THE FUTURE OF MANUFACTURING

How Digitalization & Sustainability will shape the
Business Models of Manufacturing Companies by 2030

ABOUT THE REPORT

This report is produced by Kairos Future in cooperation with PLM Group. The report's findings result from thorough research carried out during the winter and spring of 2022. The result of the research was then analyzed and discussed with PLM Group representatives and customers.

In addition to this research, Kairos Future has conducted a survey among 58 top executives in manufacturing companies in Sweden, Denmark, and Finland, where questions and issues regarding this report were investigated and discussed. There are also some results from the EGN Leadership Report based on a survey of 2200 leaders in Western Europe in late 2021, where 250 respondents were from manufacturing SMEs in the Nordic Countries. The facts and figures in the report referring to the EGN Leadership report are from these 250 respondents.

ABOUT KAIROS FUTURE

Kairos Future is an international consulting and research company that helps companies and business leaders to understand and shape their futures. We work as consultants for strategic futures, providing our clients with trend analysis and scenario planning, strategy and innovation, strategic change, and capability development. The company was founded in 1993 and has its head office in Stockholm and representatives and partners around the globe.

ABOUT PLM GROUP

We make you innovate. Our mission is to empower people and manufacturing companies to innovate. We do that by digitally transforming your entire value chain, integrating every stage of the product lifecycle from design to aftermarket.

As an innovation partner we support companies across many industries. We have been collaborating with Dassault Systèmes SOLIDWORKS for over 25 years as a value adding partner. Our 3D Printing division co-operates with world-leading additive manufacturing companies, allowing us to provide our customers with the latest and greatest technologies.

Our local teams of experts and global partnerships are at your service. Get in touch.

EXECUTIVE SUMMARY

This is a report on the future of the manufacturing industry. It's an industry facing transformative times. Increased turbulence and complexity have arisen in 2022 with a new risk: excessive energy and primary resource costs, supply chain problems, upcoming inflation, and increased financial costs.

At the same time, the two megatrends, digitalization and sustainability, continue to change the business landscape for manufacturers steadily. These megatrends harness several specific trends that will reshape business models and production terms. This development will call for new business models for many small and medium-sized manufacturing companies.

Sustainability trends are driven by increased consumer demands, the financial industry, and regulators, especially in the EU. The demands will likely widen to more subjects and extend beyond one business.

These needs will deepen and new levels of traceability for the products and services the manufacturing industry provides to the market will follow.

Digital development leads to hyper-automation in every department of every organization. It creates a data-driven business landscape that, together with servitization, currently profoundly changes most industries' business models. Digitalization combined with an up-levelled material revolution are on the verge of creating an additive manufacturing situation that enables increased localization in the years to come.

This development leads to a future where blurred lines will be part of the transformation process for businesses and organizations. The future calls for future-proof strategies to ensure short- and long-term success. True innovation will become a necessity. This report presents five points of advice for manufacturers that want to ensure a future-proof business.

DRIVERS OF CHANGE

Digitalization

Sustainability

Increased risks

TRENDS IN MANUFACTURING

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DRIVERS OF CHANGE

Sustainability, innovation, and digital transformation are the most critical and crucial challenges in the next three to five years, according to top executives in the manufacturing industry in Denmark, Finland, and Sweden. In the upcoming year, the strategic priorities instead are accomplishing growth, managing economic downturn, and dealing with supply chain issues.

The above underlines that even though a turbulent and uncertain year like 2022, sustainability issues and digital transformation have become the main drivers that will shape the future of the manufacturing industry towards 2030.

These trends drive the necessity of true innovation further. Even though there has been plenty of focus on buzz words like Industry 4.0 and similar; this is now becoming a reality.

Therefore, it's necessary to have the following drivers as a starting point when finding out what the future of the manufacturing landscape will look like.

DIGITALIZATION

Digitalization affects all industries and businesses, and manufacturing is no exception. New technology and digital tools continuously unveil new opportunities and make us more efficient, productive, and creative. IoT and sensors help generate new data that allow measuring almost anything in real time.

Artificial intelligence and advanced analytics will enable us to generate new insights based on the data. Collaborative platforms and digital tools help us work together and make better decisions based on our gathered data and insight.

65% OF TOP LEADERS IN MANUFACTURING COMPANIES HAVE DEFINED ACTIONS ON DIGITAL TRANSFORMATION

For manufacturing, digitalization has the potential to transform business models and unlock new opportunities to understand and serve customers in a better way, optimize existing processes and save costs, and to manage risks intelligently.

SUSTAINABILITY

Sustainability has been a driving force for a long time, and now we see an acceleration of efforts and activities in this arena. Most companies are expected to do what they can regarding environmental sustainability, social responsibility, and inclusiveness. ESG (Environmental, Social, and Governance) demands from regulators, investors, and customers to guide capital for companies embracing this opportunity.

For manufacturing, sustainability will become an even more critical business driver and competitive advantage, and companies that make the necessary investments will be rewarded in the long run.

IN 5 YEARS TIME, HOW IS YOUR ORGANISATION PLANNING TO DEAL WITH THE UNCERTAIN FUTURE?

Source EGN Leadership Report 2022

74% OF TOP LEADERS IN MANUFACTURING COMPANIES HAVE DEFINED ACTIONS ON SUSTAINABILITY

INCREASED RISKS

Recent years have shown us that we cannot take anything for granted. The COVID pandemic has disturbed our supply chains and forced us to adopt new ways of working. The war in Ukraine came unexpectedly just as we were beginning to emerge from the pandemic. The current concerns evolve around inflation, cybersecurity, food crises, and the existential threat of climate change. Our dependency on critical infrastructure and each other has been exposed. In these uncertain times, people and companies are looking for ways to minimize risk and find long term stability.

For manufacturing, this means building sustainable businesses that can withstand rapid changes. It means creating robust and resilient supply chains and ensuring that data and digital infrastructure is secure.
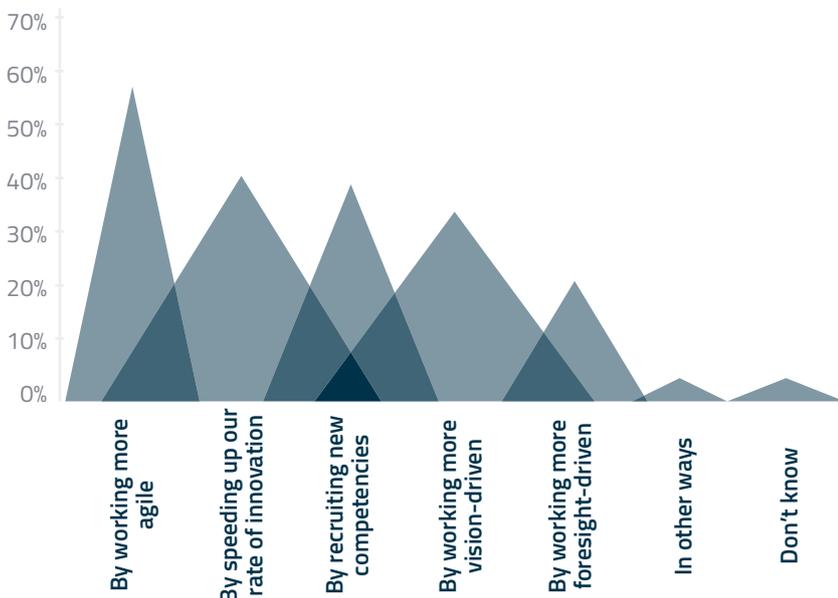
BUILDING A SUSTAINABLE BUSINESS

Many people still think of sustainability primarily in terms of environmental sustainability, yet it has come to incorporate many more aspects. Businesses today must be environmentally, socially, and economically sustainable. It means being a business that can be profitable in a changing world and survive in the long term. Sustainability is also no longer just about regulatory compliance.

