

Discussion Paper

# Pay-Per-Use in Machine Manufacturing



# IMPRINT

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Open Industry 4.0 Alliance  
Christoph Merian-Ring 12, 4153 Reinach, Switzerland  
<https://openindustry4.com>  
[info@openindustry4.com](mailto:info@openindustry4.com)

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## **Editors**

Lucas Wolf (Open Industry 4.0 Alliance)

## **Authors**

Alexander Hüsgen (DG Nexolution)  
Alexandra Altermann (SAP)  
Dr. Christian Liedtke (KUKA)  
Georg Probst (Open Industry 4.0 Alliance)  
Martin Rönnebeck (Giesecke+Devrient GmbH)  
Nikolaos Stivaktakis (DG Nexolution)  
Sebastian Baierle (Giesecke+Devrient GmbH)  
Sebastian Weber (DG Nexolution)

## Abstract

Pay-Per-Use (PPU) in manufacturing is a concept that has been around for a long time, but despite its potential, adoption remains limited. Instead of purchasing machines outright, companies pay based on actual usage, reducing upfront investments and creating a more flexible financial model. While similar approaches exist in IT and mobility, the rise of Industry 4.0 makes PPU more viable for manufacturing by enabling real-time tracking and automated billing. However, implementation is still complex, with financial, operational, and technical hurdles that make companies hesitant.

For users, PPU offers access to advanced technology without requiring large capital expenditures. Costs can scale with demand, making production more flexible and reducing financial risk. Machines that were previously out of reach due to high purchase prices become accessible, and companies avoid the burden of maintenance and depreciation.

For providers, PPU creates continuous long-term revenue streams and strengthens customer relationships. Instead of one-off sales, they benefit from recurring income and gain valuable insights into machine usage, allowing them to refine their offerings and provide additional services.

Despite these benefits, adoption is slow. One of the biggest barriers is the misalignment of financial expectations. Users expect lower costs, while providers aim to secure stable revenue. There is also a trust issue - customers worry about hidden fees or unclear pricing models, while providers hesitate to take on financial risks tied to machine performance. On a technical level, implementing PPU requires seamless data collection, secure payment processing, and integration into existing operational structures. Many companies lack the expertise or infrastructure to manage these requirements efficiently.

Still, the potential of PPU is significant. As more companies experiment with usage-based models, experience will grow, and best practices will emerge. Ecosystems like the Open Industry 4.0 Alliance provide a platform for collaboration, helping to develop industry standards and frameworks that make PPU easier to implement. By addressing financial, operational, and technological challenges together, providers and users can take full advantage of this model and drive a shift toward a more flexible, service-oriented manufacturing landscape.

## Introduction

The concept of Pay-Per-Use (PPU) is not new. At its core, it is a usage-based billing model that has existed for centuries. In simple terms, one person provides access to a tool or resource, while another compensates them based on actual usage. The key principle remains that ownership does not transfer, only the right to use the asset. But what sets Pay-Per-Use apart from short-term leasing? While leasing offers a simple, predictable way to temporarily access an asset, PPU is a more flexible, utilization-based model. It introduces new complexities but also creates more opportunities. In the business world, PPU is often presented as a shift in thinking, an alternative way of structuring financial transactions. However, the fundamental mechanism has remained the same: a fee linked directly to usage. In industrial applications, PPU has gained momentum with Industry 4.0, where digitalization enables new business models that were previously impossible.



PPU is part of the broader trend of “servitization”, where companies move away from selling products outright and instead offer them as a service. This meets the growing demand from businesses that want to focus on their core expertise rather than owning expensive equipment. Many companies no longer see value in owning assets that are not central to their competitive advantage. This model is already well-established in many industries. Car-sharing and e-scooter rentals are common examples of

PPU in everyday life. In IT, Software-as-a-Service (SaaS) allows businesses to access software without purchasing it outright. Rolls-Royce introduced a PPU approach in the 1970s with its Power-by-the-Hour model for aircraft engines, where airlines paid based on actual engine usage rather than ownership. Other industrial applications include compressed air systems, office printers that charge per printed page, and even utilities such as electricity and heating, which have always been based on consumption.

The model can be extended further with an “outcome-based business” approach, where customers do not pay for machine usage itself but for the actual output it generates. Instead of dealing with operational efficiency, maintenance, or staffing, the customer only pays for the agreed-upon production results. This shifts the responsibility for machine performance entirely to the provider, making production costs more predictable for the user. This approach can be particularly beneficial in industries where demand fluctuates, production volumes vary, or product life cycles are short. For example, a manufacturer could pay per successfully assembled unit rather than per operating hour of the machine.

Nevertheless, this transfer of responsibility to the provider of the machine also means that, without any further conditions, the provider may potentially bear a disproportionate risk compared to the user. This could be the case if the provider's incoming payments depend on the performance of the user's employees. This highlights the importance of fair contract design for both parties, based on their respective risks and obligations, which—due to the individual challenges and complexity of each case—often requires significant time and can therefore hinder the implementation of such models.

