CAR Master training

CONTENT UNIT 8

ENVIRONMENT AND GREEN SKILLS

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8 Environment and green skills

8.1 The introduction

The topic

Scarcity of raw materials, population growth, increasing traffic volume and thus also increased emissions. So, both in the economy and in daily life, there is a need for more environmentally friendly and sustainable alternatives that do not depend on limited raw materials such as oil and natural gas. It is therefore no surprise that e-mobility is seen as the concept of the future, especially in the automotive sector. But how exactly does e-mobility work? What different forms does it take? And can't risk also arise?

Practical Relevance

Gigafactory Berlin-Brandenburg is Tesla's first manufacturing location in Europe and the most advanced, sustainable and efficient facility yet. Slated for completion in 2023, it will manufacture hundreds of thousands of Model Y vehicles and millions of battery cells. (https://www.tesla.com/giga-berlin)

In the following learning unit, you will learn everything you need to know about this new form of mobility.

In this unit you will learn about:

- You know the basics of drive concepts.
- You know the risks of new drive technologies.
- You know the current state of science on climate change.
- You are able to describe what business can contribute to a sustainable environment.
- You are able to describe methods to implement sustainable culture.
- You know the principle of the circular economy.
- You know measures to avoid waste.
- You know how to deal with solid and liquid waste.

8.2 E-mobility and automotive

Unlike the conventional technologies we find in the automotive market, electric vehicles do not run-on fossil fuels such as petrol and diesel, but on alternative fuels. Let's take a closer look at these alternative technologies and find out how and why an electric vehicle work.

Practical Relevance

In February 2023, the European Parliament voted to approve a new law banning the sale of petrol and diesel cars from 2035. The new rule - part of a larger effort to combat climate change in the EU - will speed up the bloc's transition to electric vehicles.

We can distinguish between the following drive concepts:

- Battery electric vehicle (BEV): These are purely battery-powered vehicles that are driven exclusively by an electric motor. These vehicles have particularly low emissions.
- Plug-in hybrids: This refers to vehicles that have an internal combustion engine that can charge the vehicle battery using a generator. The battery can also be charged via the electricity grid. The combustion engine is only used when the battery is empty. The wheels are driven exclusively by the electric motor. These vehicles also emit few emissions.
- Fuel cell vehicles: These vehicles also have an electric drive and obtain their energy from ethanol or hydrogen, which in turn is produced by fuel cells and is either converted directly into motion in the electric motor or can also be stored in a battery.
- "Simple" hybrid vehicles: These vehicles charge their battery purely through the braking process. The energy released in the process is low, but is

sufficient for a few kilometres in city traffic, for example, where braking is frequent. However, according to the legal definition, these vehicles do not belong to electric vehicles, as they can only travel a few kilometres purely electrically.

Hint

Electric vehicles can only be as clean as their electricity. It is true that no emissions are emitted during driving and e-cars are therefore often considered emission-free. However, one must bear in mind that emissions are also released when the electricity required for the drive is generated. Only if the electricity for the drive is produced in a clean and environmentally friendly way can electric vehicles live up to this claim.

As innovative and in demand as e-mobility is in the automotive industry, one must also consider the possible **risks that** the new drive technologies present. Fires, explosions, and electric shocks are perhaps the first dangers that pop into your head when you think about the possible risks of electric cars. But how likely are these dangers really and are electric cars more dangerous than conventional vehicles with combustion engines? Let's take a closer look at the possible risks of electric cars.

In principle, **three types of risks** can be distinguished:

- **Electrical risks**: Arcing is a particular electrical hazard. This refers to arcs that can occur when there is a voltage surge between two or more electrical system parts. This happens, for example, with insufficiently insulated cables. If a person touches these high-voltage parts, this can result in cardiac arrhythmia, ventricular fibrillation or, in the worst case, a fatal electric shock. Even mild electric shocks are not harmless and can lead to respiratory distress or even internal burns. The reason for this is the enormous heat generated. In addition, the electric arcs as well as overheated batteries can lead to fires in the car.
- **Thermal risks**: These occur when there are temperature changes. The greatest danger is the "thermal runway". In other words, the battery burns out. If the battery heats up to more than 120°C, there is a risk that the battery will ignite itself. The result: fires and explosions. Short circuits are also a possible consequence of overheating.
- **Chemical risks**: The heart of the electric car is the battery, which contains highly flammable liquids and gases. This also increases the chemical risk of electric vehicles. If the vehicle's lithium-ion battery is defective, hazardous substances can escape. This can happen if the battery casing is destroyed or if temperatures are too high. If the gases that are released (for example methane and propane) react with oxygen, they ignite. These fires can only be extinguished with great difficulty and large amounts of water.

