WHITE PAPER

Manufacturing-as-a-Service

Online, on-demand and super-fast delivery

How competition in subcontracting is changing dramatically as new players with online services, ramped-up digitalisation and bundling of production capacities take the market by storm

sirris innovation forward

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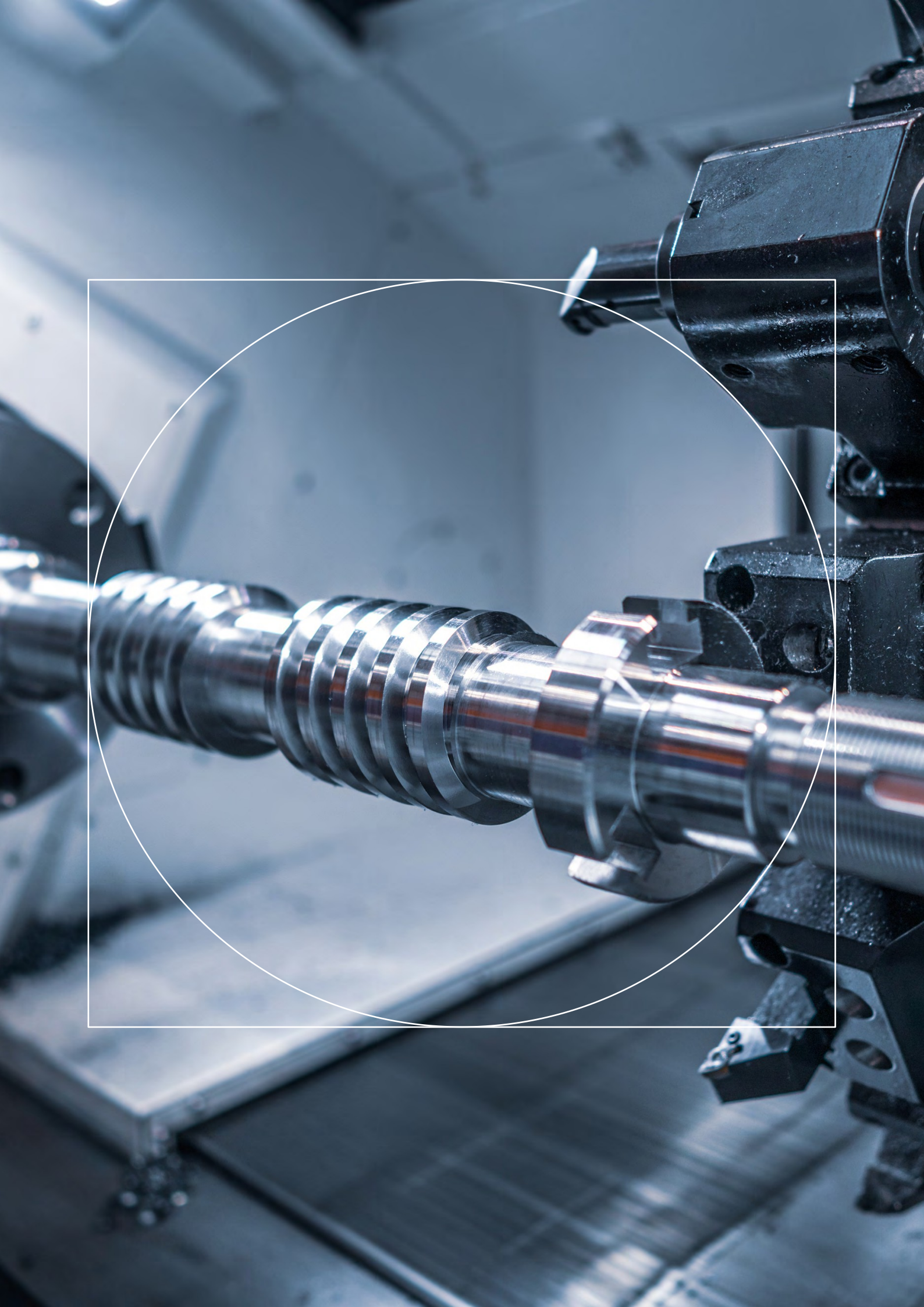
Introduction

Materialise, 247TailorSteel, ProtoLabs, Weerg or myProto, more and more suppliers are offering an online service for 3D printing, sheet metal, machining, injection moulding, electronics or various other tailor-made production processes: you load up your 3D product model, specify
product characteristics and immediately receive a price offer and delivery date. Thanks to extensive digitisation, advanced technologies and ample production capacity, the manufacturing company can ensure fast and high-quality quotations, production and delivery for customised parts and components.

Xometry, OrderFox, FACTUREE, techpilot, HUBS or Plyable, an increasing number of marketplaces for the manufacturing industry offer a networked production model that links locally and globally dispersed production resources of supplying manufacturing companies with business demand
and consumers. These online marketplaces control and organise production through cloud services and offer it as a one-stop-shop solution.

With this new generation of suppliers, manufacturing a product has become an online accessible service. The simplicity of these online services, transparency and speed of supply are transforming the competitive environment. This white paper provides insight into this new generation of suppliers and the pillars they rely on. It outlines the challenges and opportunities for small and medium-sized manufacturing companies to respond to this new competitive environment in a timely manner. We call it 'Manufacturing-as-a-Service' (MaaS) in this white paper for simplicity's sake.



Been under the radar for too long, but now impossible to ignore

Traditional manufacturing companies looked somewhat dismissively at these new types of players, with arguments like "They are too expensive" or "This is only possible for simple products, they cannot handle complex products". As a result, MaaS remained under the radar for too long, but with the ongoing digitalisation, automation of the production system and rapid growth, more and more companies are seeing the potential and impact of this new offering.

The disruptive business model of these digital manufacturing companies and marketplaces competes through new performance criteria, such as ease of ordering for customised parts, ultra-short lead times, manufacturability analysis tools or access to state-of-art manufacturing capacity. And this in a wider range of manufacturing technologies and for increasingly complex products. Many manufacturing companies fear this new, rapidly growing competition, start looking for a positioning or solution so as not to miss the boat, experiment with participating in marketplaces or outsource production in case of capacity shortage. Do their customers - now or in the near future - also want a similar, state-of-the-art service? And where does this become a necessity to win the job opportunity?

> *According to a recent Paperless Parts survey of more than 400 manufacturing parts buyers and engineers in the US, 67 per cent of respondents expect a quote within 24 hours and only 6 per cent of respondents are willing to wait longer than three days.*

Extensive digitisation, "because every job starts with a quotation "

Traditional quotation generation and order processing are manual, slow processes, where it is difficult to quickly gather the necessary information to speed up response time or to increase consistency and accuracy. These office activities typically account for a third to half of the turnaround time, and about a quarter of the costs. Office staff are the customer's first point of contact, and their knowledge and skills strongly determine commercial success.