SUSTAINABILITY AS A BUSINESS DRIVER

According to a study by Capgemini, 79% of consumers are changing purchase preferences based on the social responsibility, inclusiveness, or environmental impact of their purchases, but only 36% of organizations believe that consumers are willing to make this change.[2]

79% OF CONSUMERS ARE CHANGING PURCHASE PREFERENCES BASED ON SOCIAL RESPONSIBILITY, INCLUSIVENESS, OR ENVIRONMENTAL IMPACT

Over the last few years, sustainability has developed from mainly a brand risk issue to business-driven sustainability.

"Our purpose is to drive the shift towards a sustainable transport system, creating a world of mobility that is better for business, society, and the environment"

THE OFFICIAL PURPOSE OF SCANIA, SWEDISH TRUCK AND BUS MANUFACTURER

As customers change their behavior based on the impact of their purchases, companies need to see sustainability as a business driver. This will be the case for everyone, not just for B2C companies. Large manufacturing B2B giants are driven by their B2C clients, and today a vast majority of them consider sustainability a valid business driver with both risk and opportunity. Their sustainability ambitions will therefore trickle down to all subcontractors down the line. In the future, most businesses need to become sustainable to survive and attract customers. For manufacturing companies, sustainability can lead to innovation, competitive advantage, cost savings through operational efficiencies, lower energy use, and less waste.

INCREASING ESG DEMANDS

ESG stands for Environmental, Social, and Governance and is a framework for evaluating businesses beyond economic factors that have grown in popularity in recent years. Various governmental organizations and financial institutions currently use it, and the ESG demands from regulators, investors, and customers are rapidly increasing.

The new European Climate Law and the new 'EU fit-for-55' Taxonomy for sustainable activities will guide investments towards sustainable projects and companies. It establishes six environmental objectives, covering climate change, water, pollution, biodiversity, and circularity, and it defines conditions that economic activity needs to meet to qualify as environmentally sustainable.[3] Investors, both institutional funds and retail, are increasingly examining ESG considerations when making investment decisions.

37% OF SWEDISH RETAIL INVESTORS INVEST THEIR SAVINGS IN SUSTAINABLE FUNDS

A study from 2021 shows that 37% of Swedish retail investors already invest their savings in sustainable funds and that 77% are willing to do so.[4] This will also trickle down to the manufacturing industry, and the number of aspects that will account for sustainability issues will most likely rise in upcoming years.

With increased ESG demands from customers, regulators and investors, capital will flow to companies willing to invest in sustainability. The effects will trickle down the value chain to suppliers and partners. In the future, manufacturers that seize this opportunity will have a competitive advantage and easier access to favorable financing conditions.

END-TO-END TRACEABILITY

Sustainability has previously focused on the company's direct impact, but the boundaries of responsibility are widening. Customers are increasingly expecting companies to take full responsibility for their effects on the planet, people, and society, across the whole value chain and throughout the product life cycle.

Nowadays, it is equally vital for a company to know that their suppliers are living up to expectations as it is to know that their customers are responsibly using their products. They are also expected to be transparent and tell their customers and investors about these aspects.

Traceability has become the answer to these increasing demands for responsibility and transparency. This development demands thorough ERP solutions to keep track of the whole process.

For example, Adidas is partnering with TrusTrace to enable near real-time traceability throughout their supply chain. As materials and products move through the value chain, purchase orders, production steps, certificates, supplier declarations, and quality reports will be collected on their platform, allowing them to support their sustainability claims with hard data.[5]

Coca-Cola is another example. The company recently started using the blockchain-based service Digineto to ensure that their subcontractors use and fulfill the sustainability demands Coca-Cola sets, including those for child labor and the use of fresh water. The car manufacturer Polestar is another example that uses blockchain technology for this purpose.

In the future, customers and consumers will expect manufacturers and suppliers to provide the whole story —— from raw material to finished product —— and back it up with verifiable data. Manufacturers that prepare for this future will be well equipped to serve the demands of their customers. Still, it will require investing in new technology and forming strategic partnerships with like-minded suppliers.

"For us, transparency and traceability are very closely connected, and we need to be in the forefront using digital tools that help us detect the sustainability footprint of our products. Our customers demand it, and our coworkers need to be able to answer to customers if they can't figure it out on their own. This is a major challenge for us."

SUSTAINABILITY OFFICER, SWEDISH GROCERY RETAILER

TOWARDS NEW LEVELS OF CIRCULARITY

Circularity expands the recycling concept to include sharing, reusing, repairing, refurbishing, and remaking. It aims to take better care of our planet's scarce resources, eliminate waste and pollution, and reduce carbon emissions by creating a closed loop system.

The European Commission plans to introduce a "digital product passport" (DPP) to support the circular economy. It will contain all relevant information about the product lifecycle, including an inventory of all raw materials and components used. This increases the chance that products are reused multiple times and adequately recycled at the end of their lifetime. DPPs will initially be implemented for consumer electronics, batteries, fashion, furniture, steel, cement, and chemicals.[6]

We will reach a new level for recycling products and materials in the future. Manufacturers will play a key role in designing products that can be reused often during their lifetime and easily broken down for effective recycling.
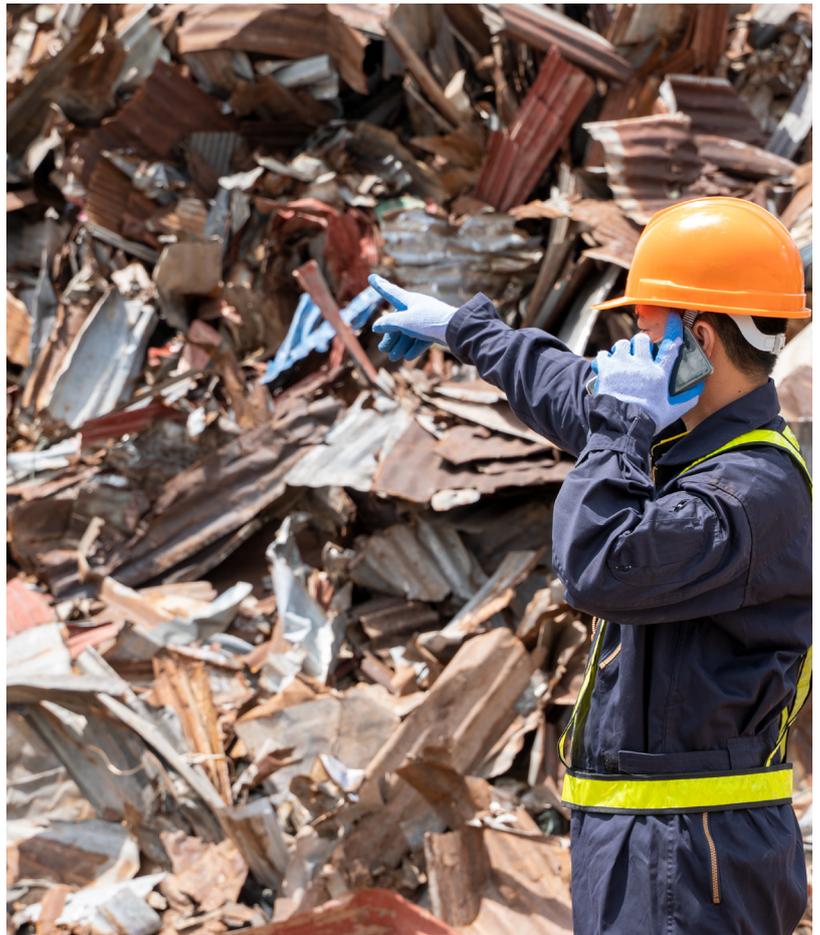
"Sustainability and circularity might be the last defense for midsized manufacturing companies. Circular solutions will drive the industry towards end-user-driven production, which means increased business localization. This is an opportunity for Europe."