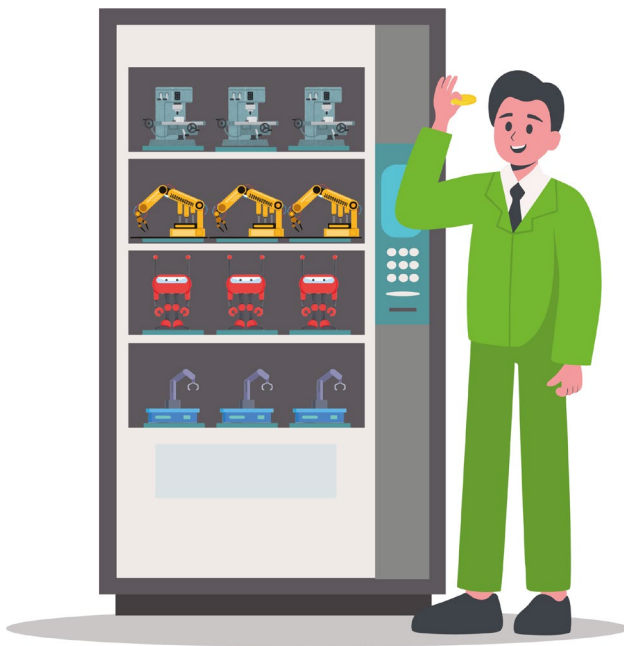
This paper explores the fundamentals of Pay-Per-Use, analyzing both its advantages and the barriers of adoption. Beyond identifying challenges, it will also discuss how PPU can be successfully implemented in manufacturing and where it offers the most value. The goal is to provide insights by various companies and what they think in terms of feasibility - and more importantly: to invite YOU to engage with us in this discussion and how YOU see this concept being applied to your company.

## PPU in Real-World Manufacturing

Although PPU is not a new concept, Industry 4.0 has accelerated its adoption in manufacturing. The ability to collect real-time data on machine usage makes it possible to implement usage-based billing models with greater accuracy. Previously, providers took significant financial risks due to uncertainty in machine utilization and maintenance requirements. Today, digital tracking reduces this risk. It allows providers to offer uptime guarantees and minimize unplanned downtime, while users benefit from a cost-effective model by paying only for actual machine usage.

### What Does it Really Mean for Users?

For manufacturers, Pay-Per-Use alters the way machines are accessed and integrated into production. Instead of purchasing equipment outright, they engage in a model where costs are directly linked to usage.



This changes financial planning, as machines are no longer classified as owned assets but as ongoing operational expenses. Since payments depend on actual utilization, financial commitments adjust dynamically instead of being fixed at the time of purchase. Operational responsibility also shifts. Traditionally, manufacturers own their machines and oversee maintenance, repairs, and performance. In a PPU model, the provider retains ownership and remains involved throughout the lifecycle of the machine. This introduces a different type

of relationship between user and provider, where availability, reliability, and service quality become continuous factors rather than concerns that arise only when a purchase decision is made.

Machine data plays a key role in this structure. Since the provider remains the owner, it typically collects and analyzes data on usage, efficiency, and wear. This data is necessary for billing but also influences maintenance strategies and future improvements. Users must navigate the implications of relying on a provider's systems for performance insights, which differs from the complete control they would have with owned machines. PPU also influences how businesses scale their production. With traditional ownership, investment

in new machinery requires long-term planning and capital allocation. In a PPU setup, companies can expand or reduce their machine usage with fewer financial constraints, adjusting capacity more fluidly based on demand. This means that production planning is no longer tied to fixed assets but instead becomes dependent on access agreements with the provider.

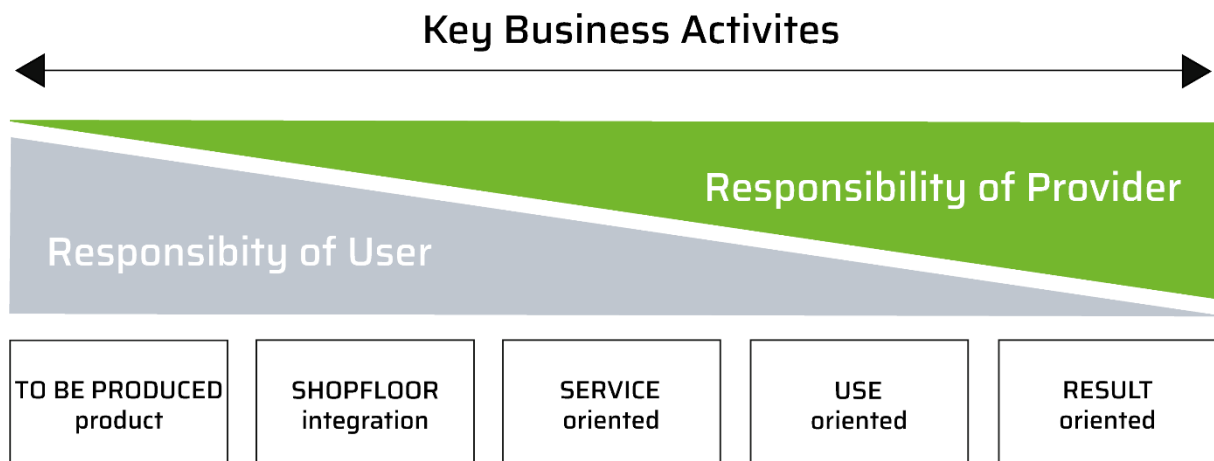
## What Does it Really Mean for Providers?