In MaaS, extensive digitisation automates the preliminary process (i.e. quotation and work preparation). This is the basis of a service model that unburdens customers and offers unprecedented production flexibility online. Combined with extensive automation, manufacturing companies use these platforms to expand their order books. Internally, the software supports and automates the entire production process: quotation, work preparation, production planning and logistics.

The (free) online software platforms integrate production knowledge and support, among others:

- A simple and transparent online process for the customer.
- A real-time online generation of a quotation based on the analysis of a CAD model with artificial intelligence (AI).
- A smart pricing model that not only takes into account the actual production cost, but also adjusts for other factors such as market conditions or seasonality. For example, the price is typically highly dependent on the requested delivery time.
- The automation of the production planning process, enabling the indication of a reliable delivery time (as a function of available materials and production capacity).
- An analysis of manufacturability and estimating the cost of a product design.
  Many designers are now integrating this manufacturability feedback into their design process early on to simplify the design and thus reduce design lead time and production costs.

The digitalisation of the preliminary process speeds up the whole process considerably. This allows customers, without sufficient production resources, to quickly bring small series to market. Thus, prototypes can be produced in a very short time and, if required, different variants without loss of time or high costs. This enables users to test different prototypes in an accelerated manner.

Automating the work of highly skilled workers with software makes customised production scalable and supports opening new state-of-the-art factories at an additional site close to customers. As MaaS evolves, the cost of digitally manufactured products may fall.

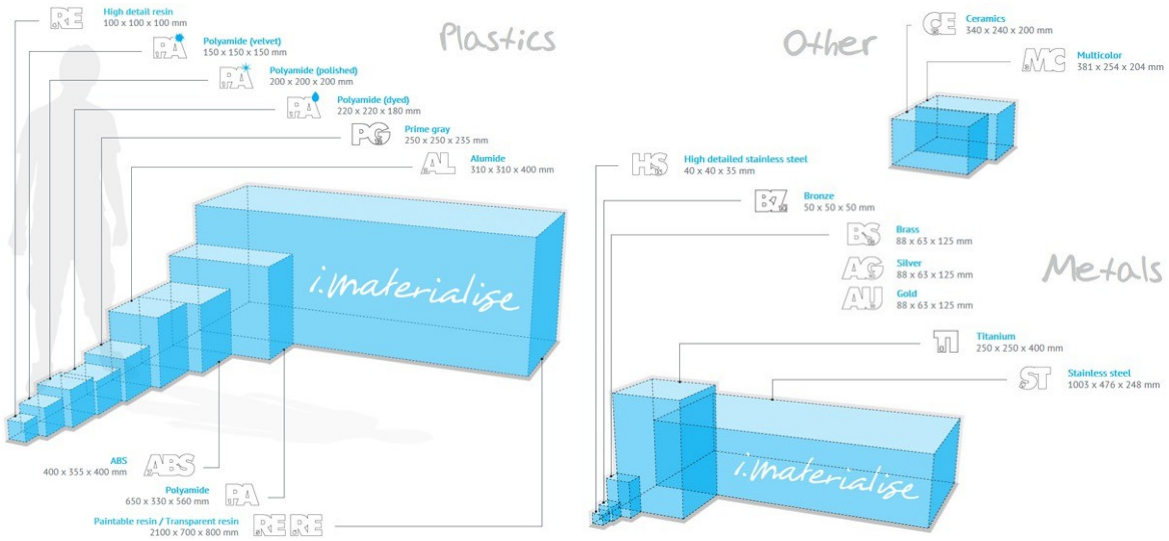
Continuous optimisation, with attention to detail throughout the process

The software platforms were not perfect at the start - still not today and limit what can be realised on-demand. But they learn from every order, every production and every step to expand capabilities, eliminate errors and deliver unmatched quality.

The software platforms reduce the need for highly skilled staff in the preliminary stage. Work planners can focus on the difficult jobs and increasing the software's production knowledge and capabilities. The latter are evolving rapidly.
As they evolve, the business can grow and this creates a snowball effect. Although their strategy focuses on small batches, it scales up with customer demand.
Over time, they are significantly more efficient than their traditional competitors. The examples are inspiring, but the large investment in sophisticated software tools and the long timeframe required to integrate production knowledge into them does not make the MaaS concept easily replicable. The forerunners already have a huge production and automation capacity concentrated in their plants.

Some examples of forerunners in various sectors

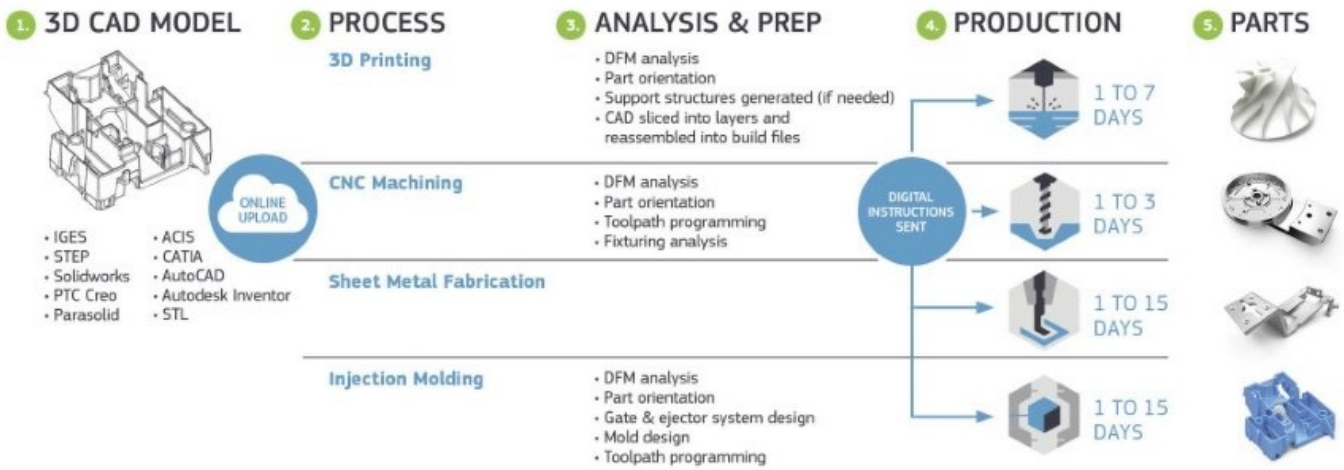
Materialise has the largest fleet of 3D printers in Europe and has long offered industrial customers and consumers online services for 3D printed products (NextDay service, within 12 hours, and i.materialise, within 48 hours). Materialise was a forerunner with the development of a platform of supporting tools that manage and control the 3D printing process more efficiently (e.g. Magics 3D Print Suite), help scale 3D printing to larger runs (CO-AM Software Platform) or support 3D printer builders in developing their controls and build process. For industrial customers, the service is designed with a view to
customer support. The industrial service includes additional materials and finishes and allows direct contact with in-house engineers. Through i.materialise,
designers easily open a shop and sell their designs.
Materialise was the pioneer and set the tone with its quick service. Meanwhile, fast service is the norm among the many suppliers of 3D printing - a pre-eminently digital production technology. Materialise itself makes full use of this software development capacity as the basis of its strategy, for example for the development of innovative 3D printing
applications (e.g. a platform for medical applications or the mass customisation of customised production tools or fixtures) or offers software suites and platforms to players in additive manufacturing (e.g. machine builders).