CEO, SWEDISH OFFICE FURNITURE MANUFACTURER,

70% OF SME MANUFACTURERS IN SWEDEN, DENMARK, AND FINLAND HAVE DEFINED STRATEGIC TARGETS ON INCREASING CIRCULARITY

RESILIENT SUPPLY CHAINS

Nowadays, companies are more interconnected and dependent on each other than ever. As we have seen with the COVID pandemic, geopolitical uncertainty, and commodity price volatility, this interconnected system of supply chains represents a significant risk to companies in most industries. Rather than trying to manage all the risks in the system, one solution is to build supply chain resilience – i.e., supply chains that can persist, adapt, or transform in the face of change.

One way to increase supply chain resilience is to adopt dual sourcing policies and always have a backup option if something happens with one's primary supplier. Another way to decrease risk is to use shorter, less complex supply chains, such as looking for local suppliers versus international ones. Finally, digitalization and increased visibility throughout the supply chain can help one respond quicker when potentially disruptive issues occur.

In the future, it will be more important to have a resilient supply chain for manufacturing companies. While the costs for sourcing input materials might increase, the decreased risk for disruptions could lead to higher profitability and a more sustainable business in the long run.

"We thought the supply chain issue would disappear with the pandemic, but with the war in Ukraine, it's become an even bigger problem. And there will likely be new obstacles further down the road – so we will have to deal with supply chain issues for a long time."

DANISH PRODUCTION PLANT MANAGER
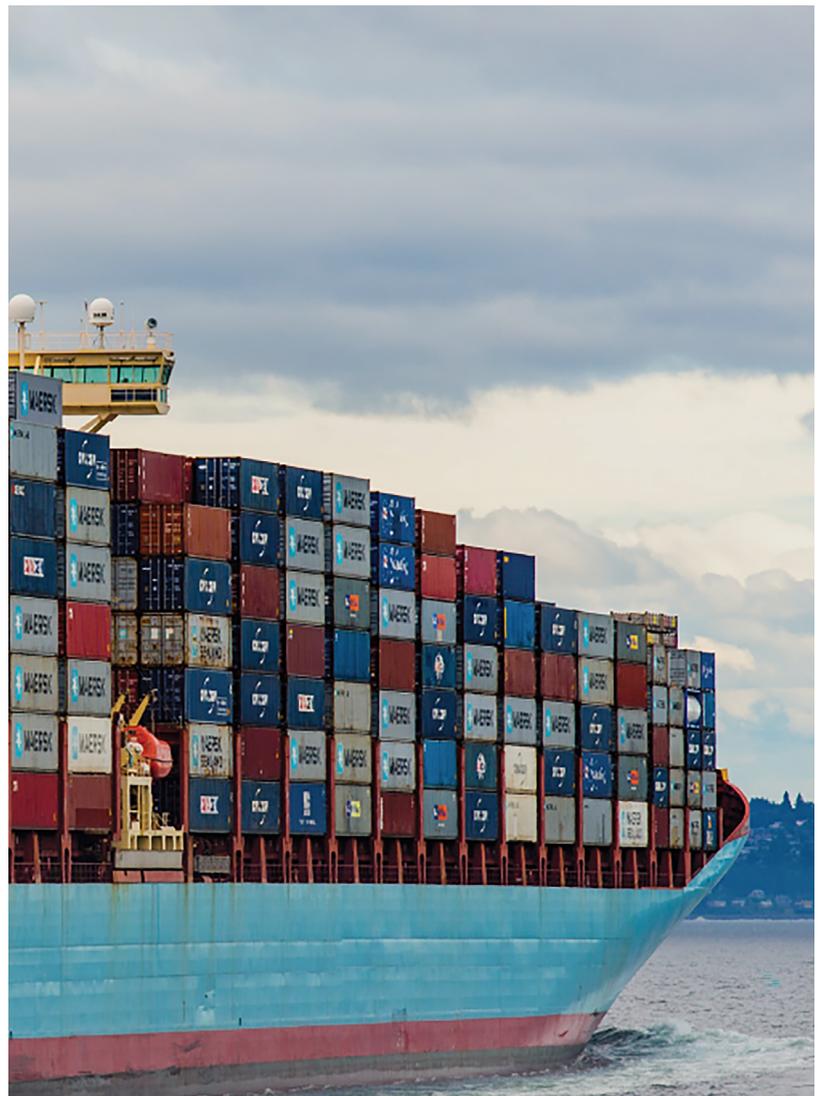
EMBRACING DIGITALIZATION AND TECHNOLOGY

A key component in all the trends covered so far is data, like reliable data on environmental sustainability, traceability throughout the value chain and product life cycle, and real-time data to detect supply chain disruptions. While many companies are trying to become more data-driven in their decision-making, data is also increasingly influencing consumers' everyday life.

DATA-DRIVEN BUSINESS AND PERSONALIZED EXPERIENCES

Consumer decisions are nudged by smart algorithm-driven recommendations based on previous habits and preferences. Moreover, when products become smart, more sources generate data that can be used to develop insights. Such insights are already used today in innovation departments and more.
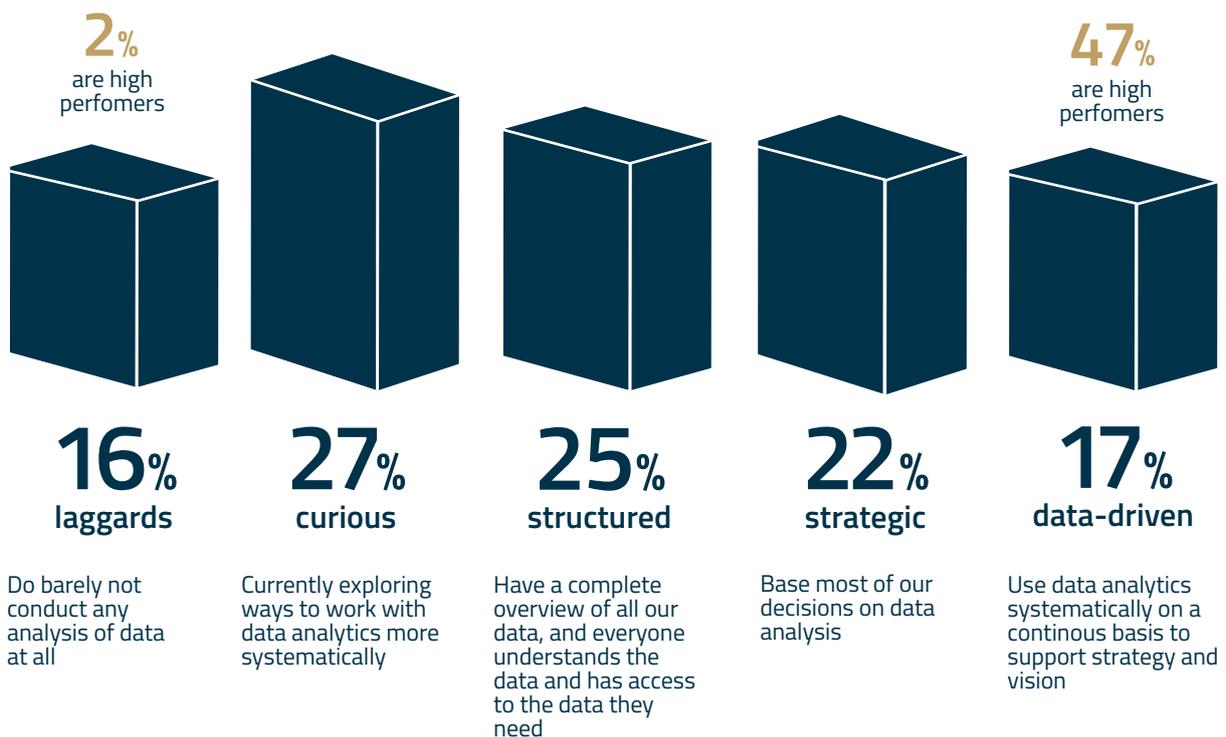

"Data analysis has become one of the most important tools for our growth strategy. It ties innovation, sales, and production together. It helps us be more efficient and customer driven."