Citation

Any firm conclusions on fire risks generally are not yet possible because there is not enough data to decide that pure electric cars are more prone to spontaneous fire than internal combustion engine (ICE) ones, or more likely to burst into flames after an accident. Graham Conway, principal engineer at the Southwest Research Institute in San Antonio, Texas, said "It is still too early to make any conclusions about EVs and spontaneity of fires. I just don't think we have the sample size of data or the reporting structure for fires to say with any certainty. What is clear is that the fire is more difficult to deal with, the energy release during the exotherm of the electrolyte takes a lot of cooling to extinguish."

Note

As with conventional vehicles, technical or electrical problems can also become a danger with electric cars. However, the **risks of electric cars are not higher than those of cars with combustion engines,** but they differ from each other. The task of an automotive company is to identify the risks and take appropriate protective measures.

8.3 Green skills in production

We have already seen that e-mobility is usually mentioned in the same breath as sustainability and environmental friendliness. It is not for nothing that e-mobility is often referred to as green mobility. At the same time, we have seen that this view must be handled with caution. After all, sustainability encompasses much more than what we see in its mere application. Let us devote ourselves in this chapter to the topic of sustainability and climate protection a little more closely and look for methods with which we can live up to the claim of living sustainability and environmental protection in business and production as well. Let's first take a closer look at a term that everyone is talking about: climate change.

Note

Global temperatures have risen dramatically, especially since the 1950s. **Global warming** affects the **atmosphere** as well as the **oceans** and **land areas.** Scientists now agree that the far too high **greenhouse gas emissions** caused by humans are the **cause of** climate change.

The high occurrence of greenhouse gases (e.g. methane and CO2) in the atmosphere means that the solar radiation reflected by the earth's surface does not return to space as it should, but is absorbed by the atmosphere. The heat, therefore, remains in the

atmosphere and heats it. In 2021 alone, 36.6 billion tonnes of CO2 were emitted worldwide, 2 billion tonnes more than in 2020.

On average, temperatures have already risen by 1.1°C since pre-industrial times. With the Paris Climate Agreement of 2016, the UN member states are attempting to limit global warming to 1.5°C. However, research assumes that the 1.5°C limit will already be exceeded in 2030. Only if no more CO2 enters the atmosphere by 2030 could the target still be reached.

Practical Relevance

The European Green Deal, presented by the Commission on 11 December 2019, sets the goal of making Europe the first climate-neutral continent by 2050. The European Climate Law enshrines in binding legislation the EU's commitment to climate neutrality and the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels.

In the transition to a net-zero economy, Europe's competitiveness will strongly rely on its capacity to develop and manufacture the clean technologies that make this transition possible. As between 35% and 40% of all jobs could be affected by the green transition, developing the skills needed for well-paid quality jobs will be a priority for the European Year of Skills

The consequences of climate change for nature and thus also for humans are dramatic.

Here are just some of the consequences of global warming:

- Sea level rise and associated land loss
- Melting of the Arctic snow cover and glaciers
- Natural disasters such as storms, heavy rain, heat waves and floods become more frequent
- Desertification
- Species extinction
- Water scarcity
- Threat to agriculture and food supply à famines
- People are forced to leave their homes à climate flight

But now there is good news: we are not powerless against climate change! Because global warming is caused by humans, it can also be stopped or at least reduced by humans.

Important

However, this requires an **immediate and drastic reduction of greenhouse gases in all** global **sectors.** That means in all energy systems, agriculture, transport, industry and so on.