Source: Materialise

247TailorSteel aspires to have a scalable network of more than 150 production sites for metal sheets, tubes and edge parts built close to customers as soon as demand increases. All available production resources are merged into a 'cloud facility', so to speak. The customer cannot distinguish which production facility will be responsible for realising the requested products. For the sixth time in a row, 247TailorSteel has been found in the 'Top 250 Growth Companies' (with an annual growth of at least 20 per cent in employment). A third German production facility of 15,000 m^2 in Langenau was opened in 2022. A Belgian site of 17,000 m^2 in Hooglede and a second Dutch location in Oud Gastel will follow in 2023. In addition, the capabilities of existing branches and the online assistant Sophia® (Sophisticated Intelligent Analyser) are constantly expanding.
And this in a stagnating market. The state-of-the-art factories are characterised by the latest production machines, a high level of automation with AGVs and robots, energy-efficient processes and a pleasant working environment.

Protolabs aspires to be the fastest digital production source for prototypes and low-volume production parts. They aim to use 3D printing, CNC machining, sheet metal working and injection moulding technologies to produce parts within days. With on-demand manufacturing with various technologies, they aim to be able to quickly and cost-effectively support the need for production and tooling throughout the life cycle of a product.



Protolabs was founded in 1999. It experienced 45 per cent revenue growth from 2016 to 2020 and has 2,700 employees in production facilities in five countries. In 2021, ProtoLabs acquired 3D Hubs. Greater than expected operational difficulties integrating the acquisitions recently limited ProtoLabs' financial results.

DVC's **myProto** is an online platform for rapid assembly of high-tech PCB prototypes. Customers upload the requirements for their prototype (BOM and Gerber data) online. myProto delivers standard PCBA prototypes within five working days, from order confirmation to shipment, including sourcing of parts.
For complex projects, myProto provides a customised quotation. Through analysis of incoming data and visual inspection of the products, myProto strives to produce prototypes with the same quality as for series production. For the production of prototypes, myProto uses DVC's high-tech production machines and cooperates with component and PCB production partners. Larger series are also no problem.
problem. Proto-Electronics and Tempo Automation also developed platforms to bring new electronics to market faster than ever. Digitalisation, data and software speed up the process and allow manufacturability issues to be addressed in early design iterations.

Due to their success and rapid growth, 'copycats' profile themselves over forerunners such as Protolabs: "Better Prices than Protolabs - Protolabs Customers Choose Us", "Protolabs for small production: find a metal company for a complete production process at CNC Netherlands". Competition on MaaS suppliers via best prices, quality and short delivery time is already in full swing. These copycats are trying to copy the model, but without similar tools or production system. The simple online services, the available production capacity and a thorough end-to-end automation for fast production of small series is hard for newcomers to match.

Manafucturing-as-a-service marketplaces

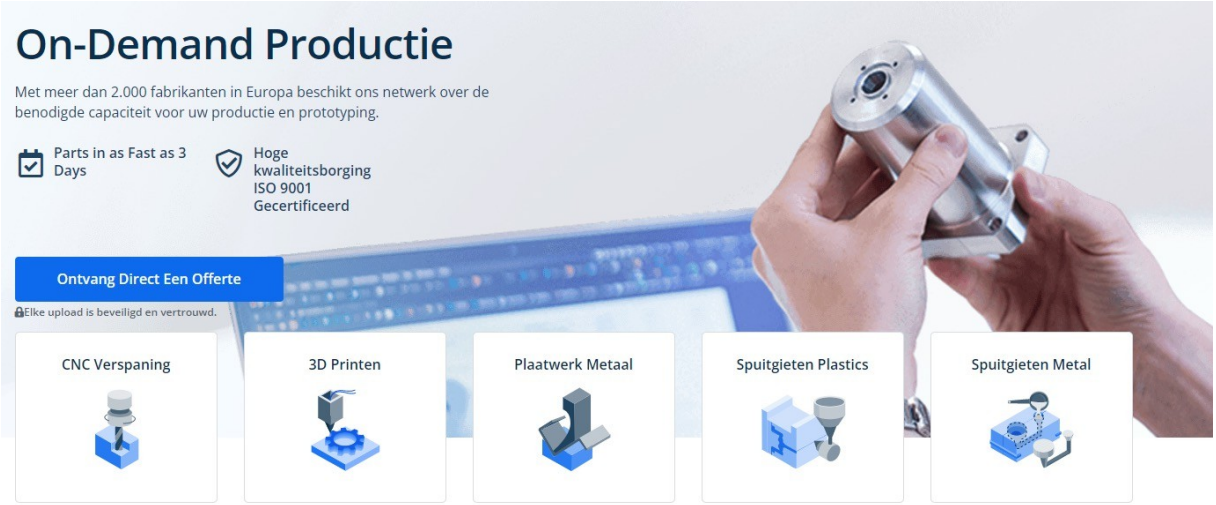
Besides MaaS companies with in-house manufacturing capacity, several online marketplaces offer customers access to a wide network of manufacturing partners. The MaaS business model reduces their capital requirements by offering no or minimal in-house manufacturing. Instead, they work with a broadly distributed network of manufacturing partners to match their (almost) unlimited free capacity to demand, as Uber does for car rides.

Manufacturing-as-a-Service (MaaS) marketplaces are **digital platforms** where manufacturers and customers collaborate in a **virtual manufacturing ecosystem**. On these MaaS platforms, both **individual entrepreneurs and established companies** can offer their manufacturing capabilities and services. By facilitating **secure payment systems, quality control measures and customer support**, these online marketplaces promote trust and reliability in cooperation between manufacturers and customers.

They unburden their production partners and customers, with, for example:

- A fast online quotation process for price and delivery time, with technical feasibility check, design upload and reliable data transfer and privacy.
- A flexible quotation optimisation with regard to price or delivery time and the selection of optimal manufacturers for the order. According to the customer's design, material, quality requirements and/or delivery criteria, they use AI algorithms to analyse who can optimally fulfil the order. For example, AI anonymously compares parts with previous, similar products and matches them perfectly with the capabilities of the machinery in their production network, based on accumulated competence, know-how and experience. The marketplace also takes into account other aspects, such as the margin it expects to can make. Today's supply-chain issues mean that clients opt not only for the cheapest, but sometimes the highest-quality or quickest match.
- A guarantee of delivered quality and on-time delivery, transport insurance and financial services for secure payment or advances.

