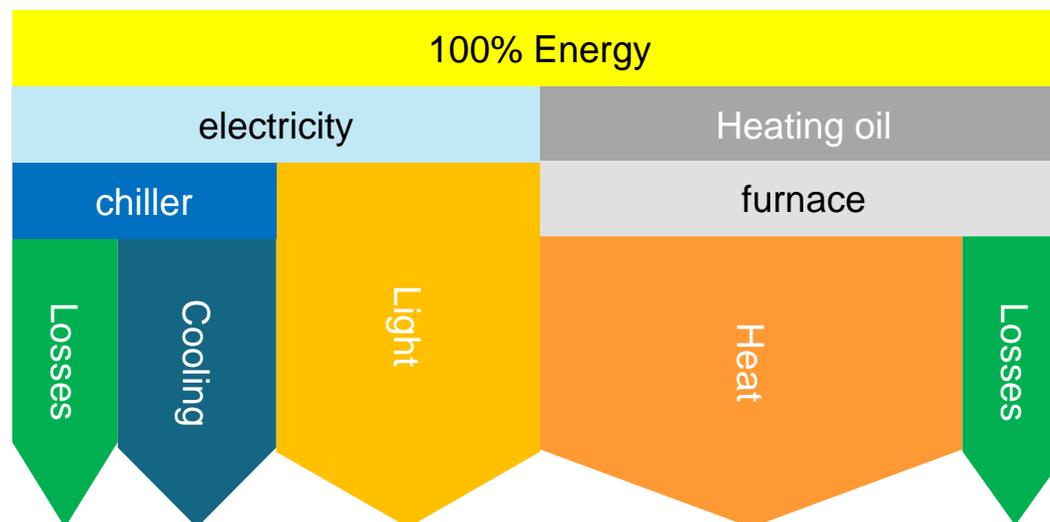
Vattenfall

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Environmental Justice

– **Definition:**
Environmental justice describes the environmental harm of regions or places and its impact on the social and ethnic groups who live there.

– **Method:** Fair Trade

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Sustainable manufacturing

– **Definition:**
The creation of manufactured products that use processes that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers and are economically sound

– **Method:** Key Performance Indicator

Understanding KPI's

A car accelerates in 7 seconds

A car accelerates in 7 seconds from 0 to 100 kph

Summary and outlook

- It's possible to train methods to every topic of sustainability

- Environmental and economical topics taught in learning factories

- There is no learning factory which consider all topics of sustainability

- Identify the mutual influence of method and content

- Find the right combination of methods

- Learn how to teach them