#68

ROI EFESO
MANAGEMENT CONSULTANTS

# DIALOG

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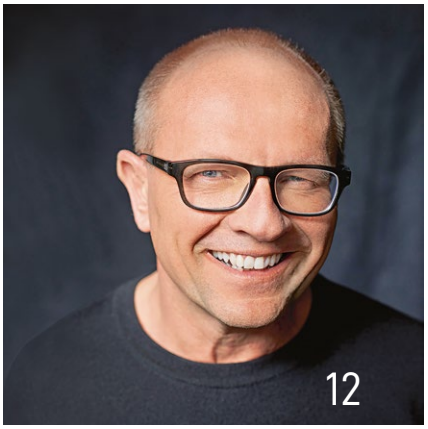
ENGLISH EDITION

# INDUSTRIAL SUSTAINABILITY

# CONTENT

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V. i. S. d. P.: Hans-Georg Scheibe | ROI-EFESO Management Consulting AG
Infanteriestraße 11 | D-80797 Munich | Phone: +49 (0)89 121590-0 | E-mail: dialog@roi.de
Board of Directors: Michael Jung, Hans-Georg Scheibe, Sebastian Diers


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## Industrial Sustainability

# WHY ONLY EXCELLENT PROCESSES CAN BE SUSTAINA-BLE

August 4, 2023 was a landmark day for the planet. Why? Because, according to calculations by research organisation Global Footprint Network's, that was the day that humanity's demand for resources this year exceeded what the earth can regenerate annually. The organisation calls it Earth Overshoot Day and we've been reaching it quicker every year, ever since it began keeping records in 1971.

The fact that the 'day' has been reached earlier and earlier every year since then is largely thanks to the increasing resource consumption of economies of the developing countries, and by no means just those based in North America, Western Europe or the Far East.

OK, it's true that the Earth Overshoot Day is merely a theoretical model calculation, one whose statistical validity can be questioned, just as easily as its polemic content. But perhaps it would be more productive for us to consider instead what reaching this day says about the highly automated, digitized and supposedly environmentally conscious world we supposedly live in.

The answer is obvious - our industrialized processes, value chains and product life cycles consume far too many resources. Quite simply, they are not good enough, not as efficient as they could, and should, be. That is not for want of trying. Throughout the history of industrialization, participants have constantly sought to increase efficiency and reduce the waste of resources. Because, whether we are talking about minimising the wastage of raw materials, time, energy or capital, it's profitable - on every level - to attempt to do so.

But increasing efficiency and conserving resources go hand in hand. And inefficient industrial processes cannot, by definition, be sustainable.

Our collective experience has shown that the need to be ever-mindful of this truth isn't so compelling if the negative effects of production can be externalized, and, or if, resources are available at low cost and in unlimited quantities. So it falls to the legislators, political decision-makers and the public consensus - at both national and international level - to ensure that wasting resources simply does not pay.

At its core, any work undertaken to foster lean, digitally industrialized processes, those that strike an appropriate balance between efficiency and resilience, is therefore also work that inherently improves the ecological footprint of the manufacturing industry.

Frankly, it's an effort that we should all be fully invested in, and one that - self-evidently - we need to prioritise as a matter of urgency, particularly given the seismic shifts in the global economy and the very visible resulting impacts on our environment and ecology.

In this issue of our magazine, we want to explore the concept of 'Industrial Sustainability' and show how the industry of the future can effectively combine sustainability, innovation and process excellence.

I hope you enjoy reading it.
Hans-Georg Scheibe,
Executive Vice President, ROI-EFESO


STRATEGY
PRODUCTS
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## Industrial Sustainability

We shed light on five key aspects of Industrial Sustainability and show how environmental and social goals combine with process excellence, innovation, customer orientation and efficiency.


STRA
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## What impact do sustainability criteria have on business models?

When evaluating products and solutions, sustainability criteria are becoming increasingly important for both customers and investors. On the one hand, this relates to the immediate environmental and social conditions of production itself and the recyclability of created products. On the other, it's also true that the design of the supply chain, including its geographical distribution, also has an influence on the consumer's judgment. In addition, national and international compliance requirements are creating an increasingly demanding framework with regards to sustainability.

The key takeaway is that the design parameters of many business models can no longer be maintained in their current form. Higher risk and reputation costs, investments in modified product design and adapted supply chains, as well as expenses for monitoring and managing suppliers, means that established business models can no longer be continued without substantial changes.

However, this development also has a positive side. New services can be created, for example, around the circularity or collaborative use of products. In addition, innovative processes and production methods can become more attractive. It is crucial to evaluate the business model portfolio holistically at an early stage and to develop transformation scenarios to enable targeted adaptation to new framework conditions.

## How can investment security be achieved in view of the openness of technology?

Early phases of technological upheaval are phases of extreme uncertainty. The rules of the game, the distribution of power and growth potential are not yet set in stone; the legal framework is constantly changing and it is still unclear which markets will be affected and to what extent. A major factor in this 'strategic fog' is the openness of technology. In principle, new types of problems can be solved by different technologies. But it's to predict which ones will ultimately prevail at this moment in time.

The sustainable transformation of the economy is also only just beginning. Which is why the long-term implications of social and industrial projects such as energy transition or the replacement of combustion engines in road, sea and air transport are unclear. As yet, we don't know which energy types and distribution systems will prevail in which regions. Nor do we know which drive technologies and charging infrastructures will become established, and for which areas of application.

For the industry, all this uncertainty entails serious risks and burdens. These arise both from an early commitment to a technology standard, and from the complex and expensive parallel development of several technologies and business models. Solution approaches include sound scenario management and integration into ecosystems in which risks, tasks and knowledge are distributed. But at the same time, processes must be continuously improved to achieve a higher degree of efficiency, adaptability and scalability.

## How does Industrial Sustainability influence EBIT?

The sustainable restructuring of industrial value chains is inevitably accompanied by extra burdens. However, it also offers significant opportunities to improve earnings. The first levers are efficiency improvements and cost savings. This is because the focus of sustainably oriented processes is on avoiding the waste of resources: energy, water and raw materials need to be used efficiently and the production of harmful waste products reduced.

It's important to take a perspective of the entire product life cycle here. If products are designed for effective and residue-free disposal right from the design phase, the cost of taking them back and recycling them can be reduced, or even allow new sources of revenue and raw materials to be unlocked.