Artificial Intelligence (AI) increasingly drives the platforms and, based on a 3D model, looks for upload suppliers who can make it, based on criteria that the buyer selects in advance or not.



Source: Xometry

MaaS marketplaces have great potential. Despite often unanswered questions about the feasibility of the business model, marketplaces for various manufacturing technologies are springing up like mushrooms.

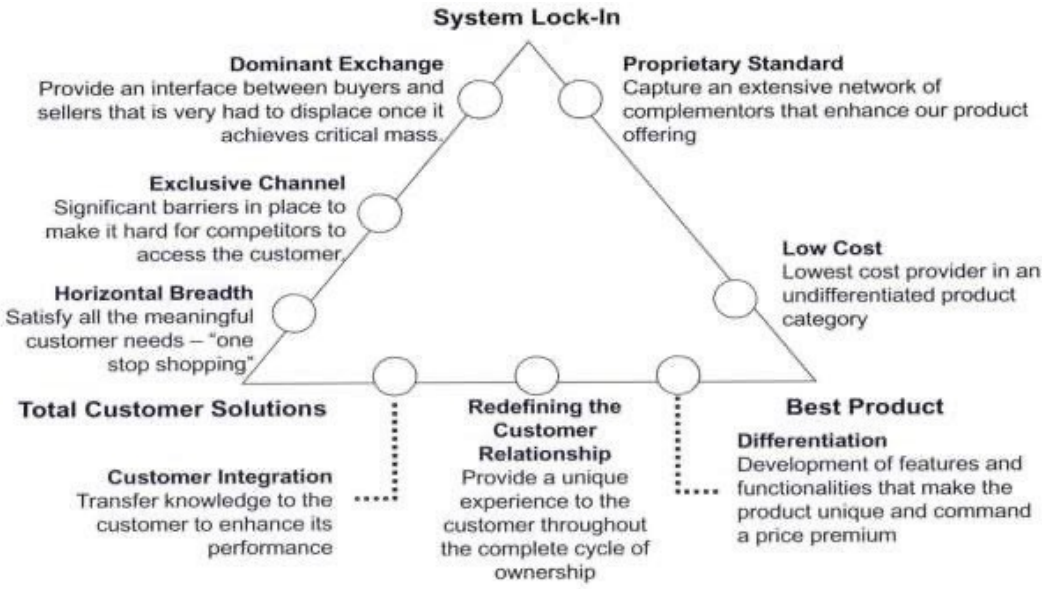
Besides developing these services, generating a network of suppliers and customers requires a large investment to achieve customer loyalty and customer retention, establishing a production network and managing quality and delivery time in a distributed production network.

The entry threshold for a customer through an anonymous platform provider is low. However, over time, customers build relationships with manufacturing companies they trust. The danger is that once relationships are built, customers go straight to the supplier. They use the marketplace for easy real-time checking of prices, but do not buy from it. Especially when customers move to larger batches. Marketplaces should counter this threat with user-friendly services (e.g. CAD integration - simplicity of ordering) or tie suppliers to the network by providing them with both orders and discounts on purchasing their own required materials. Access to this information also helps with accurate pricing estimates.

Suppliers gain access to an extensive customer base on the one hand. On the other hand, their speed and transparency put pressure on prices, as inefficiencies are removed from the market. It also requires new skills from manufacturing companies: marketing and sales are shifting towards online. For providers of more complex operations and hybrid technology with specialised and diversified machinery, broad platforms can but struggle to encompass the specific manufacturing expertise (compared to platforms linked to in-house production facilities or a specific application).

Marketplaces: big, bigger, biggest - the Amazon, Uber or Alibaba effect?

Marketplaces aim to create a 'lock-in' by offering an interface between buyers and suppliers. This 'lock-in' is very difficult to overcome if the marketplace reaches a sufficiently large critical mass of participants and services.



Marketplaces position themselves in the 'Delta Model' as 'Dominant Exchange'-system lock-in players. Traditional suppliers are more likely to focus on total customer solutions. (Source: Hax Delta Model)

Quite a few platforms claim to be large or the largest (Orderfox and techpilot), to offer the best prices and to have a broad customer base (e.g. several tens of thousands of customers). Xometry (CNC machining, 3D printing, sheet metal, plastic and metal injection moulding) and FACTUREE (CNC machining) each include a network of more than 2,000 suppliers in Europe. Plyable says it is a frontrunner for precision moulds. 3DEXPERIENCE is DassaultSystems' online marketplace (and includes Xometry as a supplier). As a supplier, can you still ignore access to such market potential? As a supplier (or customer), it does not seem easy to choose between these marketplaces. RapidDirect or NiceRapid also provide similar services in China, either online or with an intensive support service team.

Xometry aspires to become the de-facto procurement tool and marketplace through which buyers quickly and flexibly source their production from a wide network of (local SME) suppliers.
Xometry therefore integrated additional digital solutions to s t r e n g t h e n supply chains, for example an integration with large companies' procurement systems and a procurement tool for sourcing from more than 500,000 suppliers within the ecosystem from Thomasnet.com®. Free cloud MES system (Workcenter) digitises workflow at SME suppliers and enables them to view all their Xometry and non-Xometry orders, optimise efficiency, speed up payment and get goods to the market. An API allows external developers to integrate their innovative solutions for suppliers. For example, Colab integrated its tools to securely discuss design issues between buyer and supplier on the workcentre platform.

MaaS marketplaces rival MaaS manufacturing companies?

Marketplaces are in competition with MaaS manufacturing companies with their own production capacity.

Marketplaces have a wider production network, but cloud manufacturing companies, thanks to their own in-house production and ubiquitous software automation, seem to have an advantage in their niche in a number of ways.

They can integrate deeper manufacturing knowledge, can integrate end-to-end digitally (from quotation, through work preparation, planning and production to delivery), have control over quality and delivery time themselves. They have direct contact with the customer and cannot be eliminated as an intermediary. While marketplaces automate the preliminary process and delivery, many of their participating suppliers still operate on a traditional with a classic production offering that is little digitised or automated.

Protecting MaaS business model through integrated IP strategy

Offering an on-demand MaaS business model creates major intellectual property (IP) challenges. The intellectual ownership portfolios for traditional business models are no longer sufficient. For instance, the technologies used are becoming more complex, different IP aspects converge in a digital service and companies no longer own all intellectual property rights.

An integrated IP strategy, where multiple intellectual property rights complement each other, is crucial. This strategy includes dealing with a wide range of IP and related rights, such as, patents, copyright, designs, data and confidentiality.

Key IP challenges for MaaS include:

Protecting specific manufacturing knowledge. Improvements to machines and processes may be necessary to support on-demand production. Traditional **patent** protection of innovations remains an important aspect of IP strategy (e.g. automatic generation of support structures in 3D printing).