CHANGE DIRECTOR, KONE, FINLAND

Developing a data-driven way of working is, therefore, perhaps the most critical task for current top management – in all industries. According to a study by Bisnode, nearly half of the analyzed companies that had a true understanding of and outspoken strategy for how to use data in all parts of the organization were high performers. In contrast, only two percent of the organizations that lacked a strategy for how to be data-driven were found in the high-performing group.

For manufacturing companies, emerging technologies help expand the opportunities to become data-driven. Using low-cost sensors and IoT, gathering data throughout the manufacturing process is now possible. With advanced AI and machine learning algorithms, organizations can enable predictive maintenance of expensive manufacturing machinery and reduce costs and downtime. Digital twins can enable virtual simulation of development, testing, and validation of products, and AR/VR can even let customers try products before they are made.

The correlation between data-driven companies and financial performance
Source Bisnode (Dun&Bradstreet) 2019

2% are high performers

47% are high performers

16% laggards

27% curious

25% structured

22% strategic

17% data-driven

Do barely not conduct any analysis of data at all

Currently exploring ways to work with data analytics more systematically

Have a complete overview of all our data, and everyone understands the data and has access to the data they need

Base most of our decisions on data analysis

Use data analytics systematically on a continous basis to support strategy and vision

CLOUD AND SECURITY

Most companies store their data and IT environment in the cloud. To enable efficient collaboration, the involved people need ease of access. But with the increased flexibility, productivity, and collaboration, we also get increased risks for security threats. Companies are more vulnerable to security breaches when their data is stored in the cloud, and there has also been a drastic increase in cybercrime.

In 2019, Norsk Hydro was hit by an extensive cyber-attack that affected its entire global organization and its 35,000 employees, locking the files on thousands of servers and PCs. It ended up costing them $71 million.[7] According to IBM, manufacturing was the second most targeted industry in 2021, after finance.[8]

Therefore, it is more important than ever that companies make the necessary investments in secure cloud infrastructure and routines that safeguard the company from cyber-attacks. In the future, it will be an absolute necessity for manufacturing companies who want to manage risks and survive.

The percentage of British organizations over time where cyber security is seen as a high priority for directors, trustees, and other senior managers.
Source: Cyber Security Breaches Survey 2022, British Government

1 TRILLION USD.
THE ANNUAL COST OF CYBERCRIME IN 2020 ACCORDING TO PARACHUTE.

TOWARDS ADDITIVE MANUFACTURING

Additive manufacturing (AM), also known as 3D printing, is a maturing technology that continues transforming how things are produced. As the technology has become more cost-effective and efficient, it has become more popular. The average year-on-year growth in manufacturing in the last ten years has been 27%, excluding 2020. New materials and applications are continuously being added, and actual additive manufacturing is already a reality and the basis for many companies' business models.

Today we can see it in consumer-related services, like orthoses for medical use or midsoles for athletes' shoes, 3D printed furniture, and as a growing part of B2B industries like spare parts and high-end specialized products.

Sweden's first 3D printed house

In 2021, Sweden's first 3D printed house was built in Tumba, outside of Stockholm. It was made from 3D printed concrete which took only 28 hours to print. It is the prototype that will be scaled up further.[9]

Additive Manufacturing can increase innovation and speed up through rapid prototyping, allowing a team to quickly go from design to a physical prototype that can be tested before investing significant amounts of time and money into creating a fully finished product or part.

In PLM Group´s 2020 survey[10], The State of 3D Printing in Nordics & Baltics, 94% of those surveyed responded that they use 3D printing for prototyping.

It can also be used to manufacture end parts, often resulting in lighter, stronger parts and systems. GE Aviation could replace their traditional fuel nozzles, which were welded together from 20 different components, with a 3D printed version made in one part. This reduced its weight by 25% and increased its strength by five times, reducing labor and time.

RPA REPRESENTS OPPORTUNITIES FOR INCREASED EFFICIENCY AND MORE ENJOYABLE WORK FOR EMPLOYEES. THE APPROACH CAN ENABLE FASTER TIME TO MARKET, HIGHER FACTORY OUT-PUT, AND LOWER OPERATING COSTS, ALL THE WHILE REMOVING THE MOST BORING ASPECTS OF EMPLOYEES' DAY-TO-DAY WORK.

HYPERAUTOMATION – DESIGN AUTOMATION

Automation has always been a natural part of the manufacturing industry. Automated manufacturing processes lower operating costs, increase productivity and quality and make workplaces safer. In addition to physical robots on the plant floor, automation of intellectual work is becoming common. For instance, the use of robotic process automation (RPA) to automate repetitive and administrative tasks has increased rapidly in recent years and is projected to transform most businesses by 2030 radically.[11]

One area of usage for RPA is supply chain management. Robots can prepare purchasing proposals, collect bids, create contracts, and automate the creation of complete and compliant paperwork. Operations can also have valuable gains from RPA, like bills for material management and automated manual data entry.
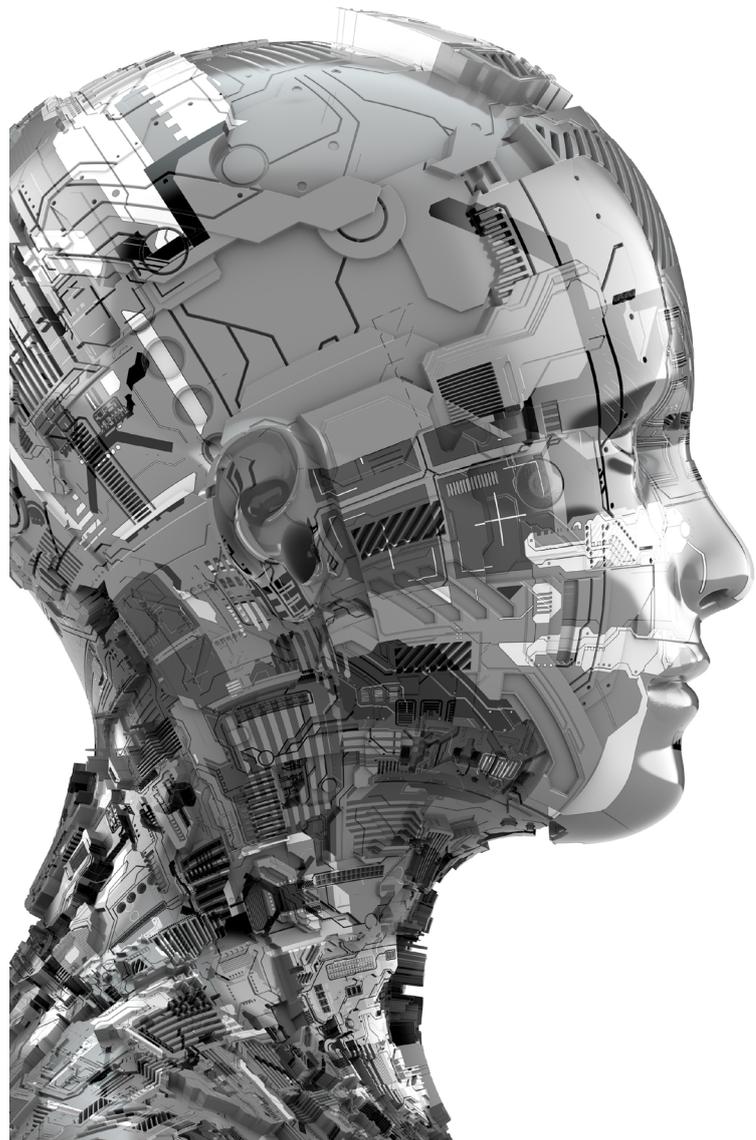
FROM TECHNOLOGY TO PEOPLE AND CULTURE