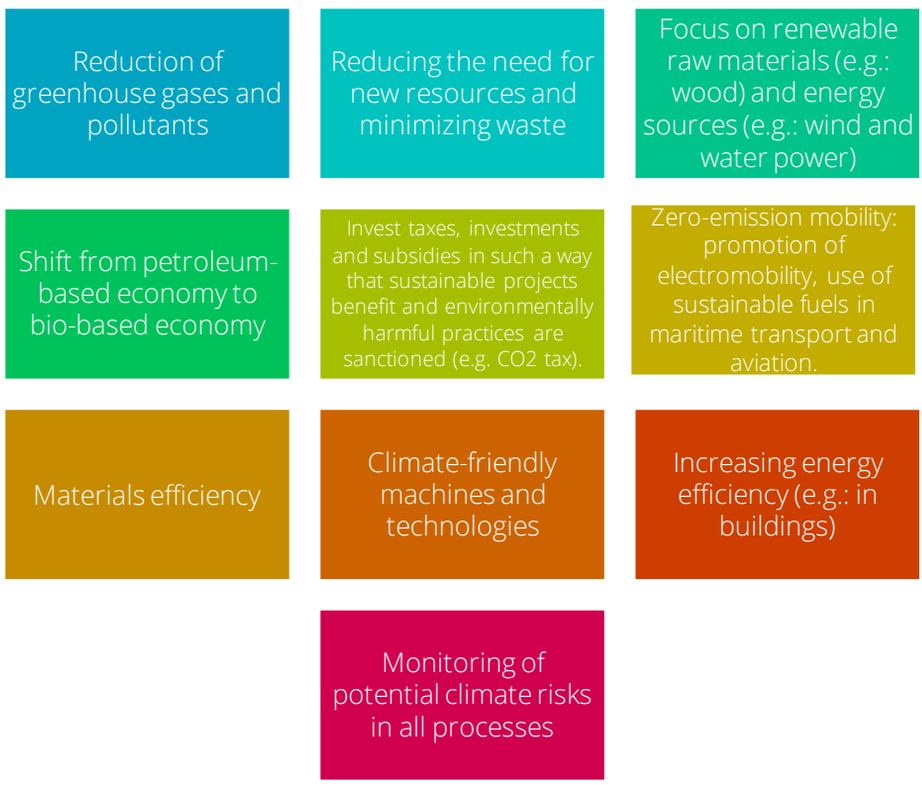
But what do these measures mean for the economy, some of you are probably wondering? Another piece of good news: the impact on global economic growth would only be slightly noticeable, research agrees. A **sustainable economy** in the sense of a **Green Economy** should thus be the guiding principle for future economic development. Green Economy means a form of economy that is in harmony with the environment. But what exactly is a sustainable economy? What criteria must it fulfil?

Definition

A **sustainable economy** means a form of economy that can be run **profitably in** the **long term without increasing resource scarcity and exploitation**. A sustainable economy aims to **use** only **as many resources as it can regenerate**.

The business has an enormous potential to contribute something to the promotion of environmental protection, to counteract global warming and thus to help shape a sustainable and environmentally friendly future. What does a company have to do to achieve this? That is, how can these Green Economy approaches be put into practice? Let's take a look at some concrete methods of how a sustainable culture can be implemented.

Every company has a wide range of options open to it:



8.4 Resource management

A sustainable economy and way of life also include careful use of available resources. This means using existing resources if possible and avoiding waste. Because in the EU alone, over 2.5 billion tonnes of waste are produced every year. This is of course dramatic for our environment, especially when one considers that many important resources are scarce and only available in limited quantities.

Practical Relevance

The EU Commission will propose a Net-Zero Industry Act to identify goals for net-zero industrial capacity and provide a regulatory framework suited for its quick deployment, ensuring simplified and fast-track permitting, promoting European strategic projects, and developing standards to support the scale-up of technologies across the Single Market. The framework will be complemented by the Critical Raw Materials Act, to ensure sufficient access to those materials, like rare earths, that are vital for manufacturing key technologies, and the reform of the electricity market design, to make consumers benefit from the lower costs of renewables. (https://ec.europa.eu/commission/presscorner/detail/en/ip_23_510)

A particularly efficient way of reducing waste and increasing the lifetime of resources is the principle of the **circular economy**.