Sustainable processes also contribute to the systematic reduction of risk costs. The industry is confronted with increasingly complex sets of regulations that significantly expand the scope of liability. These risks can be reduced by transparent and verifiable structures throughout the value chain that are in line with current and future compliance regulations.

In addition, it is worth considering the risks associated with products and manufacturing processes. For example, raw materials whose extraction and disposal have negative social and environmental impacts represent an obvious potential risk. Products manufactured in this way are increasingly subject to strict sanctions, including import bans.

In addition, the use of non-renewable energy sources can have a negative impact on our reputation. Factors like this are risks for all existing business models. A comprehensive consideration of risk scenarios and the early transformation of value creation therefore has a direct influence on future revenue strength, access to capital and company valuation.

## Are radical innovations made possible by sustainability?

Sustainability efforts go hand in hand with innovative technologies and business models: ecological changes, political transformation agendas, and regulatory incentives and sanctions are creating new markets for industrial products and services. Buildings, infrastructures and factories, for example, need to be adapted to changing climatic conditions as well as circularity. The move away from fossil fuels is opening up access to sectors that were previously closed off and organized on an oligopolistic basis.

Customer requirements are also evolving and generating demand for products whose positive sustainability 'balance sheet' is becoming a key purchasing criterion. All these processes offer a wide range of new opportunities for industrial companies, if they succeed in identifying relevant trends, precisely defining their own value contribution, and effectively aligning the available R&D resources.

## Does sustainability require a new strategy model?

When it comes to the formulation of strategies, addressing sustainability does not inevitably mean the re-evaluation of all values. Many companies have already undergone a realignment of mindset, methods and organization in recent years. Strategy processes are increasingly attuned to openness to future developments, as well as disruptive change, rapid, lateral decision-making, agility and resilience.

The sustainability perspective now adds further facets to these developments. The starting point is the consistent life cycle consideration of products and their impact, from raw material extraction to recycling. This means that phases in the life of a product the manufacturing company has not had direct access to in the past, now become relevant. The task is to map these out strategically and to analyze opportunities for exerting influence.

Within the company, this approach requires a much stronger linking of functional strategies. At the cross-company level, integration into new types of ecosystems becomes imperative: new forms of cooperation are needed to improve knowledge, customer access and resource utilization, and to make the company, as a whole, environmentally and socially sustainable.

# PRODUCTS

# The environmental potential of a product can only be understood through a deep understanding of the customer's perspective and consistent product lifecycle management

## How do the products a company makes affect its environmental footprint?

Product design, working conditions, the type of raw materials used, resource consumption during production and use, recycling and reuse - products have a massive impact on the social and environmental footprint of manufacturing companies. Reducing that footprint requires the consideration of sustainability to be anchored in every aspect of the value chain and organizational structure.

The organizational aspect focuses in particular on a specific mindset and the skills and competencies required for consistent 'Design for Sustainability'. The technical aspect focuses on innovations that are necessary to develop new technologies, change manufacturing processes and enable the use of more environmentally friendly materials. Digitalization, automation and the use of artificial intelligence, on the other hand, help to improve the efficiency of production and achieve a long product life.

When looking at a product, however, it is crucial to realize that its assessed sustainability is never solely in the hands of the manufacturing company: it's also significantly influenced by customer use. So, taking a wider view of the entire product life cycle, as well as gaining a deeper understanding of usage scenarios, forms the basis for the development of truly sustainable products.

## How does one adopt a sustainable mindset when carrying out product development?

Taking an environmental view of products requires a radical broadening of perspective. It involves examining interdependencies and relationships between the product and its social, natural and technological environment, as well as its influence on different aspects of sustainability, the context in which it is used by the customer and its life cycle. The product development process is a crucial building block in this respect.

The classic 'Design for Manufacturing' approach must therefore be supplemented in several respects: because 'Design for Sustainability' focuses not just on efficient and resource-saving manufacturing but also on the entire life cycle of the product, from the extraction of the raw materials to how the product is eventually recycled as part of a sustainable circular economy.

In short, adopting a sustainable mindset means thinking about products holistically, across systems, and consistently taking the customer's perspective into account. For many products, their environmental footprint is determined not only by how they are produced but also by how they are used and recycled. Which is why manufacturers must exert their influence as early as possible - at the product development stage - and consider the entire product life cycle from a sustainability perspective.

## Why are sustainable products a matter of customer perspective?

The environmental potential of a product can only be understood through a deep understanding of the customer's perspective and consistent product lifecycle management. How do customers use the product? To what extent are sustainability features a differentiating factor? How do sustainable products influence customer satisfaction and loyalty to the product? Which features and characteristics are crucial, which are not? How does the importance of certain functionality change in the context of general trends?

Products are always part of complex preference structures and application scenarios. So, sustainability and understanding one's customer go hand in hand. Only then can it be seen, for example, that users of a certain make of car are more likely to accept speed limiters because they appreciate their inherent sustainability benefits, even if the manufacturer's primary motive is to reduce the risk of accidents.

At the same time, taking an environmental perspective opens up the potential for embedding products and systems in higher-level systems. This can give rise to new approaches when it comes to designing integrated mobility solutions, building decentralized energy systems or reducing the wastage of resource, for example, through harmonized hardware, software and process interfaces.

But aligning product strategy with sustainability goals isn't just a driver of positive corporate development. Taking an environmental perspective invariably reveals how digitization and sustainability can reinforce each other: for example, when networked and smart products interact in an integrated IoT landscape, to optimize the customer experience and improve the environmental footprint of the overall system.

## Which path leads to sustainable product innovations?

Aligning product development with sustainability criteria opens up new scope for innovation. In order to exploit these in a systematic way, environmental thinking must also be systematically anchored. One example is via open innovation formats such as 'Sustainathons', events modelled on hackathons. Here, employees can compete against each other in an informal setting, the aim being to devise new, more sustainable ways of developing product.

Seeking innovative collaborations outside of existing industry and competitive structures is another promising approach. The decisive factor here is to bring together experts in the company and the value chain, on an interdisciplinary basis, the goal being to come up with radically new scenarios that are 'outside the box'. Core competencies can therefore be combined in new ways to create forward-looking solutions.

Industry 4.0 approaches play an important role here: the use of digital twins, deeply embedded sensor technology and artificial intelligence can significantly increase the longevity of classic hardware products. These can then be continuously monitored, analyzed in known usage scenarios and continuously optimized via ongoing interaction with customers, processes that – happily - often give rise to entirely new business models.