Today, it is almost accepted that digitalization is key to success in our current world. Yet, many companies fail to transform successfully and reap the full benefits of digitalization.

To realize the possibilities of digitalization, organizations have to focus as much on the people and culture of the company as on the technology that supports them. According to a study by BCG, companies that focused on culture in their digital transformation were five times more likely to achieve breakthrough performance than those that neglected culture.[12]

It is not enough to buy a new solution or platform and hope that it will automatically increase creativity, efficiency, and collaboration. Trust is a central element in the transformation - if employees are reluctant to use new technology, adoption will be slow. Therefore, management needs to focus on behavior and culture in addition to technology to truly succeed with digitalization.

TRANSFORMING ORGANIZA-TIONS AND BUSINESS MODELS

Manufacturing has traditionally used a B2B business model, but with the growth of online market-places, increasingly informed consumers, and personalization of offerings, the B2C business model is becoming increasingly relevant for manufacturers.

The development is partly driven by new customers – the consumer-creators, who transition from passive consumers to active creators, and the prosumers, who are erasing the lines between consumer and producer.

For manufacturers, shifting to a B2C model can uncover new opportunities. While B2B represents a more stable source of revenue, establishing a direct relationship with consumers can lead to a stronger brand, higher profitability, and new sources of growth. As the feedback loops with consumers are typically much shorter, it can help transform the company into a more fast-moving and innovative player.

## FROM STABLE B2B TO FAST-PACED B2C

Compared to B2B, the B2C models require different skills and capabilities, making a shift between them a challenge. One of the most well-known successful examples is Tesla, which challenged the traditional franchised car dealership model and started selling its cars directly to consumers. Owning the sales channel and the relation to the consumers, they can better understand their customers and improve the buying experience, ultimately creating stronger brand relationships and improved loyalty.

SERVITIZATION

Most manufacturing companies focus on producing and selling products, but as servitization is becoming more popular, some are exploring ways of serving their customers beyond the traditional model. Servitization means selling the product's value as a service rather than selling the product itself. The model is common in IT services, for instance, IaaS (Infrastructure as a Service) or PaaS (Platform as a Service). The same development is underway for the automotive industry through the business model shift from products (vehicles) to Mobility as a Service (MaaS). This development trickles down to all subcontractors and service providers.

Philips is an example of manufacturing, offering Light as a Service. Changing from conventional light sources to LED lamps can often reduce energy consumption significantly, but the lamps are expensive and require a significant upfront investment. The Schiphol Airport in Amsterdam is using LaaS from Philips and pays for the light it uses, while Philips owns and takes care of the fixtures and installations.[13]
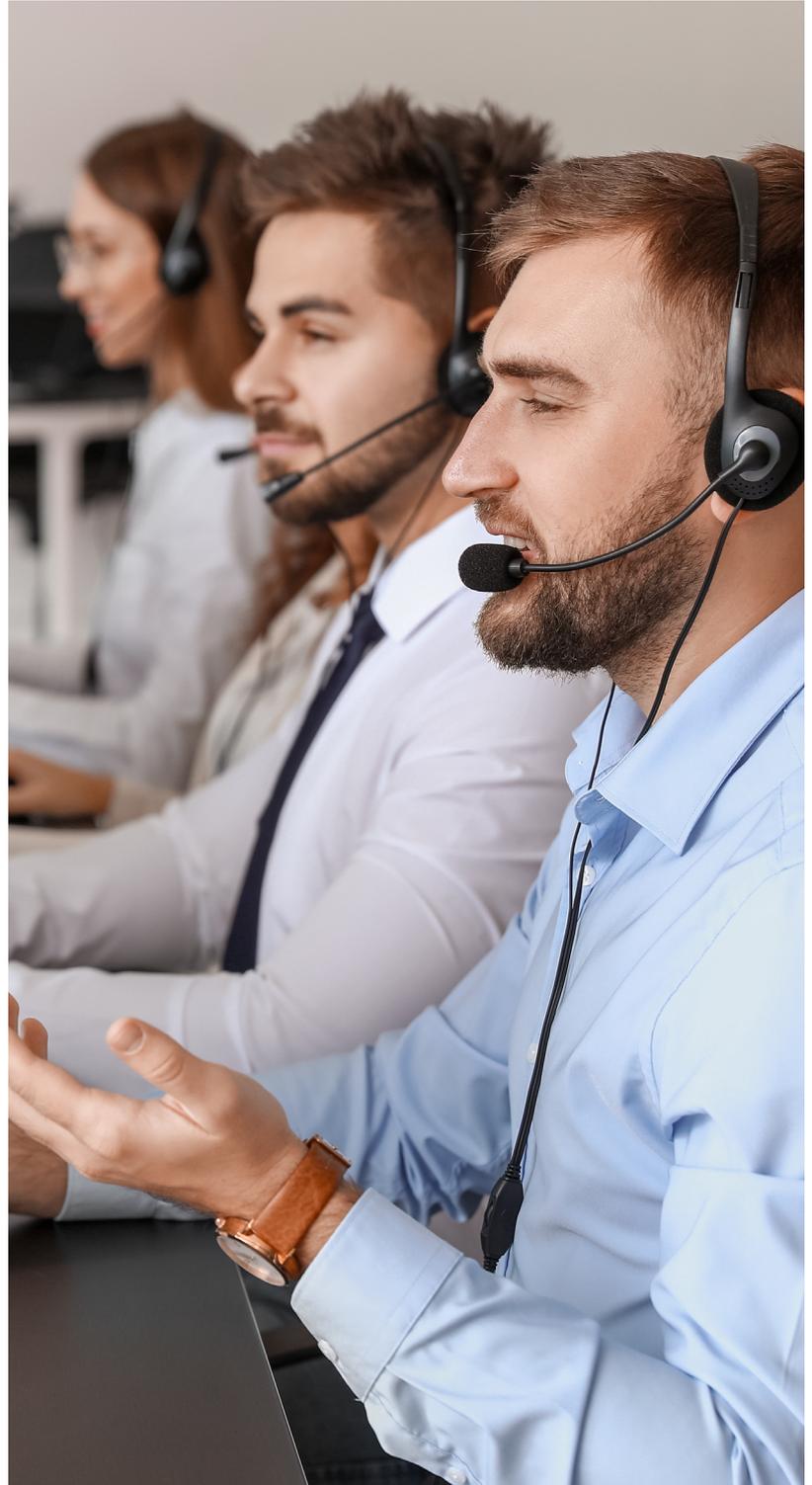
There are many benefits for manufacturing firms that become service providers. Providing services allows manufacturers to understand better how value is realized for the customers, so they can better meet their demands and build better solutions. Taking responsibility for the end result also allows manufacturers to move to value-based pricing, higher profitability, and increased customer satisfaction. To succeed in transitioning to a service-based business model, manufacturers need to utilize IoT and sensor technology to get real-time data on how the service performs.