Definition

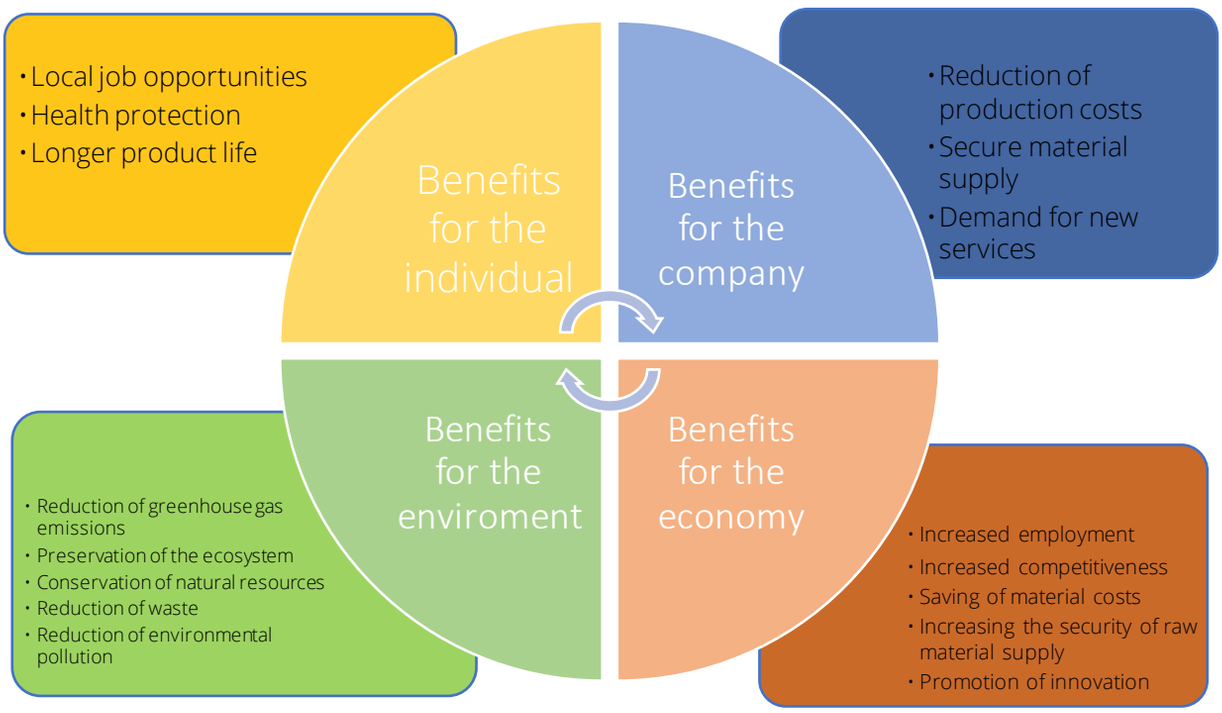
A circular economy describes a **production and consumption model** that aims to **preserve existing materials for as long as possible**. This means sharing, reusing, repairing, refurbishing, or recycling materials and products. In short: extending the life of a product and thus conserves resources and reduces emissions.

So, what does this mean in practice? The basic attitude should be: To reduce waste as much as possible. Even if a product can no longer be used, its resources and materials should be preserved in the economy. This means that they should be used productively.

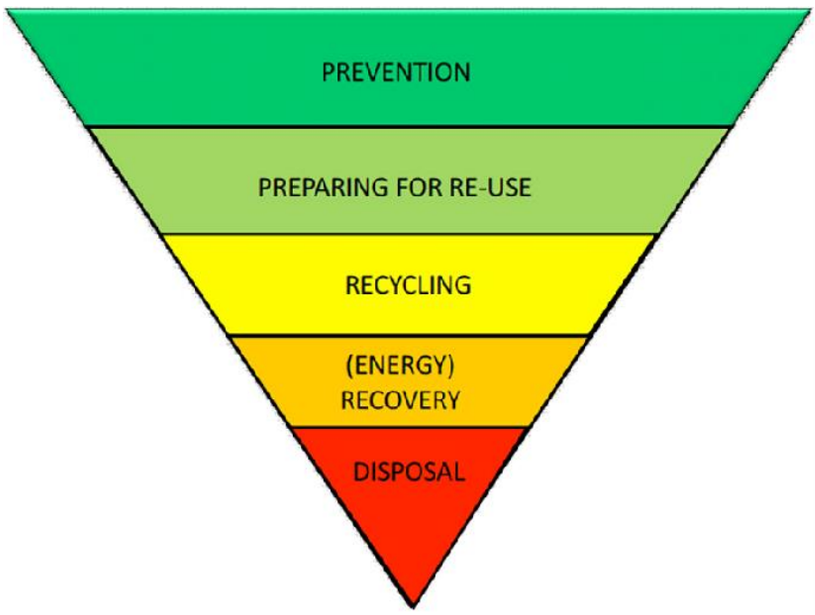
The following illustration clearly shows the process of the circular economy, which starts with durable product design and environmentally friendly use of raw materials, continues with sustainable product manufacture and uses and ends with recovery and recycling of the product.