## How does the circular economy inspire more sustainable product design?

The central tenets of the circular economy are the extension of product use, the minimisation of waste and loss of resources, and the use of regenerative or recycled raw materials. In order to meet these objectives, the core requirements of the circular economy, (e.g. longer product life and separability of materials), must already have been taken into account in the product design phase.

Taking a wider perspective on a product's life cycle and ensuring the consistent alignment of products with customer requirements, and their usage scenarios, increases both customer satisfaction and the manufacturer's inherent competitiveness.

For example, unnecessary product features can be eliminated through requirement engineering. Manufacturing processes such as 3D printing (additive manufacturing) can also be used to develop and produce resource-saving designs using integrative components and lightweight structures designed in accordance with load paths.

**DIALOG**: Mr. Schulze-Hausmann, as the Chairman of your organisation's board, you have a unique insight into how industry has dealt with sustainability issues. Can you tell us what key developments you have observed in recent years, and how the perspective of companies has changed?

**SSH:** The best way to answer that is to give you a brief overview of the history of the German Sustainability Award. When we first started out, we approached German industry with a relatively long list of questions and asked, "Where do you stand in terms of sustainability?" I have to tell you, our questions really weren't taken very seriously at the time. Most companies answered that they either didn't have the KPIs we had asked for, or didn't want to disclose them. Amusingly, despite that, however, they were still more than keen to tell us about the social projects they were involved with in Africa, sponsoring the local soccer club, or their use of recycled paper!

That was back in 2008. In the following years companies quickly began to set up sustainability strategies, create management structures and finally give the topic a place on the corporate management agenda. The applications that reached us from that point onwards were no longer sent by a PR agency or, at best, by the environmental officer, but by members of senior management.

**DIALOG:** So, the topic of sustainability had come of age?

**SSH:** Yes, that's a good way of putting it. Sustainability had become a subject for boardroom discussion and its consideration increasingly led to structural changes within the companies. Initially, the focus was on 'housekeeping' matters (i.e., the conversion of the company car fleet to green electricity, the installation of solar glazing and other obviously sensible measures). But then the focus increasingly shifted to production and logistics (i.e. the core processes of companies).

People then began looking more intently at products and thinking of new ways of designing them so that they achieved as many sustainability benefits as possible throughout their entire life cycle. And that changed the perspective quite markedly. Today, the main drivers for sustainable transformation are competitiveness, leadership in issues, and market leadership. And, invariably, considered on a global scale.

**DIALOG**: So, being sustainable is no longer just a question of purpose?

**SSH:** It is still a matter of purpose, of course, but it's much more than that. Sustainability is about scrutinizing every single process, every single product life cycle. The hardest step is to get from outlining a vision and purpose to actual industrial implementation. If that fails to happen, the benefits will remain just hypothetical - they will be neither credible or truly transformative.

Poor, inefficient processes are inherently sustainable; they cannot capitalize on the economic opportunities that result from sustainable transformation. However, it's also true that if a company's strategy is not shaped by an overriding

Interview with
Stefan Schulze-Hausmann,
Chairman of the Board of the
German Sustainability Award
Foundation

# "BEING 'PURPOSE-DRIVEN' WORLD CHAMPIONS IS NOT ENOUGH."

purpose, and there is no will on the part of the management to make sustainability a guiding maxim, then the best that can be achieved is process optimization, using existing tools, methods and objectives. That is not enough.

**DIALOG:** So, when does 'purpose' become strategically relevant?

**SSH:** In a large company, there are pivotal moments that happen on a daily basis when somebody will say "this is the easiest, most efficient way of doing something". It's at that point when everybody has to take a step back and consciously choose another solution or action, one that everybody knows is more sustainable, but perhaps not as efficient.

**DIALOG**: We have seen in recent years that the overemphasis on efficiency targets has a downside - for example, you cannot maximize efficiency and resilience at the same time.

**SSH:** Very true. Another interesting term in that context is sufficiency, i.e. avoiding overconsumption, a waste of resources that overburdens our livelihoods and economies. Happily, this thinking is very compatible with industrial logic; avoiding waste of any kind is, after all, at the core of the 'lean' philosophy.

So, we need a broader understanding of the environmental, social and economic aspects of sustainability, and we need to actively look for ways to combine them.

**DIALOG:** Do you see this differentiated, broad perspective reflected in the way that the industry, and now also the public, discuss sustainability?

**SSH:** Absolutely. Sustainability was initially viewed as a 'green' measure, basically ranked the same as environmental protection. I think the biggest change in the last five to eight years has been the 'discovery' of the social dimension of sustainability and its subsequent integration into strategies and regulatory frameworks. We see this in developments such as the Supply Chain Act and Scope 3 issues, frameworks which greatly expand what companies are now deemed to be responsible for.

But the reality is that sustainability must have a 'pay-off', because otherwise it simply wouldn't exist, is also being more widely accepted. After all, a sustainability strategy that deprives companies of a stable basis for growth and competitiveness is a contradiction in terms. To protect people and nature, you have to make money. That is now the consensus. And that's one of the positive outcomes that we have seen after 15 years of running the Sustainability Awards. Sustainability is now primarily seen as a growth, rather than a cost factor.

**DIALOG:** Alongside environmental and social aspects, governance forms the third pillar of sustainability. This topic seems to be somewhat more difficult to grasp.

**SSH:** I would put it a little differently. Good lawyers can quickly draw up a written code that clearly sets out the need for transparency, equality and other factors - but applying this framework to day-to-day life can be complex. But if a company can't do that, it won't make sustainable progress on other fronts, either.

**DIALOG:** We often have discussions about what the shift toward sustainability means for our industries in an international context. Do you think it makes us more fragile? Or stronger? Or, perhaps, more vulnerable?

**SSH:** It's a question that needs to be answered primarily from a technological and industrial perspective. We were - and are - leaders in 'green tech' in many areas. But we have to be careful that key areas where we are strong don't slip through our fingers.

I can think of two recent examples where that has happened: the first is in the field of photovoltaics. Although we initially played a major part in the development of this technology, we have subsequently failed to nurture it into a growing, globally competitive industry and to keep the innovation drivers in the country.

The second example is the automotive industry: here we failed to retain the initiative to transform an industry in which we were already outstandingly strong. Now we are having to play catch-up with others.

Sometimes it's inevitable that we have to take a 'backseat' in technological or industrial terms, but we don't want that to happen too often in the years to come. Because we urgently need this excellence in sustainable technologies, in order to both secure the country's economic foundations and its global competitiveness, and to make a substantial contribution to overcoming the global environmental crisis.