Dealing with property rights on software (in-licensing, out-licensing or exploiting open source): software tools are crucial for the advanced digitalisation in the MaaS business model. These software tools can be developed in-house and/or can use commercial or so-called 'free' open-source software. Often, use is only 'free' under certain conditions and the user must make all software developed on an open-source component freely available to the community. Companies will need to understand the complexities, differences and requirements of the numerous **licence forms** to avoid infringing licences and maximise protection of their own business. Some companies opt to patent software, while others opt for the power of secrecy. For example, Xometry took out several patents on the automated analysis of 3D drawings for generating quality quotes with the cost, quality and delivery time for different manufacturers.

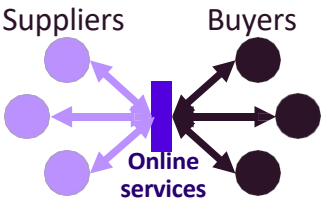
Protecting and valorising the **huge amounts of data** generated in a MaaS business model. The data can be used to train in-house AI algorithms, resulting in a better-trained AI algorithm with higher value. But data can also be shared - selectively or not - with other players, generating revenue.

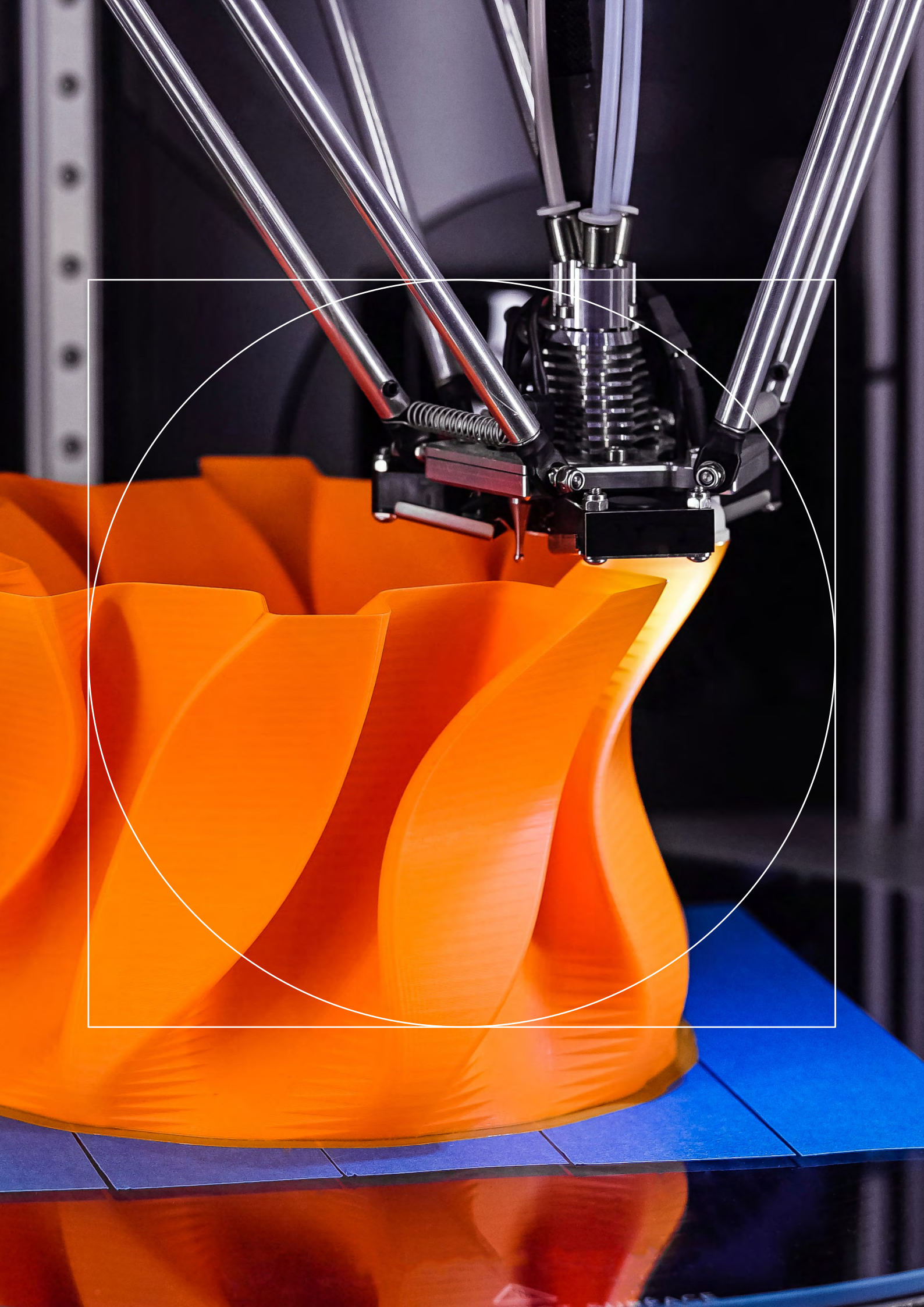
In MaaS manufacturing companies, there is a lot of information and knowledge that one cannot or does not want to protect with IPRs, e.g. trained AI algorithms, automated processes for online service, data but also customer files and other commercial knowledge. Since 2018, a Belgian law on trade secrets has been in place that provides a legal framework for keeping such information secret. As a result, companies will have to identify their most valuable knowledge and data and treat, protect and maintain them separately.

Naturally, such IP strategy must be aligned with the structure of the organisation. The management of intellectual assets (assets) is often spread across different departments, which will have to work in an increasingly integrated way: new technologies are managed by patent departments, brand names by marketing departments, licences and other contracts by legal teams, data management and contracts for software by IT.

Clearly, any company with a MaaS business model needs to develop its own specific IP strategy, aligned with its business objectives, which is likely to be very different from the traditional IP strategy.

Comparison: MaaS compared to traditional delivery

	Traditional supply	MaaS supplier	MaaS marketplace
			
Type of production	On-demand, on-forecast, on-stock.	New players with strategic focus on on-demand and on-time.	
Digitisation	Limited, mainly offline and manual processing.	Thorough digitisation of front-office (online) and back-office processes.	
Bowls	Hard to scale up.	Easily scalable. Large investment in own production capacity and additional sites.	Easily scalable with large investment in network building, but limited/no investment in production capacity.
Focus	Complex components, modules and systems.	Specialised offering: focus on number of production processes with standardised and automated machinery.	Wide offer from all production processes in the network of production partners.
USP	One-stop-shop	Simplicity of ordering, ultra-short lead time, delivery reliability.	Simplicity of ordering, uniform access and services to a wide network, offer manufacturers access to wide customer network and support services.
Scale	Local players limited number of customers.	Critical mass/growth is necessary for digitisation and short lead time from available capacity, large number of customers.	
Success factors	One-stop shop aimed at completely unburdening and thinking along with the customer. Wide range of technologies and processes.	Full automation of the order processing (quotation, work preparation).	Good management of a wide network of manufacturing companies. Dominant interface between buyers and suppliers.



On-demand manufacturing: an inevitable competitive environment?