The **advantages of the circular economy** are numerous. It can save money as well as resources and reduce greenhouse gas emissions. This benefits both the environment and the economy, but also every individual. Because the reuse of resources relieves the environment and at the same time reduces a company's dependence on expensive imported raw materials. It also creates new business models and services and thus jobs

(the EU wants to create around 700,000 new jobs in the sector by 2030). Let's take a closer look at the different benefits of the circular economy:



The circular economy is therefore an efficient means of conserving resources and reducing waste. Currently, however, only about 55% of the waste produced is recycled. The most frequently recycled materials include waste paper, waste glass, waste metals and biowaste. Only about half of plastic waste is recycled. Countless electrical appliances, electrical goods or electronic accessories are also disposed of in household waste and then incinerated. This leads to a waste of energy and resources that could be avoided. The EU waste directives show relevant measures on how to implement waste prevention and reuse of products. The guidelines are presented in the form of a five-level waste pyramid, which you can see in the picture below:



As you can see, the pyramid here is inverted, so to speak, to show that waste prevention is at the top of the waste management hierarchy. Because if waste is not created in the first place, the growth of waste is stopped, the harmfulness of waste is reduced and thus at the same time our groundwater is kept clean, as well as energy and valuable raw materials are saved and thus the environment is actively protected.

How can companies now also actively contribute to waste prevention?

There are numerous helpful and easy-to-implement strategies for this:

- Use reusable instead of disposable packaging for materials
- Try to reduce the amount of material in production processes
- Reduce the size of warehouses and counteract waste caused by the expiry of the minimum storage date
- Repair or rent machines and equipment instead of buying new ones
- Keep the warehouse tidy so that there is no waste due to improper handling of materials.
- Keep the workplaces clean so that no waste can be generated by pollution
- Use longer-lasting rechargeable batteries instead of batteries
- Upcycle and recycle products and materials
- Raise awareness of waste prevention among the workforce

Note

These are just a few tips on how to avoid waste. Also use projects and information events on waste prevention, which are often offered by ministries or environmental organizations.

Unfortunately, however, waste cannot be avoided 100% in our society. If this is the case, as can be seen in the waste pyramid, it comes down to the correct disposal of waste. So let's look at how we can dispose of waste correctly and properly. To do this, we must first distinguish between solid and liquid waste, as disposal depends on what form of waste we are dealing with.

Definition

Solid waste = **municipal waste** includes products that have had a certain period of use and have reached their useful life. A distinction is made between **biodegradable waste** and **inorganic waste**. The latter are remnants of waste that can only be degraded very slowly due to their chemical composition (often containing heavy metals, for example).

There are now different ways of dealing with **solid biodegradable waste sustainably**. In the best case, the waste is recycled and reused. Another option is to store waste in a landfill. Some of the waste produces biogas in this storage process, which in turn has a large amount of energy that can be used to generate electricity.

The following applies to **solid inorganic waste**: Many of them are suitable for a recycling process. If this is not possible, they must be treated with consideration for their hazards. In particular, the following must be considered: Inorganic solid waste is considered hazardous waste and must be disposed of properly.

This means in practice:

- The waste must be collected in separate containers according to their material. The materials must not be mixed under any circumstances, as there is a risk of solids reacting with each other and igniting.
- Clarify with the disposal point whether and how much of the solid waste may be disposed of together with liquid waste.
- If you are unsure whether reactions can occur, only dispose of small amounts of waste at a time and divide the disposal into several parts.

- The final disposal of inorganic waste requires special chemical-physical waste facilities. There, the first step is to reduce the volume of the waste and then separate it from liquids so that the potential for damage can be minimized.