EMPOWERED PRODUCT MANAGEMENT

Previously, product managers have had limited responsibility for their products, primarily executing on business decisions made by someone else. But this role is increasing in importance for businesses that want to succeed. It is now critical to empower product managers to make their own decisions to enable rapid innovation and customer-driven product development.

Some companies, like Spotify, even have product managers with their own development teams that they run like mini startups within the company, each with its own product vision and strategy. They are responsible for understanding the customer's needs, designing solutions, and collaborating internally to get the job done.

In the future, product managers in the manufacturing industry must be empowered to make critical business decisions based on customer data and insights. To move quickly in a complex world, decision-making processes need to be simplified and shortened, and authority held by the one closest to the problem to be solved. Product management will be a challenging role, which is why it will be particularly important to find and attract the right people for the job.

A model over frameworks for successful Empowered Product Management. Source: Partho Ghosh
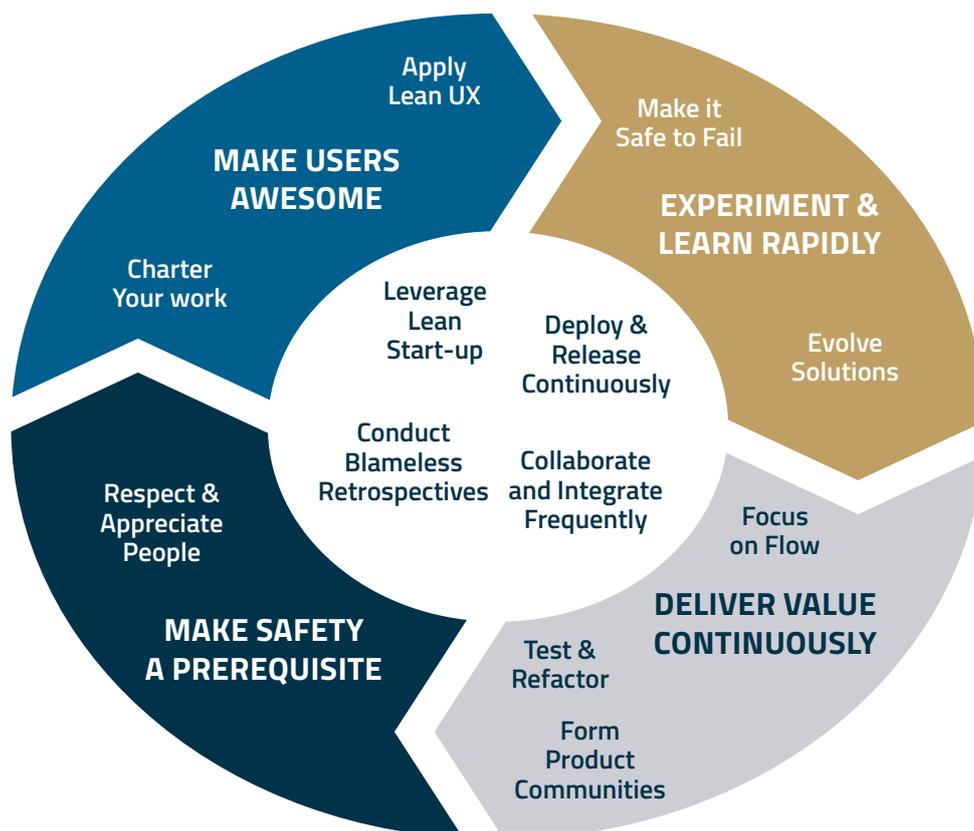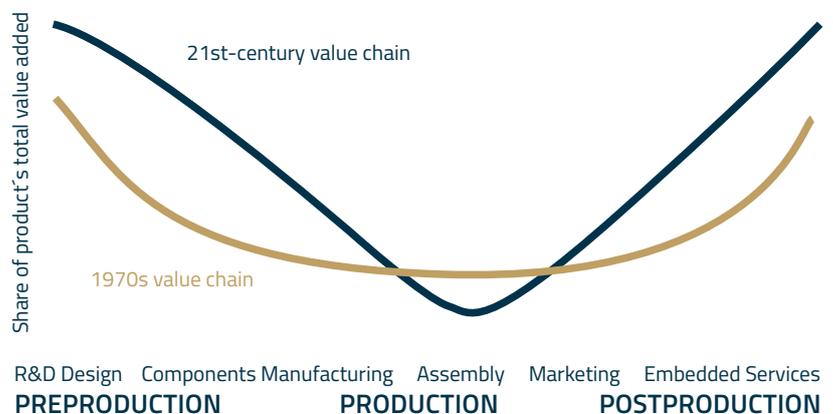
NEXT LEVEL INNOVATION

For many companies, innovation is an activity conducted in secret within the walls of the organization or even within a specific department. However, some companies take the opposite route and borrow ideas from open-source communities. They believe that collaboration is key to successful and rapid innovation. Combining expertise and experiences from different people results in more ideas and faster validation, increasing both the throughput and the quality of the innovation. Some companies take this to another level, inviting customers and suppliers to collaborate and get financial benefits from their contributions.

For example, LEGO has successfully launched products that customers originally suggested – and rewarded them for it. They have a crowdsourcing platform where customers can post ideas, and if they get more than 10,000 votes, they are reviewed by LEGO. If an idea is chosen to become a commercially available product, the creator receives 1% of the product's revenues.[14]

LEGO's approach is an example of an emerging trend: consumers are becoming creators and actively involved in the product development process. Unlocking this next level of open innovation in networks of people within the company or outside requires platforms where information and ideas can be shared and worked on. It also requires a collaborative culture, mindset, and willingness to try new things. The LEGO case is an example of how the innovation process has changed in recent years, where innovation is becoming more structural and in many cases, driven by an innovation leader. The task of the innovation leader is often to make the whole organization develop an innovation mindset, to depart from the model where innovation is a job for the R&D department only.

