



The three revolutions shaping the future of manufacturing



Gerd Leonhard

Manufacturing, once confined to assembly lines and manual labour, is on the cusp of transformative change. Three revolutions are converging to reshape the industry: the digital revolution, the sustainability revolution, and the purpose revolution. These seismic shifts promise to redefine how we produce goods, consume resources, and envision the role of business in society. In a recent podcast with **EIT Manufacturing**, futurist and CEO of The Futures Agency **Gerd Leonhard** provided a fascinating insight into how these revolutions will impact on the next decade of manufacturing. We listened in and here's the summary of what was said

1

The digital revolution: Connecting the dots

At the forefront of the manufacturing evolution is the digital revolution. This entails the integration of smart technologies into every aspect of production, from predictive analytics to robotic process automation. The result is a paradigm shift in efficiency, speed, and environmental sustainability. Through real-time data analysis and automation, manufacturers can optimise operations, reduce waste, and minimise pollution. This revolution isn't just about harnessing technology; it's about leveraging connectivity to unlock unprecedented levels of productivity and resource conservation.

2

Sustainability revolution: Fossil fuels to renewables

The urgency of climate change has propelled the sustainability revolution to the forefront of manufacturing agendas worldwide. With a concerted push towards renewable energy and circular economies, the industry is undergoing a monumental shift away from fossil fuels. Governments, corporations, and consumers are increasingly prioritising green initiatives, recognising that sustainability is not just an ethical imperative but also a profitable venture. Investments in renewable technologies are soaring, paving the way for cleaner, greener manufacturing. Momentum towards sustainability is irreversible.

3

The purpose revolution: Redefining business objectives

A generational shift is underway as younger leaders usher in the purpose revolution. Millennials and Gen Z, driven by values beyond profit margins, are reshaping the priorities of businesses. Their agenda emphasises holistic prosperity, encompassing people, planet, purpose, and prosperity. Profitability is no longer the sole measure of success; companies are expected to contribute positively to society and the environment. This shift in ethos is challenging traditional business models, driving a wave of corporate social responsibility and ethical entrepreneurship.

Technological synergy

These revolutions are not isolated phenomena but interconnected forces driving manufacturing into uncharted territory. The convergence of technologies such as quantum computing, 3D printing, artificial intelligence, and renewable energy heralds a new era of limitless possibility. With computing power reaching unprecedented levels and AI deciphering complex data patterns, manufacturing processes are poised for unparalleled efficiency and innovation. Moreover, the transition to sustainable energy sources promises to further accelerate progress, providing the foundation for a cleaner, more resilient future.

As we stand on the precipice of this manufacturing revolution, challenges and opportunities abound. Ethical considerations surrounding AI and autonomous technologies must be addressed, alongside policy reforms to ensure equitable access to emerging technologies. Moreover, industries reliant on fossil fuels face a critical juncture in their transition to renewable energy. However, with proactive measures and collaborative efforts, these challenges can be overcome.

In embracing these revolutions, manufacturers have the opportunity to not only thrive but also lead the charge towards a more sustainable, purpose-driven future. By harnessing the power of technology, embracing sustainability, and redefining business objectives, the manufacturing industry can pave the way for a new era of innovation and prosperity.

But the time to act is now, for those who fail to adapt, risk being left behind in the wake of progress.

In the landscape of manufacturing, the traditional model of self-reliance is evolving into a collaborative ecosystem of innovation and progress. Companies are recognising the power of partnerships and leveraging diverse networks to drive efficiency, sustainability, and innovation. There are many ways for businesses to harness these opportunities:

Rather than operating in isolation, successful companies are embracing ecosystem thinking. By collaborating with a multitude of partners,

from start-ups to research organisations, companies can tap into a vast pool of expertise and resources. This approach fosters innovation, agility, and accelerated progress, as each participant contributes their unique strengths to the collective effort.

In this era of ecosystems, strategic partnerships are also essential for success. Companies should seek out partners who complement their capabilities and share their vision for the future. Forging strategic alliances can unlock new opportunities for growth and differentiation and include valuable and diverse skillsets.

Diverse skills are essential in this changing world. As the manufacturing landscape undergoes rapid transformation, regulatory frameworks are evolving to prioritise sustainability and environmental protection. Companies must anticipate and adapt to these regulatory shifts proactively. By incorporating circular and sustainable practices into their operations, businesses can ensure compliance while also driving competitive advantage in an increasingly green-conscious and changing market.

Don't be afraid of this change – embrace it. The adage "gradually, then suddenly" encapsulates the essence of the manufacturing revolution. While change may seem incremental at first, there will come a tipping point where innovations such as 3D printing and decentralised manufacturing become the new norm. Companies should embrace this gradual evolution and position themselves to capitalise on emerging trends and technologies and foster a culture of resilience and agility.