And this is where the circle closes: because it's now very clear that 'just' being purpose-driven world champions simply won't be enough in the future.

# PRODUCTION

## What levers can be used to make production processes more sustainable?

The design and optimization of production processes for sustainability is nothing new; it takes place all the time, through the optimization of material consumption, the better utilization of machines and the reduction of waste. However, these selective measures are not enough in themselves to achieve the required sustainability goals. Rather, what is needed is a greater intensity and focus on tackling the biggest contributors to emissions, as well as a willingness to devote time and resources to developing and procuring more effective solutions, even if they prove more costly.

The focus here is primarily on reducing CO2 emissions from the production processes themselves (Scope 1) and the energy required for them (e.g. for operating machinery) which is defined as Scope 2. In order to influence these in an effective manner, structural adjustments to existing production processes are usually required. Examples could include the switching of energy supplies to electricity generated by renewable sources, or the introduction of new, CO2-neutral or CO2-reduced production processes (e.g. in the steel industry).

For those with responsibility for production, this gives rise to three main challenges; they must create the necessary transparency around the main emission drivers, find effective levers to combat them, and, finally, reconcile them with existing measures both inside and outside production. How successful they are in doing so also depends to an extent on whether companies can afford the associated investments, not easy, given the current economic situation.

## What does transparency mean when it comes to sustainable production?

The pre-occupation with increasing Industrial Sustainability reinforces the need for better transparency with regards to energy sources, resources, and waste that is sourced and disposed of by the factory. On the one hand, it's needed to meet sustainability reporting requirements for disclosure of Scope 1 and 2 emissions. On the other hand, it forms the basis for identifying relevant emitters and waste drivers in the production process.

Companies are therefore faced with a dual challenge. On the one hand, they have to create end-to-end transparency about sustainability-relevant energy and resource flows, all the way from the corporate to the machine level. On the other hand, they must also find ways to control the time and cost involved in transparency reporting.

The digital twin has a key role to play here. It enables the simulation of consumption or entire production plants on the basis of existing sensor technology, so reducing the cost and effort required to create transparency. But its simulation and forecasting capabilities also make it possible to leverage efficiency potential. A prime example is in the operation of complex production plants, where it can help to resolve potential objective conflicts by improving the basis for decision-making. This can range from providing a decision-making basis for employees, in the context of shopfloor management, to self-optimized machine control.

## How can today‘s production be aligned with tomorrow‘s sustainability goals?

One of the particular challenges of Industrial Sustainability is the knowledge that, thanks to the long service life of machinery and equipment, investments made in production infrastructure today will affect the achievement of mid-century sustainability goals many years down the line.

This shifts the planning horizon for investment decisions massively backwards and poses some complex weighting decisions for production managers. For instance, is it worth investing in new, more energy-efficient plant or manufacturing technology today if you already know your product portfolio is likely to change in the coming years, because of sustainability considerations? Is the efficiency level of the planned production plant sufficient to meet future sustainability requirements? Which framework conditions (e.g. with regard to the type of energy supply), will determine the use of machinery and equipment in the future?

Answering these questions requires a more forward-looking view of the production system than needed before. In some cases, new instruments and methods, such as scenario planning, will have to be deployed, in order to identify dependencies, and take into account the effects of different developments in framework conditions (e.g. gas price changes) on the decision-making process.

## Is the 'Zero Carbon' Factory accessible?

The ultimate aim of a Zero Carbon Factory is to completely eliminate production-related Scope 1 and Scope 2 emissions. In principle, three complementary approaches are available for reducing production-related emissions.

The first involves the avoidance of emissions, for example through more efficient processes, the use of emission-free production methods, or the switching of energy supplies. The second involves the recycling of CO2 and other greenhouse gases back into the production process, or their capture and storage. And the third is offsetting emissions through compensation measures.

In the case of products where, in addition to the energy used, the manufacturing process itself releases greenhouse gases - as in cement production, for example – the Zero Carbon vision can only be achieved via a combination of these different approaches.

Creating a zero-emission factory is therefore not just down to optimizing production: it also requires interaction with other areas of the company. In addition to reducing the emission drivers which can be directly influenced, the role of those responsible for production is, above all, to create the necessary transparency that's needed as the foundation for such a combined approach.

## What is the end goal of sustainable production?

A narrow focus on CO2 emissions, as the primary optimization variable for Industrial Sustainability, ignores other significant factors which influence the ecological and social footprint of manufacturing companies. In the production environment, in particular, there are two key influencing variables that must be taken into account, as part of comprehensive energy and resource optimization.

The first entails ensuring the sustainable use of one of the most critical resources: water. This involves both reducing water consumption within the production processes, and avoiding contamination and other environmental pollution when extracting and recycling process water. The second involves avoiding, properly disposing of, and recycling or recirculating waste and residual materials in the production process.

Both aspects have potential impacts on people, as well as the environments inside and outside the factory. That makes them a crucial consideration in any holistic ESG approach, alongside other important issues such as occupational safety and fair pay.

In order to properly understand their impact in the overall production process, it's necessary to dig deeper when it comes to transparency, in order to gain better insights into the associated environmental and social footprints. Unsurprisingly, such efforts will invariably go well beyond merely considering straightforward CO2-related emissions.


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## How do environmental factors influence site selection and TCO?

Environmental laws and regulations can vary considerably depending on the location. This results in - sometimes significantly - different efforts, costs and risks when it comes to operating a site. At the same time, the availability of resources is increasingly becoming a more important factor. This involves, on the one hand, ensuring access to renewable energy sources, which can have a significant effect on the overall ecological footprint of the site, and, on the other hand, access to the raw materials required for production. An efficient transport infrastructure matters, too: if the site is in an unfavorable location, additional transport costs can adversely affect the CO2 balance.

In addition, the impact of site operations on the environment may also become relevant - for example, if a site is located near settlements, wetlands, watersheds, or protected ecosystems. In such cases, additional costs may be incurred, in order to avoid negative impacts on people and the natural environment.

## Do local networks and shorter supply chains promote sustainability?

Generally speaking, shortening and localizing supply chains is not an answer to most environmental and social challenges. Instead, it's necessary to take an overview of the factors which are included in the calculation of the sustainability balance, and in site planning.

If sites are located close to well-developed, efficient transport infrastructures, for example, such locations can partially offset possible disadvantages resulting from the geographical expansion of the network. The deciding factors are the local structures and environment: efficient, regenerative supply networks, effective recycling systems and opportunities to use secondary raw materials, as well as functioning social and legal institutions (with regards to occupational safety and environmental protection).