As with the transition from analogue to digital photography, assessing a breakthrough innovation with traditional performance criteria is dangerous. Digital photography did not initially conquer the market on quality, but on numerous other criteria. Thus, innovations remain under the radar of traditional players for a long time.

MaaS makers and marketplaces are shifting - already today, and certainly in the near future - customer expectations for an online state-of-the-art, fast and transparent service. They create a new competitive environment with changed performance indicators: online service, transparency and speed of delivery. This makes outsourcing production easy for customers.

The market for on-demand fast delivery of customised parts is growing. How fast the market will move beyond standard supply, prototypes and spare parts is unclear. MaaS companies are probably already ready for it. Now they mostly still differentiate based on their service and speed and can therefore charge higher prices. Some already compete (to a limited extent) on price or are able to produce larger series cost-effectively. They are well armed for this due to their advanced automation, efficiency, limited need for highly skilled workers or production capacity. MaaS success will depend on market timing.

How to respond to MaaS as a small or medium-sized manufacturing company ?

The short delivery times of the MaaS companies rests on two pillars: on the one hand, there is the far-reaching digitalisation of the quotation and order processing process, and on the other hand, the large scale of these players ensures a strong lead time reduction via the 'pooling' effect. Ample, available production capacity is essential to quickly meet the specific needs of each customer on-demand and necessary for scaling up.

The pooling effect can be easily understood using an example: if you have one busy machine with a 90 per cent utilisation rate, there is only a 10 per cent chance that the machine will be free when an urgent order comes in. This urgent order will then have to wait until the machine becomes free, or the running order will have to be interrupted. However, if you have 20 machines, each with a 90 per cent utilisation rate, then on average two machines will be available to start immediately on the order. So the more machines you have, the easier it becomes to achieve a short delivery time, even when working at high utilisation rates. The pooling effect holds
in that the average waiting time at a machine is roughly inversely proportional to the number of machines. So if you have 10 machines, the average waiting time across all orders will decrease by a factor of 10. Larger Maas companies and marketplaces typically have hundreds of machines, which makes achieving very short lead times easy.

Thus, the advantages of the MaaS players rely not only on thorough digitalisation, but also on their scale. The latter advantage is much harder for an SME to replicate than digitalisation. More so, as the MaaS players grow further due to the attractiveness of their quick service, it will become increasingly difficult to compete with the MaaS players' short delivery times. A self-reinforcing spiral effect underlies this. The growth of the MaaS players creates an additional economy of scale through
the pooling effect, and also gives them the means to invest further in digitalisation, with smaller players increasingly losing the competitive battle, leading MaaS players to grow further. Where a number of sectors (such as sheet metal processing and machining) are now typically characterised by many smaller players, it is quite possible that in the future only a limited number of mastodon players will remain.

Now that on-demand MaaS is clear, what aspects are important to inform your choice and how can companies respond?

How do you position your SME or organisation within this new competitive environment and competition?

The MaaS players have some strong assets, but also have some weak flanks that can be exploited. The MaaS players focus on activities that are easy to scale up and digitise.

These are typically machine-based activities, often with lower-skilled operators, activities where work preparation can follow automatic rules, and activities where direct customer contact is limited. This means that there is still plenty of room for manual activities (e.g. assembly work, manual welding work), complex work preparation that requires a lot of knowledge (e.g. overhaul work), and activities where added value arises from deep cooperation with customers (e.g. engineering work).

Companies from various sectors are starting to refer to this service as an example of how to innovate their production system. Fundamentally, given the rapid evolution, you need to make the right strategic choices in time. And certainly to remain successful in standard supply.

Each supplier must consider whether (and by when):

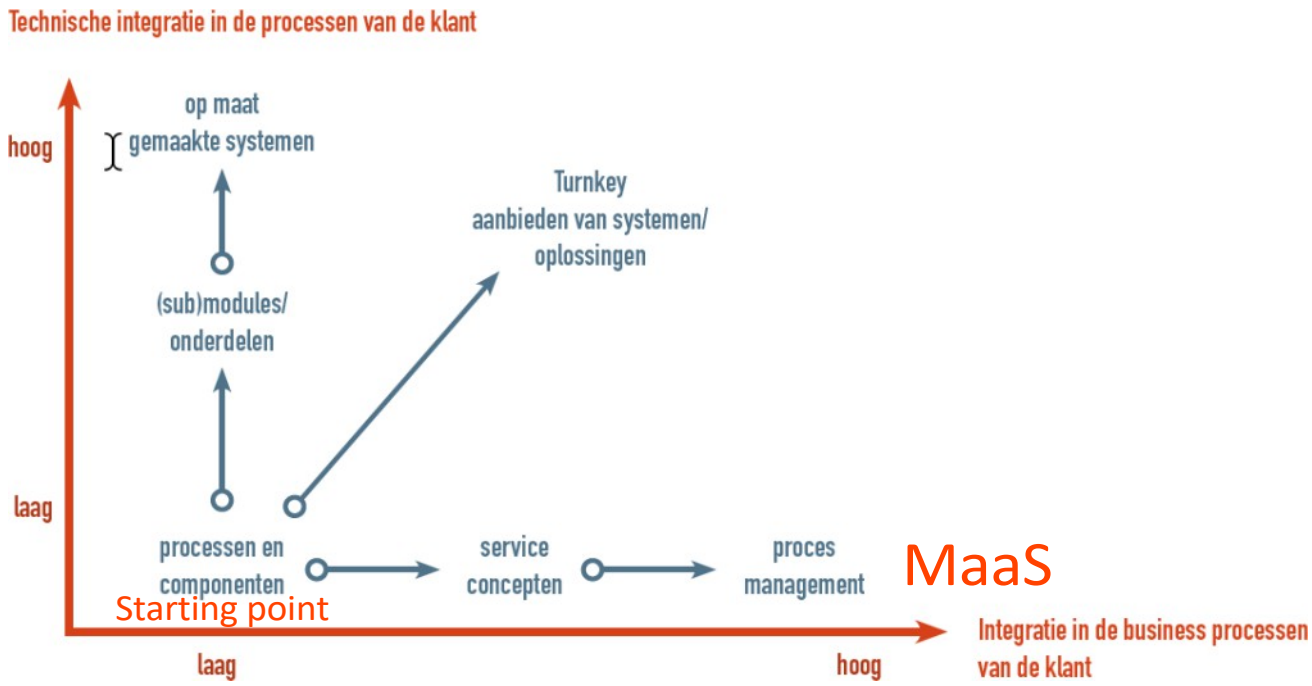
- he can speed up his turnaround time for on-demand custom production,
- he himself can/will set up such online state-of-the-art, fast and transparent service,
- he wants to join strong global digital ordering platforms to access their broad market,
- a change in operations or market positioning is necessary.