In a rapidly changing landscape, resilience and agility are paramount. Companies must cultivate organisational flexibility to adapt to shifting market dynamics and technological advancements. By fostering a culture of innovation and experimentation, businesses can stay ahead of the curve and seize opportunities as they arise.

Of course, throughout this change, it is the customer that must remain paramount, too and industries must prioritize a customer-centric approach amidst the technological upheaval. It will be essential not to lose sight of the end

customer. Companies should prioritise customer-centricity in their product development and manufacturing processes. By understanding and anticipating customer needs, businesses can deliver superior products and experiences that drive loyalty and market differentiation.

The future of manufacturing lies in collaboration, innovation, and sustainability. By embracing ecosystem thinking, cultivating strategic partnerships, anticipating regulatory shifts, and fostering resilience, companies can navigate the complexities of the modern manufacturing landscape with confidence and agility. As we continue to evolve, those who embrace change and leverage opportunities will emerge as leaders in the era of manufacturing ecosystems.

Manufacturing as a service: Navigating the intersection of purpose, automation, and ecosystems

As the manufacturing landscape undergoes unprecedented transformation, the emergence of Manufacturing as a Service (MaaS) is poised to revolutionise the industry, too. MaaS represents a paradigm shift towards on-demand, decentralised production, enabled by advanced technologies such as 3D printing and automation. However, the implications of this shift extend far beyond operational efficiency, touching upon broader societal and economic considerations.

Leveraging automation and technology are, of course key in this regard. They lie at the heart of MaaS. Robotics, AI, and 3D printing are driving the transition towards on-demand manufacturing, allowing for rapid prototyping, customisation, and decentralised production. Companies that embrace these technologies stand to gain a competitive edge in terms of speed, flexibility, and cost-effectiveness.

In parallel with technological advancements, however, there is a growing emphasis on purpose-driven business models. The younger generation, in particular, values companies that prioritise people, planet, purpose, and prosperity over profit maximisation. Employers must adapt to this shift by aligning their operations with sustainable practices, ethical sourcing,

and social responsibility. MaaS presents an opportunity for companies to demonstrate their commitment to these values by reducing waste, minimising environmental impact, and fostering equitable employment practices.

MaaS also thrives on collaboration and partnerships within ecosystems of innovation. Rather than operating in silos, companies are leveraging diverse networks of suppliers, start-ups, and research institutions to co-create value. This collaborative approach fosters innovation, accelerates product development, and expands market reach. By cultivating strategic partnerships, companies can access a wealth of expertise and resources, driving mutual growth and success.

Collaboration must also exist on the factory floor. While automation and technology promise increased efficiency and productivity, they also raise concerns about job displacement and socio-economic inequality. Employers must navigate this delicate balance by investing in upskilling, reskilling, and workforce development initiatives. By empowering employees with the skills and training needed to thrive in a rapidly evolving landscape, companies can mitigate the negative impacts of automation and ensure a more equitable distribution of opportunities.

Ultimately, the rise of MaaS reflects a broader shift in economic paradigms towards purpose-driven capitalism. Profit maximisation is no longer the sole measure of success; companies are increasingly judged by their contributions to society and the environment. By embracing this holistic approach to business that prioritises sustainability, social responsibility, and purpose, companies can not only survive but thrive in the era of Manufacturing as a Service, which represents a transformative force reshaping the manufacturing industry. By leveraging automation, embracing purpose-driven business models, fostering collaborative ecosystems, addressing socio-economic impacts, and shifting economic paradigms, companies can harness the full potential of MaaS to drive innovation, sustainability, and prosperity for all stakeholders. As we navigate this era of unprecedented change, it is imperative that we embrace these opportunities and remain mindful of our broader, societal and ethical responsibilities.

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Decoupling economic growth from carbon: A roadmap for change

The imperative to decouple economic growth from carbon emissions is no longer a lofty ambition but a pressing necessity in the face of climate change. Fortunately, the groundwork for such a transition has already been laid, with successful examples of countries and industries achieving economic growth while simultaneously reducing their carbon footprint. However, the path forward requires concerted efforts at both the global and local levels, with a focus on technology, regulation, and societal shifts.

Achieving decoupling on a global scale necessitates collaboration amongst nations, particularly between developed and developing countries. Financial investment and technological support must flow from wealthier nations to those with emerging economies, enabling them to adopt cleaner and more efficient technologies. This requires a reorientation of global priorities, with a focus on collective action to address climate change as a shared challenge.