These factors must be given greater consideration alongside classic criteria when evaluating network topography, in order to holistically assess the profitability, competitiveness, resilience and sustainability of the network, as well as the attractiveness of individual locations.

# Shortening and localizing supply chains is not an answer to most environmental and social challenges

## What is the importance of transparency for sustainable networks?

It's imperative that sustainable networks feature high transparency. This also applies to the evaluation of the ecological, social and institutional sustainability of sites. A central task here is the recording of all relevant factors and the development of an operationalizable key figure system.

The challenge lies both in the consideration of different national, international and industry-specific standards, and in the scope of the analysis. The recording of Scope 3 emissions, for instance, which requires comprehensive knowledge of the value chain over the entire product life cycle, can be particularly demanding. This also applies to the monitoring of social and ethical conditions of value creation.

Transparency about the sustainable footprint of purchasing, logistics and production networks doesn't just serve to meet compliance regulations and corporate ethical codes. It's also a prerequisite for holistic risk management, identification of market opportunities, robust planning processes and stable customer and investor trust, which is increasingly based on the complete traceability of products.

## What role will energy maps play in footprint decisions?

The transition from fossil fuels to emission-free, or low-emission energy sources will have a significant impact on the CO2 footprint of the manufacturing industry. However, especially in energy-intensive industries, renewable energies cannot cover the entire energy demand in the medium term, or guarantee an uninterrupted supply at reasonable costs. So, when considering the energy supply capability of sites, it is a matter of weighing up economic efficiency, security of supply and the lowest possible ecological impact.

There are significant regional differences in the design of a secure and cost-efficient energy mix, especially with regards to the availability of environmentally friendly energy sources. This is especially true when it comes to topographical and climatic conditions, the quality and stability of infrastructures, or access to technologies.

In addition, legal frameworks and political roadmaps also play an important role. Regional and national support programs, incentives and sanctions, institutional stability, and the degree of support for 'green' industrial settlements, can all have a significant impact on the attractiveness of a location. That's why energy roadmaps that map out these different facets will become an increasingly important tool in the development of network strategies in the future.


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## Will forecasting replace planning in supply chain management in the future?

Planning is one of the central tasks of supply chain management. Among other things, it determines which production resources must be available when, in what quantity and at what location. However, given current global supply chain risks and increasingly volatile customer requirements, traditional planning methodologies no longer do justice to the dynamics of many industries.

As a result, supply chain management and planning may have to be thought about differently in the future, with a move away from static planning. Instead, predictive forecasting of customer needs and flexible adaptation of supply chain management to dynamic developments will likely become the norm. The basis for this is provided by new tools that include the likes of demand sensing, which combines artificial intelligence with real-time data to predict short-term changes in consumer demand with high accuracy. This enables companies to respond quicker to market fluctuations, minimize planning errors and significantly reduce waste.

## Who will win the race for low-carbon resources?

The ongoing drive to lower Scope 3 emissions means that the need for low-emission precursors - low-carbon resources, ranging from raw materials to highly processed components - is daily increasing in the manufacturing industry. Today, the demand for 'base' materials such as green steel or recycled plastics already exceeds the available supply on the world market.

It's clear that companies will have to develop new strategies to secure reliable, long-term access to low-emission raw materials and other materials. The focus here will be on building closer partnerships between companies and their suppliers. Together, they will be able to develop roadmaps for expanding the supply volumes of sustainable or low-emission materials and actively support them (e.g. by providing financing assistance for new production facilities or helping with the switch to renewable energy supplies).

## How do you apply 'in-house' optimization methods to the entire supply chain network?

Production and logistics processes in most manufacturing companies have been developed over many years and optimized according to well-known principles such as lean management or 'just-in-time'. As a result, they have helped to maximise efficiency and operate value creation processes in a more sustainable way. That's why most process ‚breaks' and inefficiencies (e.g. due to downtimes, empty runs and other forms of waste) occur when the processes of different supply chain partners are out of sync. Those glitches are often accompanied by a lack of data transparency and quality.

In order to minimise the resulting negative environmental impact, a careful analysis of the main waste drivers at these interfaces is required, which allows measures for a more sustainable process design to be developed. Typical starting points are in the areas of transport and packaging design. For example, the number of empty runs can massively be reduced by optimizing loading and bundling trips as well as adjusting delivery rhythms.

## Is supply chain instability becoming a sustainability killer?

The numerous crises the world has endured over the past few years have massively shaken up global supply chains. As a result, the trend toward streamlining supply chains has been partially reversed, in favor of larger inventories and planned redundancies along the supply chain. This shift comes at the expense of sustainability, as buffer stocks are invariably accompanied by greater storage requirements and energy consumption, as well as higher transport costs and risk of obsolescence.

To resolve the tension between increasing resource efficiency and maintaining supply chain stability, companies need to find new ways of increasing the resilience of their supply chains without neglecting sustainability aspects.

One possible way forward is to realign procurement strategies for global, regional and local sourcing, something that has already been increasingly implemented in the wake of the current crises. Not only can this effectively reduce global dependencies, but it also brings down transport-related emissions.

Furthermore, the instruments for identifying and assessing supply default risks need to be improved. In this way, companies can stockpile individual components or materials with a high availability risk or difficult substitutability, while the other supply flows can be streamlined.

## Is the traditional supply chain now becoming a circular supply chain?

The embedding of circularity principles across industry means that companies are no longer just responsible for products, per se, but for entire product life cycles. This means that the return of products or materials to the value creation process, through repair, reuse or recycling, is becoming considerably more important.

This isn't just for the sake of enhancing sustainability: increasingly, it also makes sense from an economic perspective as it allows for the recovery of strategically important raw materials (e.g. for battery production).

This creates multiple new challenges for supply chain management: on the one hand, an efficient reverse logistics process has to be established to facilitate the return of products, which in itself must be designed to be as sustainable as possible through optimized transport and route planning.

On the other hand, it is necessary - especially in the case of highly engineered and variant-rich products - to understand which specific components or raw materials can be extracted and reprocessed or reused, and which need to be disposed of properly and in what form. Addressing both challenges necessitates better traceability of the products, not just in terms of knowing which products were delivered in which form to which customers, but also in what condition. In short, when considering the entire life cycle, it's vital now to take the requirements of the entire supply chain – extant and future - into account as early as possible during the product development process.