The Future of Manufacturing
Source: Hallward-Driemaier and Nayyar 2017

Share of product´s total value added

21st-century value chain

1970s value chain

R&D Design · Components Manufacturing · Assembly · Marketing · Embedded Services
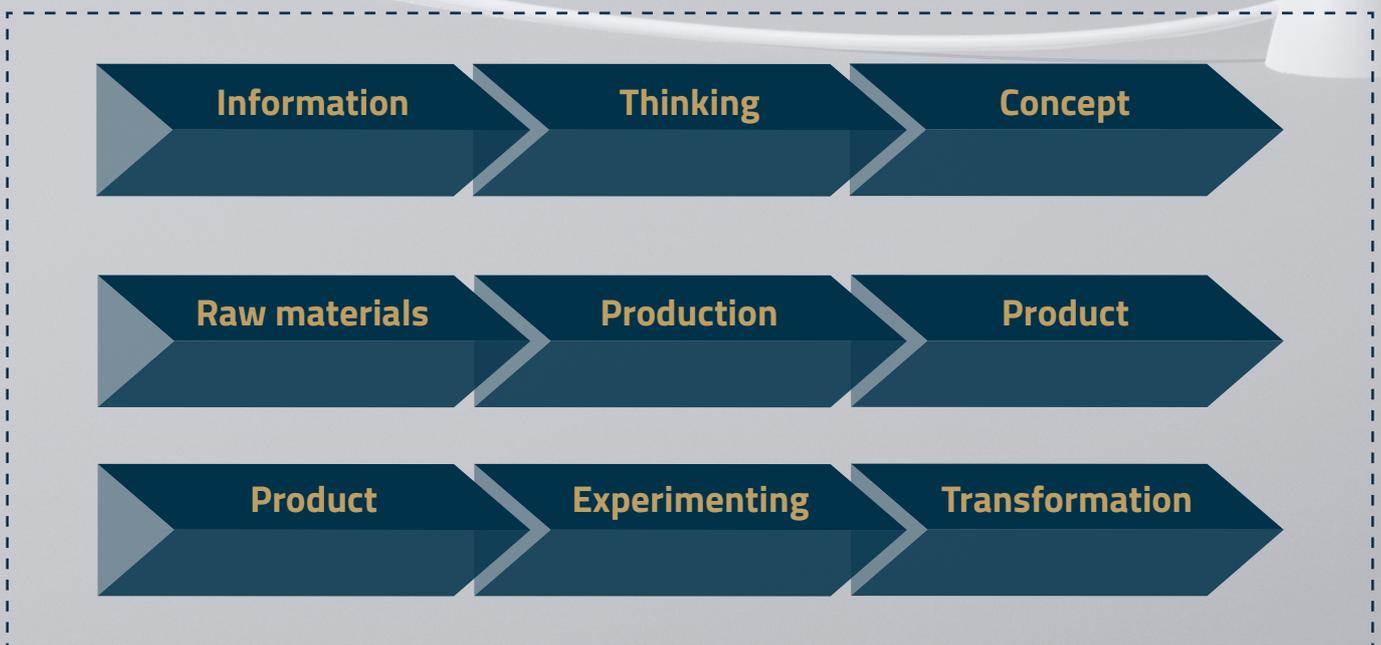PREPRODUCTION · PRODUCTION · POSTPRODUCTION

82% OF SME MANUFACTURERS IN SWEDEN, DENMARK, AND FINLAND HAVE INNOVATION AS A STRONG PRIORITY OVER THE NEXT YEAR.

Historically, manufacturing companies mainly focused on finding the proper raw materials and transforming them into products sold to other companies. Today the value chain has developed on both ends.

Beyond just producing physical products, a growing part of companies' value creation is strategically using the information to develop new services and concepts. On the other end, when manufacturers are not just leaving the customer with a product but are staying involved with the customer while they enjoy their services, the value chain extends toward the end user. These described shifts challenge the traditional innovation processes with the consequence that an innovative organization needs to create a "thought net" over every part of the organization rather than rely on a single "thought cell" (RnD department).

THOUGHT NET

Information	Thinking	Concept
Raw materials	Production	Product
Product	Experimenting	Transformation

The extended modern value chain where enhancing innovation enables a thought net over the entire organization.
Source: Lindgren M

BLURRED LINES AND HYBRID ORGANIZATIONS

The traditional organization where employees are all located in the same building and work the same hours are a thing of the past. As a result of the pandemic, most companies have been forced to learn how to work remotely and digitally. In addition, close partnership models between actors in different parts of the value chain make traditional borders between companies vague.

Some companies, like Spotify and Deloitte, are embracing this new way of working by allowing their employees to work from anywhere in the world. New types of organizations are emerging, for instance, DAOs (Decentralized Autonomous Organization), and new forms of employment are becoming more common. There are also less strict lines between primary producers and their subcontractors.
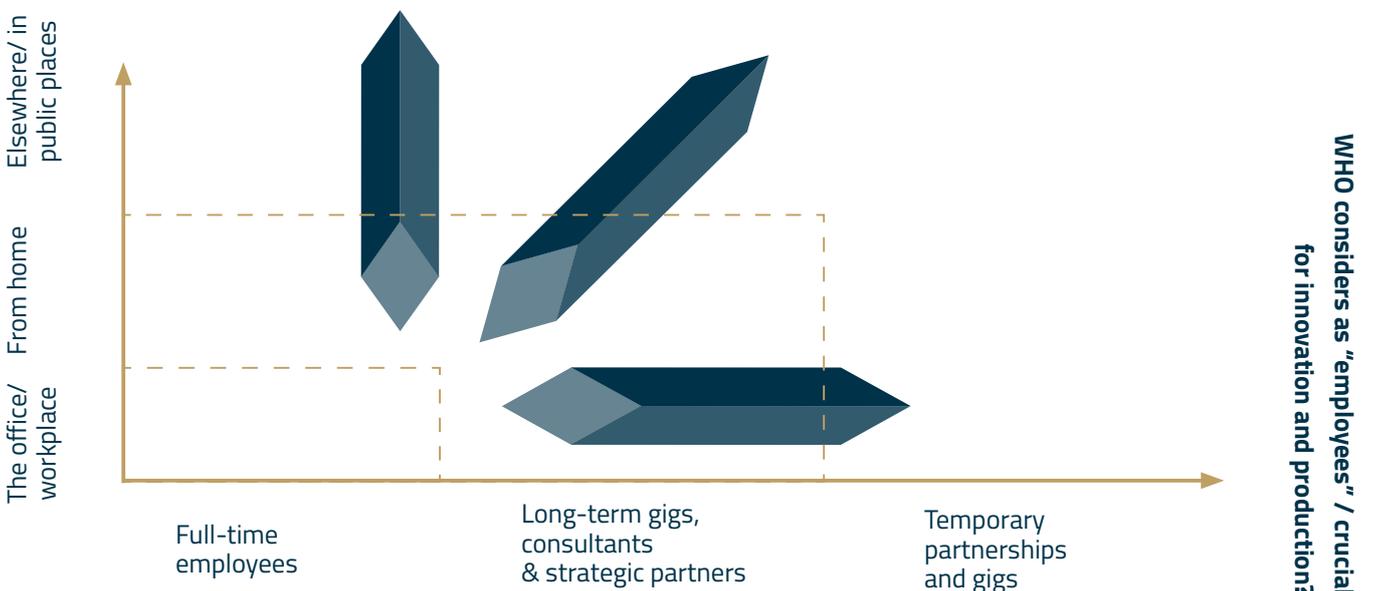
"We need to have our subcontractors deeply involved in the product development process. They need to have an in-depth understanding of how IKEA works to be able to achieve efficient, low-cost manufacturing. Otherwise, it will cause problems when new products are introduced in their plants, and some fundamental solutions and thinking behind the products don't suit the assembly possibilities. "

PRODUCTION MANAGER, IKEA OF SWEDEN

The future organization is characterized by blurred lines and hybrid solutions, resembling a network of collaborators more than a strict hierarchy. Siloed ways of working are a barrier that must be crossed to take advantage of all the competence and experience in a company and the company's network of customers, partners, and suppliers.

The post-Covid hybrid workplace situation is becoming the new normal

WHERE do the employees work?

WHO considers as "employees" / crucial for innovation and production?

Elsewhere/ in public places

From home

The office/ workplace

Full-time employees

Long-term gigs, consultants & strategic partners

Temporary partnerships and gigs

FIVE STEPS TO BECOMING A FUTURE-PROOF MANUFACTURER

When consumption of top-down, mass-produced, and broadcast marketed products shifts to involvement with personalized services, manufacturing has to adapt.

The change in how we consume will mean a growing market for customized items – products, and services where additive production based on customers' personal data will be in focus.

1

SAY HI TO PAL
A PERSONALIZED, ADDITIVE, LOCALIZED FUTURE

It is becoming strategically crucial for manufacturers to follow this development to deliver a short series of products that can be adjusted to single clients' and end users' preferences. With a long time horizon, this means developing a personalized and additive manufacturing process – especially in the western hemisphere, where wages are higher than in low-cost nations.