Technology serves as a crucial enabler in decoupling economic growth from carbon emissions. Advancements in areas such as renewable energy, transportation, and manufacturing have already shown promise in reducing emissions while driving economic prosperity. Governments and industries must prioritise research and development in clean technologies, incentivising innovation and adoption through subsidies, tax breaks, and investment incentives.

Regulatory frameworks also play a pivotal role in shaping the behaviour of companies and consumers towards more sustainable practices. So governments must enact policies that discourage carbon-intensive activities, such as fossil fuel subsidies, while incentivising renewable energy, energy efficiency, and sustainable transportation. Carbon pricing mechanisms, such as carbon taxes or cap-and-trade systems, can internalise the environmental costs of carbon emissions, providing economic incentives for emission reductions.

Another important aspect of this decoupling is the need for a fundamental shift in societal attitudes towards consumption and sustainability.



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Grassroots movements and public awareness campaigns can raise consciousness about the environmental impact of individual choices, encouraging consumers to opt for eco-friendly products and services. Companies, in turn, must align their business models with sustainability principles, responding to consumer demand for ethical and environmentally responsible practices.

The transition towards this requires a delicate balance of incentives and disincentives to steer behaviour towards sustainability. While incentives such as subsidies for renewable energy or tax breaks for energy-efficient technologies can stimulate investment and innovation, disincentives such as carbon taxes or emissions trading schemes can discourage carbon-intensive activities. Striking the right balance ensures that economic growth is aligned with environmental sustainability.

Ultimately, the success of decoupling hinges on public support and political will to prioritise climate action. Grassroots movements, advocacy groups, and informed citizens can exert pressure on policymakers to enact ambitious climate

policies and hold businesses accountable for their environmental impact. Political leaders must demonstrate courage and vision in championing policies that prioritise long-term sustainability over short-term gains.

Essentially, decoupling economic growth from carbon emissions is both an imperative and an opportunity to build a more sustainable and prosperous future. By leveraging technological innovation, enacting supportive policies, shifting societal norms, and mobilising public support, we can accelerate the transition towards a low-carbon economy. The time for action is now, and the path forward requires bold leadership, collaboration, and a shared commitment to safeguarding the planet for future generations.

Balancing regulation and global competitiveness in Europe: A strategic approach

As Europe navigates the transition towards this more sustainable and technologically advanced future, it must strike a delicate balance between implementing regulations that promote environmental and societal well-being while ensuring its global competitive position remains intact.

Global collaboration on key issues is a good starting point here. Europe should advocate for global agreements on crucial matters such as climate change mitigation, AI governance, and technology standards. By collaborating with other nations, particularly major players like the United States and China, Europe can ensure that regulations are globally aligned, preventing discrepancies that could disadvantage European businesses on the international stage.

Clear standards and legal frameworks will also be key in these collaborative efforts. European regulations should, therefore, focus on setting clear standards and frameworks that provide guidance for businesses while promoting innovation and competitiveness. Rather than imposing overly restrictive measures, regulations should incentivise sustainable practices and technological advancements. This approach fosters a supportive environment for businesses to thrive while meeting societal and environmental objectives.

Europe can differentiate itself in these efforts as well by prioritising ethical and sustainable innovation. Horizon Europe is a good example of this approach. Wider regulations should encourage businesses to develop technologies and solutions that benefit humanity and the planet, rather than solely focusing on profit. By fostering a culture of responsible innovation, Europe can position itself as a global leader in shaping a more sustainable future.

Europe's single market is another huge advantage as it provides a unique advantage for businesses operating within its borders. By harmonising regulations across member states, Europe creates a level playing field for businesses while unlocking the potential of a market of over 440 million consumers. This scale offers opportunities for businesses to innovate, scale up, and compete globally while adhering to common regulatory standards.

So, Europe must take advantage of this and must invest in future-focused initiatives that drive innovation and competitiveness. This includes funding even more research and development in emerging technologies, supporting start-ups and SMEs, and fostering a culture of entrepreneurship and risk-taking. By investing in its future, Europe can cultivate a dynamic ecosystem that attracts talent, fosters innovation, and maintains its competitive edge on the global stage.

Europe will need to do all these things to succeed in the global arena. Europe must cultivate a mindset that embraces the future as an opportunity rather than a challenge. By fostering a culture of optimism, ambition, and forward-thinking, Europe can inspire innovation and creativity among its citizens and businesses. This shift in mindset is essential for driving the transformative changes needed to address global challenges while maintaining competitiveness.

In conclusion, Europe's regulatory approach should prioritise collaboration, clear standards, ethical innovation, leveraging the single market, strategic investment, and a future-oriented mindset. By striking this balance, Europe can navigate the complexities of global competition while leading the way towards a more sustainable, prosperous, and technologically advanced future.

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