Interview with Alexandra and Bernd Henrich, Managing Directors of H&G Entsorgungssysteme GmbH

# "FOR A LONG TIME, SUSTAINABILITY WAS MORE AN ACCIDENTAL BY-PRODUCT"

# Industrial Sustainability ‘Made in Germany’

Industrial Sustainability is created at the point where sustainability, innovation and process excellence intersect. Few products embody this principle as well as the screw compactors manufactured and sold worldwide by H&G Systems.

These waste disposal solutions, which come from a medium-sized company based in the Siegerland region of Germany, enable the compaction of large-volume waste and recyclable materials, handling anything from plastic and composite materials to cardboard boxes and Euro pallets.

Thanks to their electromechanical direct drive systems and effective screw shape, designed to break down materials while generating a constant forward motion, the products achieve significantly higher throughput rates and filling weights than conventional hydraulic pressing systems. As a result of their superior compaction, denser load weights can be achieved, allowing more efficient shipping and enabling CO2 savings of up to 50%.

At the same time, the H&G Group itself is a shining example of corporate sustainability. A family-owned and managed business, this technology and market leader supplies products worldwide to customers from its headquarters in Burbach, helping to control the rising global tide of waste and recyclable materials in logistics and trade.

**DIALOG:** Your innovative screw compactor promises reductions of up to 50% in CO2 compared to conventional disposal solutions. What role does such a sustainability benefit play in the eyes of your customers?

**BH:** I think the perspective on this has changed a lot. When we started developing the screw compactor back in the 1990s, the initial focus was on very specific questions of process efficiency: how can you organize the disposal of cardboard boxes without having refuse trucks blocking the loading ramp twice a day? How can the number of trips be reduced by increasing transport load weights?

Of course, even then, this had an impact on reducing CO2 emissions - but the focus mainly was on optimizing operational processes and disposal costs. Sustainability was an accidental by-product, so to speak. Since then, we have seen this aspect increasingly coming to the fore, because companies are taking a closer look at their own CO2 footprints: they are actively looking for easy wins, areas where they can make their processes more sustainable and resource-efficient.

**DIALOG:** Has this stronger focus on sustainability at your customers also changed your own processes?

Bernd Henrich: Yes, quite significantly. Today, we are in a position to offer our products on a climate-neutral basis. In order to be able to justify that claim, we determined our own carbon footprint and have since been working continuously to make our value creation processes largely climate neutral.

As far as production is concerned, this initially comes down to the type of energy supply used: with a combination of photovoltaics and a combined heat and power plant, we now generate 60 percent of our energy requirements from renewable sources. And what electricity we can't generate now comes from 'green' renewable energy sources, too.

In addition, we are constantly trying to reduce the wastage of resources in a multitude of areas. A good example is our recent investment in two new paint shops, both of which have heat recovery, which reduces paint wastage, as well as energy consumption.

**DIALOG:** Most CO2 emissions occur in the supply chain. Steel in particular, as an essential component of your products, is a very climate-intensive material. What does that mean for your supply chain management?

**BH:** Yes, steel is a raw material whose production releases large quantities of CO2. New process methods for CO2-neutral steel production using green hydrogen could change that one day but they are still several years away. Until then, we are relying on CO2-reduced steels and working to optimize our supply chain footprint. We do this by purchasing the materials we need to manufacture our machines in Europe, wherever possible, and also have the mechanical processing carried out in the region, too, where we can. Unfortunately, this is not always that easy, as many steel mills have downsized their portfolios in recent years.

**AH:** We rely heavily on our partners to make our supply chain sustainable. This also applies when it comes to the issue of transparency. In order to be able to reliably report the footprint of our machines, we have to hold our suppliers and upstream suppliers accountable for proving what the carbon footprint of their supplied materials and components are, before we install them in our machines. These are things that we are constantly examining as part of our overall sustainability strategy.

**DIALOG:** The H&G Group is an family owned and managed business. How does that shape your view of sustainability?

**AH:** For us, sustainable entrepreneurship means working responsibly with the resources that are available to us. This applies both to the investments we make and to the natural resources we consume. But above all, it applies to the people who live and work here in the region.

**DIALOG:** What role do these regional roots play for you, in terms of sustainability?

**Bernd Henrich:** Our connection to the location and the region determines our actions in many respects. For us, the preservation and further enhancement of the location always take top priority.

With more than 150 employees working in our company, we supply more than 35 countries, spread across the globe, from here. We very much see ourselves as part of the community and are actively involved - whether that be in the local sports club or with local fire department - and want to offer the people here a lasting, stable perspective. That certainly sets us apart from one or two other large corporations.

At the same time, our location also regulates our actions. Because the company was founded 60 years ago on open countryside, we now find ourselves bordering a landscape conservation area and so are always looking for ways to reconcile our growth with the need to conserve nature. For me, dealing with these framework conditions and their interactions forms the core of sustainable entrepreneurship. And so far, I think we've done pretty well.

# “YESTER-DAY’S FUTURES REACH OUT FOR OUR PRESENT”

Interview with Sebastian Pirling, editor of the science fiction program of Heyne Verlag

**DIALOG:** Mr. Pirling, when technology and ecology collide in modern science fiction literature, we invariably seem to end up being presented with dystopian scenarios. Where does all this pessimism come from?

**SP:** I think the question pretty summarises what science fiction has done in the last decades, which is to extrapolate from the picture we have of our present right now. From that viewpoint, the reflective gaze turns back to the present and how humans access the world with their lifestyles and technology. A degree of pessimism and disillusionment can certainly be observed here!

I believe this tendency is embedded in a certain zeitgeist. With the beginning of the atomic age, it became possible to interfere with the innermost structure of matter and to make it submissive, in the literal sense of the word. At the same time, the development of the atomic bomb was accompanied by a kind of global shuddering. The euphoria of progress, something that previously determined our willingness to strive, as a matter of course, has since been lost to us.

New questions arise: What is progress? Is this the kind of progress we want? What are we doing to the environment? What are we doing to each other? What are we doing with technology? These questions can be asked about many areas, including artificial intelligence, environmental technologies, energy economics, and so on. Where technology, business and politics are thought of as the future, we see this disillusionment manifest itself. That strikes me as a fundamental, dominant paradigm.