Another aspect of this development is supply chain development. The need for local solutions is becoming increasingly evident. Moreover, with the possibility of local additive production, manufacturers can charge their clients and users more thanks to individualized value.

2

RETHINK AND RECYCLE
ENSURE A STRATEGIC APPROACH TO SUSTAINABILITY

The new up leveled sustainability landscape will profoundly impact all organizations. Every company in every industry needs to understand and then find its take on sustainability. Even though many manufacturers have ambitions of becoming fossil-free within their own business by 2030 (or later), it won't be enough.

The end-to-end responsibility trend on sustainability will force every company to be accountable for every subcontractor and the sustainability impact that their products have when used by the end consumer.

These consequences also apply to deeper and more specific aspects of sustainability in every step of the supply chain, i.e., more detailed information on product materials (on a molecular level), energy use/primary source, and working conditions will be required. Since sustainability has a multitude of perspectives, the future will most likely hold ethical and moral dilemmas for companies to deal with.

A future-proof strategy for sustainability will therefore demand internal systems that measure sustainability impacts that are commonplace to count today and those that are likely to be tomorrow. What raw materials are being used? How much fresh water is the process consuming? How much energy is being used in the process, and what are the primary energy sources? What are the working conditions for the subcontractors' workers? Soon, we will likely see tools that automatically collect/require all digital data on sustainability indicators for products and services.

The end-to-end responsibility trend on sustainability will force every company to be accountable for every subcontractor and the sustainability impact that their products have when used by the end consumer.

3

NO TIME TO DIE
COLLABORATE TO INNOVATE

The surrounding world will only become more 'raplex' (rapid and complex), and navigating this complexity will require a diverse skill set and excellent coordination. Internally in the company, one needs to leverage all employees' different backgrounds, experiences, and competencies. Combining the right digital tools and platforms and the right culture and mindset is essential. With the right technology, such as IoT, sensors, and cloud platforms, data can be shared between people, enabling them to collaborate effectively across different parts of the organization, no matter their role. Additive manufacturing allows for rapid prototyping and experimenting, taking team productivity to the next level.

No man is an island. And no company can exist on its own. These are old sayings that are truer than ever. And they are particularly true regarding innovation and the ability to create future-proof solutions ahead of competitors.

True innovative organizations are reliant on three different layers of innovation infrastructure. The foundation consists of a *bottom-up culture* that empowers and engages coworkers, partners, and customers in innovation. This culture also does not immediately kill new ideas but instead encourages them.

The second layer consists of well-functioning processes. An innovative organization has stable and well-known formal operations and infrastructure for innovation to make it a daily habit rather than an ad hoc event.
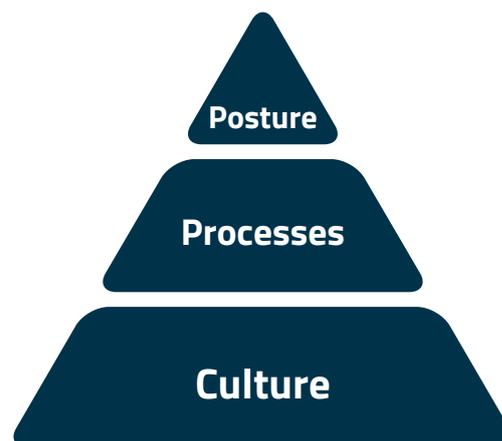
The third level is about having an "innovation posture attitude." Such posture is often inspired by inspirational leadership with true grit regarding innovation.

In a future where every manufacturing company needs to be even more forward-leaning regarding innovation, collaboration will be crucial to success. As we have seen, most trends point to greater collaboration between people internally and externally in the company and between companies in the value chain.

Three layers of innovation infrastructure must be in place to accomplish a truly collaborative and innovative organization.

The coordination of this collaboration will be a challenge that should not be underestimated, and the role of the product manager in guiding and setting a vision for this work will be a critical factor for success.

Collaborating with external players will also be crucial. On the one hand, manufacturing companies need to build close relationships with their customers and end users to understand their needs and behaviors better, especially if they want to explore the B2C market or engage in open innovation with their customers. On the other hand, the network of suppliers, partners, and resellers is key to enabling traceability, circularity, and resilience in the supply chain. Thus, collaboration, both internal and external, is vital for building a sustainable business.

4

LEARN FROM MONEYBALL
SECURE AND MANAGE DATA STRATEGICALLY

The ability to handle data is becoming equally important to the manufacturing industry as dealing with raw materials and supply chain issues. Since data is becoming "the gold of the future," it should be dealt with as such.

The data challenge is two-fold. Firstly, it is a question of examining your situation, i.e., what kind of data do you have today, and what type of data will you be able to create within your system in the future?
Secondly, you also need strategic insight into how digital data will shape the future business landscape and which data will be a necessity, a strategic asset, or merely a hygiene factor.
Then you have to ensure that the data you can not create within your system is secured in other ways.
In practice, you first need to produce a "digital data map" to get an overview of what kind of data your organization is creating today and what data might be created with the current organizational system.
Many organizations have not done this basic inventory, so this is the starting point in most cases. And it is not just the digital systems that are fundamental for the primary processes (construction- production-sales) but also the vast number of supporting systems used in the organization. Most organizations are surprised by the amount of strategic data that can be provided from the many systems in use.

In the second stage, you need to investigate the logic driving the data generation processes and how this will shape the future businesses in the manufacturing industries. That kind of data will be crucial to have access to. This means mapping initiatives from different stakeholders and synthesizing them into a map of "the future data-driven industry."

In the third phase, you must explore and exploit the data to find true golden nuggets. This requires access to highly skilled data analytics competence. Without such competence, you stand a great risk of being trapped in old ways of decision-making. In the movie Moneyball, data analytics change the game of baseball at the Oakland Athletic MLB team by relying on the numbers of previous performers from the players rather than the gut feeling of the scouts that used to be the basis of finding new talent.

The strategic approach must include the cybersecurity issue. To get the most out of your data, you need to interact with other key stakeholders, i.e., digital platform owners. Therefore, you also need to have secure cloud solutions. For most companies, this will mean using cloud solutions, but for some organizations, the information is so critical that an on-prem solution will be needed. Every company has to assess its situation and develop an approach to cyber security that fits its needs.

| Prepare data set | EXTRACT | Analyze and predict | EXPLORE | Explore and deploy models | EXPLOIT |

| Data | Analyze & export | Model |
| Prep | Explore | Deploy |

The analytics process in a modern data-driven corporation

5

GOOD WILL HUNTING
FIND YOUR PLACE IN THE ECOSYSTEM

The industrial manufacturing business landscape is on the verge of something new: the use of strategic data will create a do-or-die situation for many leaders, sustainability demands and costs will rise to new levels, but also present opportunities and borders that are blurred both within the home organization as well as towards partners, clients, academy and societal organizations. In this new world, it is crucial to establish clarity around what role you want to have and will be able to perform in the manufacturing ecosystem.

In the movie Good Will Hunting, Matt Damon's character Will is lost in the translation between his past (and upbringing) and his future. He struggles with the ability to find and believe in his true talent and trust that there will be a place for him where his talent can bloom. The film can be seen as a metaphor for the journey most manufacturers must embark on. In the new ecosystem, there will, for instance, be a significant choice for manufacturers that are primarily subcontractors.

Main choices that most subcontractors face in the new manufacturing ecosystem

Production specialist	Strategic partner

In order to define the organization's role in the manufacturing ecosystem, top management has to make sure that the company develops a future proof long term strategy that supports coping with challenges and ensure an ability to successfully explore new opportunities.

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