For example, faced with competition from the MaaS players, one supplier chose to say goodbye to a large proportion of its small, barely profitable customers and focus entirely on building a strong partner relationship with a number of larger customers. This made it possible to add value from engineering services. Another company chose to stop investing in loose parts production and instead specialise in assembly and welding, and buy some of its components itself from MaaS players.

How does specialisation offer a key to success in subcontracting ?

An Agoria study confirms that suppliers can only strengthen their market position if they manage to create additional customer value. This implies that the supplier clearly contributes to the profitability of the outsourcer.

Important here: the supplier can add value by responding to the customer's processes. The figure below illustrates how, in addition to a thorough integration of the business processes with the customer, added value is created by the degree of technical specialisation. The starting point is the current position as a supplier of processes and/or components (see bottom-left corner of the figure below).

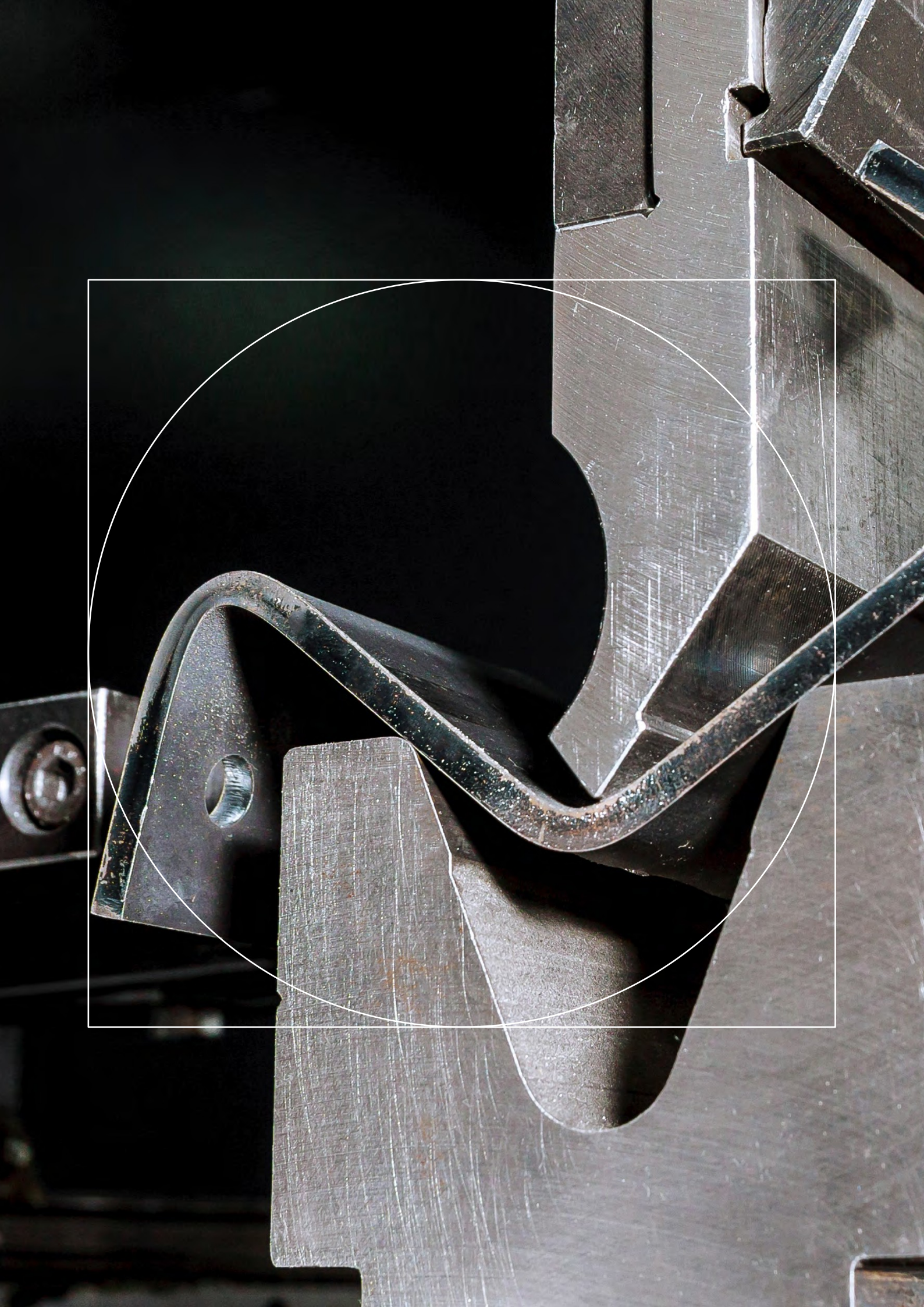


MaaS players mainly focus on simplifying customers' business processes and removing all barriers with simple online services (Source: 'Supply chain: specialisation as key to success', Agoria)

The horizontal axis - which MaaS players wet - indicates the extent to which **a company seeks added value through further integration into the customer's business process**. In this case, the company mainly tries to offer solutions that simplify the business process for the customer. As a service provider, they penetrate the customer's administrative value chain with the aim of adding additional value. They do this, for example, by expanding into a wide range of production processes and/or by adding additional services.

The vertical axis indicates the extent to which **a supplier seeks added value through further integration into the customer's technical process**. It offers a supplier opportunities for differentiation by moving up the customer's technical value chain. The supplier thereby penetrates the customer's production process step by step.
For example, a company producing components can create links between components and provide submodules. These have added value for the customer, because a number of production or assembly operations are integrated and automatic via these submodules (integrated components). At a further stage, this movement leads to the offering of total systems. **Offering these systems often requires a clear focus on certain markets.**

> *A 'strategic partner' combines both roles of system integrator and service provider. For the goods/products it supplies, this partner is the 'turnkey provider' that is responsible for streamlining and managing all the processes involved.*



Can a quick online/offline service in a traditional business?

For prototypes or customisation, customers count on fast turnaround times, clear communication and feedback from their production partners.

Some companies profile themselves as fast and cheap suppliers with a 'mock-up' of an online service: you provide your information online, the quote is created offline, quickly by a service engineer (within 1 working day). This expert support (and advice for optimisation) is played as an asset. But more is needed than a simple front-end for customers.

Planning, controlling and producing small batch, complex customised products with short lead times increases the complexity in production. Such service is difficult to realise and scale up without a process geared towards efficient production of on-demand customised products with short lead times and a modern, flexible automated production system. Wanting to combine prototypes or quick customisation with existing production, these rush orders disrupt the entire production process. Result: stress and chaos on the shop floor.

Do you have to develop everything yourself or are there software partners for small manufacturing companies?

Developing your own, online front-end requires a big investment (too big for many SMEs). A number of startups are developing software solutions for traditional manufacturing companies, ensuring that the most advanced tools are no longer the preserve of large companies.