**DIALOG:** The better we understand the world through technology, the stronger our sense that things are connected and that what we do today will have a global impact tomorrow. From technology to legislation and to new streams of philosophy, there is a desire to understand the key environmental connections and interactions. Science fiction is also part of this evolution. Where once a flight to the moon was simply that, environmental perspectives have increasingly come to the fore. There is a realization that everything we do has consequences, that there is no escape from the consequences of our actions. Does this understanding also lead to a dystopian picture of our existence?

**SP:** I would absolutely underline the idea of interconnectedness. That also forces a much more complex and concrete narrative, a stronger reflection on what it's like to actually be here today. You can see that very well in the works of an author like Kim Stanley Robinson, for example, who became very famous with his Mars trilogy. In it, he painted a grand, panoramic picture of Mars colonization, including terraforming and geo-engineering – planetary scale activities , in other words.

But Robinson's books are now moving away from distant worlds and ever closer to our own planet. In his latest work, 'The Ministry of the Future', he writes of a near future in which environmental collapse is already beginning to occur. It begins with a scene in a village in India, in which temperatures suddenly rise so high one summer that only a few people, those who manage to dive into a nearby lake, survive. From this point, he thinks very specifically about what a world might look like in which the worst predictions about climate change have come to pass.

The realization that there is no Plan B for humanity is a major thread in the current genre of sci-fi literature. It's a departure from the 'frontier' concept: i.e. the idea that in order to survive we just have to conquer more and more of space, moving ever further out into the galaxies. Now it's starting to dawn upon us that, no matter how far we travel, we always take ourselves with us. That we first have to solve our current problems in the here and now. This 'pausing' of outlook is also evident in current science fiction themes, which increasingly approximate our environmetal, political and technological present.

**DIALOG:** Let's take this thought further. There is a whole series of more recent science fiction narratives that either operate with technologies that are already there - as in the novels of Daniel Suarez or Andy Weir - or that turn increasingly to environmental themes. Here a line can be drawn between Robert Heinlein's very speculative 1950 story 'The Man Who Sold the Moon' and Richard Morgan's very 'concrete' 2004 novel 'Profit'. What makes the present suddenly narratable as a science fiction scenario?

**SP:** Yesterday's futures are increasingly encroaching on our present. I think that's why there's a feeling spreading in the genre that we are running out of future themes. The last great conquest of 'space' in science fiction was perhaps cyberspace in the 1980s. And that space was already so close to us that fiction has strongly influenced the present and technology. From William Gibson's 'Neuromancer' to Ronald Reagan's cyber-security program and the commercial Metaverse, there's a clear line of influence.

But what are the themes today? Artificial Intelligence has been the subject of many science fiction drafts, such as the short story 'The Machine Stands Still' by E. M. Forster, written over 100 years ago. And now we have Chat GPT!

So, the future as an arena of dreams, is being taken out of our hands to some extent. We only have to go around the corner to find a room waiting for us that we don't really understand yet, but in which buttons can already be pressed. That seems to me to be an important reason why stories are moving closer to our here and now.

**DIALOG:** In science fiction, generally speaking, there seems to be little belief that democracy can endure. There's hardly a future world portrayed in fiction that isn't ruled by despots, or under the dictates of global corporations, tech-dependent administrators, or fascist regimes. At the same time, environmental and political dystopias often seem to correlate with the narratives. How do you explain this staggeringly pessimistic perspective?

**SP:** It is partly rooted in the narrative structures. Democracy is very much of the present but, at the same time, it's also always a balancing act. And science fiction usually tries to envision what it's like when the status quo encounters a crisis and we slide off the horse, from one side or the other. This quickly leads to very gloomy predictions. Democracy, as an essential aspect of, at least, Western reality, often comes under attack.

But there are also 'undercurrents' in fiction that are trying to free themselves from this dystopian maelstrom. They are guided by the idea that we must continue to think about the preservation of democracy as a contemporary challenge, but not stop doing anything when we realize the seriousness of our situation. In the process, by the way, the genre boundaries are also becoming more fluid, encompassing fantasy and classic fairy tales, as well as more 'traditional' scientifically-based scenarios.

**DIALOG:** Let's take a closer look at this new 'frontier' opening up ahead. We see technological, but also societal changes happening so fast that the boundary between today and tomorrow is blurring - a new kind of 'transition zone' is emerging where speculative storytelling and strategic management meet philosophical and scientific analysis.

And we see that global challenges that lie in this zone cannot adequately be dealt with, or even described particularly well, using our functionally differentiated approach. Is this one of the reasons for the resurgence of interest in science fiction literature among decision-makers in business and politics?

**SP:** I'd like to say two things about that. First, we need to clarify the difference between extrapolating futurology, on the one hand, and what science fiction actually represents, on the other. Both are in the 'future-gazing' business but bring completely different perspectives. For example, futurologists looking at the rise of the motor car back in the 1950s, the golden age of Hollywood predicted, 'Someday there won't be movie theaters, there will be drive-in theaters.' Science fiction writers took the same starting point and instead foresaw the coming sexual revolution!

So, it's about non-linearity, about taking the technological extrapolation back to the subject of humanity, to the ethical, political and psychological questions that arise from a technology-driven scenario. So instead of asking 'What if we could go to Mars?', you then move to questions about how well we would be able to live with each other there, or what it would mean if a human were born on the red planet?

This movement of thought is central to science fiction. And that is why the views of authors within the genre, on technological or political issues, is becoming increasingly interesting and relatable to grander strategic discourses, those that have to deal with growing uncertainty and the limitations of classical extrapolation.

**DIALOG:** What is the second aspect?

**SP:** It concerns the so-called heterotopia, a term coined by Michel Foucault. He used it to describe spaces that are in our midst and yet function according to fundamentally different rules. Take, for example, a cemetery: we visit one and suddenly completely different rules apply there, it's a different sphere. I think this also applies to many ideas and themes in science fiction.

For example, the superintelligence that Nick Bostrom talks about in his book of the same name, describes an idea that has been haunting science fiction for decades. It asks how we would deal with an alien being that we may have created but which has now outgrown us. This extends to a singularity that radically tilts our lives, a new 'Oppenheimer' moment. This can be horror, as in Harlan Ellison's 'I Must Scream and Have No Mouth', or an absolute technological utopia.

But the crucial thing is the heterotopian perspective, the awareness that something like artificial intelligence is already here. The transition zone between the future and the present could therefore be much broader and more permeable than we think. Analysing this with classic forecasting tools doesn't seem to work very well. And that may explain why the specific approach of science fiction narratives is so fruitful.