Definition

Liquid waste: This includes **wastewater** and **chemicals** as well as **paints, varnishes** and **oily waste.**

Depending on the material, the waste is also treated differently here:

- **Wastewater:** This is usually discharged directly into the sewage system and transported on to wastewater treatment plants, where it is further treated and processed.
- **Chemicals:** These include, for example, organic and inorganic chemicals from laboratories, households, or industry (e.g., plastics processing). The chemicals are collected in appropriate containers. To find out in which collection container certain chemicals belong, laboratory analyses or a triage by dangerous goods offices must be carried out in some cases.

- Paints and varnishes: These are also collected in suitable containers and picked up by hazardous goods transports.
- Waste containing oil: likewise: dispose of the waste in the correct collection containers.

When the collection container is full, it is collected by dangerous goods transports by the current specifications for dangerous goods and the substances are processed, recycled if possible and reintroduced into the material cycle.

These instructions for handling waste apply to everyday life at home as well as in businesses.

8.5 The summary

Save knowledge

E-mobility is considered the concept of the future and thus also has a major impact on the automotive industry. Automobiles with alternative drive concepts are more and more in demand. There are various options to choose from and the drive concepts range from purely battery-powered vehicles to hybrid models and "simple" hybrid vehicles. Electric vehicles save valuable resources and protect the environment at the same time. Nevertheless, it must be considered that electric vehicles also have risks. These are primarily electrical, thermal, and chemical risks that can occur, for example, in the event of overheating or as a result of accidents.

At the latest after working through the learning unit, you will also know the current state of research on the topic of climate change and its consequences for nature and people. Global warming caused by humans affects the atmosphere as well as the oceans and land areas. As we have seen, the consequences are drastic. Natural disasters, species extinction and water and food shortages are just a few of them. To still be able to counteract climate change, immediate action must be taken, and greenhouse gas emissions minimized.

We have seen that both the economy and everyone can counteract climate change. The new motto for the economy should be "Green Economy". A sustainable economy should use resources sparingly, reduce greenhouse gases, use renewable energy, and focus on a circular economy. This means continuing to use existing resources if possible and reducing waste.

In addition to the circular economy, you have also received some tips on how to avoid waste in the company. Recycling, repairing and using reusable products are at the top of the list. If avoidance is not successful and waste is produced, you now know how to dispose of waste properly. The most important thing is to separate the waste correctly according to its material so that the waste can then be processed and potential hazards minimized. This applies to waste in the private sector as well as in industry and production.

8.6 References

ADAC (2021): Der Elektroantrieb – so funktioniert ein Elektroauto, https://www.adac.de/verkehr/tanken-kraftstoff-antrieb/alternative-antriebe/elektroantrieb/

Circular Futures: Plattform Kreislaufwirtschaft Österreich: Kreislaufwirtschaft, https://www.circularfutures.at/themen/kreislaufwirtschaft/

Europäisches Parlament: Kreislaufwirtschaft: Definition und Vorteile (2022), https://www.europarl.europa.eu/news/de/headlines/economy/20151201STO05603/kreislaufwirtschaft-definition-und-vorteile

Österreichs digitales Amt (2022): Allgemeines zur Müllvermeidung und Mülltrennung, für den Inhalt verantwortlich: Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie,

https://www.oesterreich.gv.at/themen/bauen_wohnen_und_umwelt/abfall/Seite.3790051.html

Schramm, D., Koppers, M. (2014). (Teil-) Elektrische Kfz-Antriebe. In: Das Automobil im Jahr 2025. essentials. Springer Vieweg, Wiesbaden.

Umwelt Bundesamt (2022): Beobachtete und künftig zu erwartende globale Klimaänderungen, https://www.umweltbundesamt.de/daten/klima/beobachtete-kuenftig-zu-erwartende-globale#die-teilberichte-des-ar6

Wirtschaft und Umwelt (2022), https://www.umweltbundesamt.de/themen/wirtschaft-konsum/wirtschaft-umwelt

Zapf, Martin; Pengg, Hermann; Bütler, Thomas; Bach, Christian &Weindl, Christian (2020): Kosteneffziente und nachhaltige Automobile Bewertung der realen Klimabelastung und der Gesamtkosten – Heute und in Zukunft. Springer: Wiesbaden.

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