For example, Paperless Parts allows manufacturing companies to make receiving orders and issuing quotes as seamless as in marketplaces, while continuing to sell directly to customers. In doing so, the software supports the costing of operations. Automated analysis of CAD files of parts provides
for various manufacturing processes basic information on a number of aspects that determine costs. For example, the number of fixtures in milling, process-specific detection of form elements (holes/pockets/3D machining), the volume to be removed or warnings about manufacturability (difficult or impossible features that make the work more expensive or complicated). This supports rapid quotation creation for a variety of complexities.

But the cost for an operation is highly dependent on the available machinery. Knowledge of the costs and capacities of the in-house machinery must be integrated into the quotation tool. Moreover, work preparation and production control must also be able to quickly process orders from the order data.

Source: paperless parts

Can the economies of scale of networked production also be realised locally?

Most suppliers are too small to compete over time with the established MaaS players with fleets of hundreds of machines, or to compete with a marketplace. Forming a local network of companies offers a way out here.

In a network, companies will work closely together to win orders (e.g. through a common website) and will also divide production among themselves based on available capacity. In reality, this amounts to forming your own marketplace with a few 'friendly' players, with the key difference being that the added value by the cooperation does not flow to a third party. A good network includes not only complementary companies, but also those with similar production assets, so that the pooling effect can also come into play. In theory, such production networks offer an answer to the economies of scale of existing MaaS players.
In practice, setting up a production network is not an easy task due to the prevailing suspicion in the supply sector. To succeed in this, some companies will have to jump over their own shadows.

How can QRM drastically reduce your lead times?

While many lean-manufacturing methods focus on mass production environments, quick response manufacturing (QRM) in a high-mix-low-volume environment shortens your lead times throughout the organisation: from order processing and material planning to production, both on the production floor and in office processes.

The idea is simple and closely aligned with 'on-demand': reducing the time between order and delivery. QRM visualises (long) lead times and reduces or eliminates their causes. In doing so, multidisciplinary and autonomous QRM cells increase the flexibility of your resources.
The concrete benefits of QRM: shorter lead times (50-90 per cent), greater delivery reliability, fewer hidden costs (such as overtime, excess stock, rush orders and expedition), greater customer satisfaction, greater employee ownership, fewer quality problems and less rework.
Quick Response Office Cells speed up the order process and allow faster response to customer requests: cross-training makes employees more broadly employable and avoids waiting times from shuffling orders-in-progress back and forth between departments.

QRM does not require a costly investment in technology, but incorporates the **organisational side and harnesses the power of employees**. **Increased agility** and **responsiveness** undoubtedly provide a **competitive advantage** for on-demand production of customised products.


INVISIBLE LASER RADIATION
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT

Is a transparent understanding of the status of the workshop feasible?

Digital shop-floor-control systems simplify production control for planners and supervisors, make up-to-date information available to production workers and provide real-time insight into the status of orders.

These systems allow employees to always work on the right things, and rapidly changing priorities no longer cause chaos and frustration. When an urgent order needs to be prioritised, simply adjust a date in the system and the order summary screens automatically adjust. So there is no longer any need to reprint the schedule and distribute it again internally, or go looking for where an order is somewhere. **Digital shop floor control systems increase delivery reliability** by working on the right orders and eliminate lost time due to late or poor communication. Digital shop floor control can be achieved through an **ERP module, a standalone system** (e.g. Propos, 24Flow) or as **part of a wider MES system**.

DIGITAL SHOP FLOOR CONTROL IS OFTEN THE BEST DIGITAL INVESTMENT ONE CAN MAKE ON THE SHOP FLOOR.

Digital technologies also allow machines **to** easily **connect, extract data from these machines and use this data to improve production**. Dashboards and the integration of this data into software applications (ERP/MES/... and their mutual integration) **increases transparency and productivity at manufacturing companies**. Existing production machines can also be easily connected.

How to flexibly automate customised production?

On-demand manufacturing companies support customisation from a strategic focus with flexible machinery and thorough automation.

247TailorSteel focuses on the sheet metal working industry and currently has 31 LVD ToolCell bending machines that make complex bending easier and more cost-effective. The press brakes are fully CNC-controlled and feature variable degree angle setting and sheet thickness adjustment. The automatic tool changer reduces set-up time, minimises errors and increases productivity. The patented Easy-Form® Laser system monitors and corrects angles during the bending process.
As a result, they work extremely accurately, reliably and first-time-right with zero-defect. For less complex work, PDEB press brakes offer efficiency, speed and quality. Internal logistics processes are supported by AGVs and robots. Sizing is also generated directly from digital order data.

A strategic choice is necessary, because not everything can be fully automated or flexibly deployed for small batches of customised work at an SME. On top of that, people remain the key to a successful manufacturing company. You need to be able to manage work preparation and automation for customisation. The collaboration between automation and operator should make them mutually reinforcing, each focusing on their strengths. Over-reliance on a few highly skilled people should be avoided (e.g. work planners or machine programming). Moreover, the investment must pay off and the whole picture and business model must be right. Therefore, Sirris explores the possibilities of flexible automation of production and logistics using robot/operator cooperation (robots/cobots), autonomous mobile robots (AMR/AGV), simple low-cost automation (e.g. karakuri kaizen with simple mechanical constructions) or automated post-processing of products with a cobot.

With a platform, can you dynamically offer every customer the right price ?

A platform can optimise pricing for maximum revenue by using data on customers to understand their behaviour and preferences, and by testing and adjusting pricing strategies in real-time.

Based on customers' specific characteristics, preferences and behaviour, AI algorithms can dynamically personalise prices for each customer at the level they are willing to pay. Determining real-time prices based on changes in demand, available production capacity and other factors allow prices to increase during peak periods or decrease during off-peak periods. Testing pricing strategies provides insight on how customers respond to different pricing strategies and allows for optimisation of prices. It is still unclear to what extent MaaS players already employ such strategies.

Could market dynamics lead to overcapacity and a price war?

Ensuring short lead times requires sufficient free capacity. MaaS companies are adding extra capacity. Moreover, MaaS companies looking to expand to other regions sometimes face very low prices from local supply.

They can no longer maintain their higher prices. To be competitive and capture markets, they have to lower their prices in these regions. By taking work away from local suppliers, capacity utilisation falls and so smaller players - with less sophisticated and cheap machinery - can offer short lead times combined with low prices. When suppliers quit, their - often universal - machines enter the second-hand market. This oversupply of second-hand machines inhibits demand for new machines. Thus, an overcapacity of machines can lead to a price war in a stagnant market. Right now, on-demand MaaS is only causing ripples; the shock wave in the market is yet to come. Its dynamics are still uncertain.

How Sirris can support you

After reading this white paper, are you wondering if MaaS makes sense for your business and what it could bring? Or rather do you have questions about how to start it up? Maybe you want to start digitising quotation generation? Or are you more likely to be triggered by the QRM philosophy that focuses on ultra-short lead times? For each of the themes raised
in this white paper, Sirris has experts in-house who can get you started and provide intensive support if required. So be sure to contact us to see together how we can help you!

Authors

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