**DIALOG:** Our view of the environment, its complexity, interdependencies and feedback, is beginning to fundamentally change, a change that is being accompanied by frictions and difficulties. How is science fiction dealing with this transformation, away from themes like terraforming and engineering euphoria towards a more holistic perspective?

**SP:** The narrative of 'we're going to go out into space and rebuild everything we discover' was indeed a dominant one, for many decades. In effect, a kind of expansive 'cowboy tames the Wild West' philosophy, extrapolated into outer space, the opposite of systemic, environmental thinking. The thinking was that there are infinite resources, if not on Earth, then certainly in space...we just have to reach out and get them. The mainstream in science fiction followed exactly the same paradigm as mainstream economics and politics.

But there have always been alternative narratives, such as Ursula Le Guin's 'The Word for World is Forest'. Here a group of colonist engineers on a planet learns that the vast forest is not a degradable resource, but that the world itself is an intelligence, a counterpart. And that the indigenous population of the planet knows that an action against the environment is an action against the world itself.

Sebastian Pirling,
editor of publisher Heyne Verlag's
science fiction program

"The realization that there is no Plan B for humanity is a major thread in the current genre of sci-fi literature"

This perspective is becoming very important today - the realization that resources are finite and that we cannot leave the world behind. That we need to make the true cost of resource consumption the basis of political and economic decisions. That seems to me to be an interesting line of thinking, one where science fiction has a lot to offer.

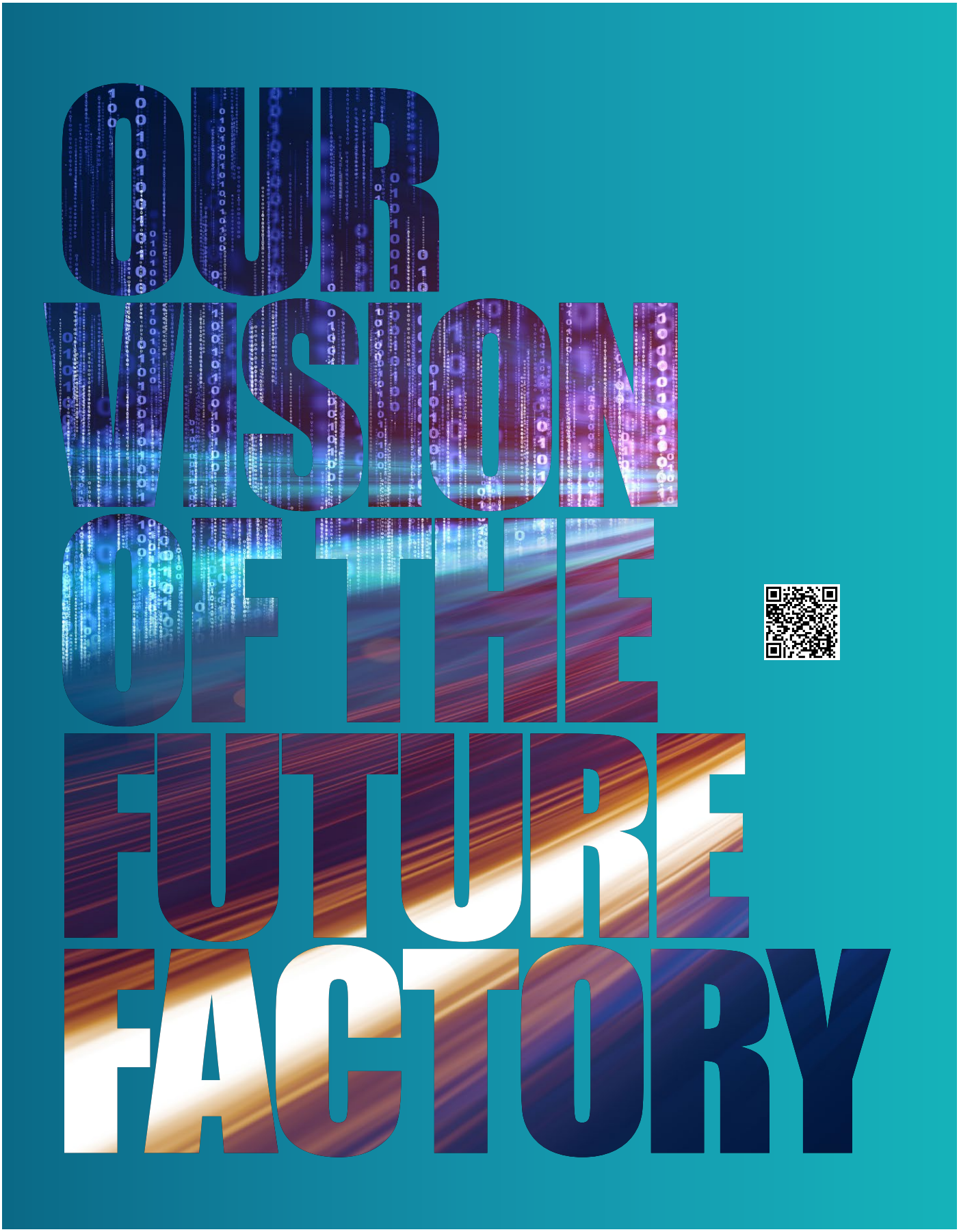
**DIALOG:** Frank Herbert's legendary Dune cycle, created in the mid-1960s, begins with a dedication: „To the people whose occupation goes beyond the realm of 'realistic projects'; to the dryland ecologists, wherever they will work or at whatever time, this attempt at prediction is dedicated in recognition and reverence."

What do you think moved Herbert, at that time, to place ecological concerns at the center of his fictional world's construction?

**SP:** Frank Herbert immersed himself in the detail of the landscapes he created for the desert planet of Arrakis, along with its coveted Spice deposits. And as a very holistic thinker, he also began to think about being in that world and its ecology. One overarching question that runs through the Desert Planet cycle is whether the planet should be preserved as a desert, or instead transformed into a thriving landscape. Central to this is the idea that Spice is a resource that can only emerge from an intact desert ecology. The book itself does not clearly answer this question.

It seems particularly interesting to me that ecological issues are never treated as a purely factual subject in Herbert's work. As the narrator, he asks, "What does this world do to people - and what do people do to this world?" And he considers the resonant effects of this interaction, and the critical risks that can arise from the resulting ripples.

That is his great skill, and the important lesson that I take away from his books: truly environmental thinking always asks the most important question: how do we want to shape our place in the world?


OUR
VISION
OF THE
FUTURE
FACTORY

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