For machine manufacturers and equipment providers, PPU represents a shift from transactional sales to long-term service models. Instead of generating revenue at the point of sale, earnings are spread over time, dependent on the actual operation of the machine. This affects financial structures, requiring different approaches to cash flow, investment, and risk management, as revenue fluctuates with customer usage patterns.



Product design is influenced by this model as well. When machines are sold traditionally, durability and maintenance are the responsibility of the buyer. In a PPU setup, the provider remains accountable for performance, making factors such as reliability, serviceability, and remote monitoring more critical. This means that engineering priorities may shift toward ensuring uptime and predictable operational costs rather than focusing solely on initial sales.

The relationship with customers also changes. Instead of a one-time transaction, the provider remains actively involved throughout the operational lifecycle of the machine. This requires ongoing service, support, and monitoring, creating a continuous point of contact rather than a sales-driven engagement. The provider must also define terms around access, maintenance, and data collection, which can vary significantly from traditional sales models. Since revenue is directly tied to machine usage, providers need mechanisms to ensure accurate tracking and billing. This often involves integrating sensors, software, and connectivity solutions that enable precise measurement of usage parameters. Providers must also consider how to manage situations where machines are underutilized or idle, as this directly impacts revenue generation.



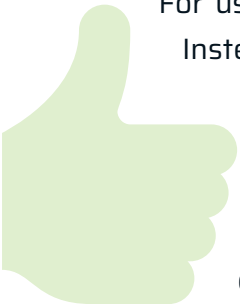
Additionally, asset ownership remains with the provider, requiring a long-term view on asset management. Machines deployed under PPU remain on the provider’s balance sheet rather than being transferred to customers. This impacts how companies handle depreciation, financing, and scalability. Unlike traditional sales, where machines are no longer a concern after delivery, PPU requires continuous oversight of deployed equipment across multiple customers. In this model, the provider is not just a manufacturer but an operator, ensuring that machines function as expected while balancing financial and operational risks. The shift from selling machines to delivering machine availability requires a different business approach, where technical performance and financial strategy are directly linked.



## Potential Benefits & Impact

The Pay-Per-Use model offers a range of benefits for both users and providers in manufacturing, including the ability to share more data and gain valuable insights. This enables both parties to optimize usage, improve efficiency, and enhance overall performance. By shifting from ownership to a usage-based approach, users can optimize costs, reduce financial risk, and gain access to modern technology without high upfront investments. For providers, this model creates new revenue opportunities, strengthens customer relationships, and enables data-driven service offerings. Understanding these benefits is key to evaluating PPU's potential and its role in shaping future business models.

### How Users Can Benefit



For users, PPU changes how they allocate capital and manage operational costs. Instead of making large upfront investments in machinery, they transition to a model where expenses are directly linked to usage. This shift provides financial flexibility, reducing the burden of long-term asset ownership and making it easier to adapt to fluctuating production demands. The ability to access machines on a usage basis enables companies to scale operations dynamically without locking in capital, making production capacity more agile.

One of the key benefits is the continuous access to state-of-the-art equipment. Traditional ownership often results in machines becoming outdated over time, requiring costly upgrades or replacements. With PPU, providers have an incentive to maintain and update machines to ensure peak efficiency, ensuring that users always operate with the latest technology. This can translate to higher productivity, reduced energy consumption, and improved output quality.

Operational risk is also redistributed under PPU. Maintenance, service, and repairs, which traditionally fall under the user's responsibility, can now be managed by the provider. This reduces unexpected downtime and shifts performance accountability to the supplier. Instead of dealing with unplanned repair costs, manufacturers operate under more predictable cost structures, allowing for better financial and production planning.

Additionally, PPU introduces a different way of managing machine data. Since the provider retains ownership, they typically monitor performance remotely, using data to optimize machine operation and preemptively address issues. While this ensures high uptime and reliability, it also requires users to adapt to a system where control over machine performance and operational insights is shared with the provider. For manufacturers operating in industries with fluctuating demand, PPU provides a way to align costs with

actual production output. Instead of holding underutilized equipment during low-demand periods, they can scale usage up or down based on business needs. This prevents unnecessary capital expenditures and enables companies to maintain a leaner balance.

## How Providers Can Benefit



For providers, PPU moves them away from one-time sales toward long-term revenue generation. Instead of earning revenue solely at the point of sale, they establish continuous income streams that provide a continuous cash flow over time. While this model requires a fundamental shift in financial planning, it offers long-term revenue stability and reduces dependency on cyclical capital expenditure patterns of customers. By offering machines through PPU, providers lower the financial barriers for customers, expanding their market reach. Small and mid-sized manufacturers that might not have the budget for high-cost machines can now access them without heavy upfront investments. This creates new business opportunities, allowing providers to serve a broader customer base.

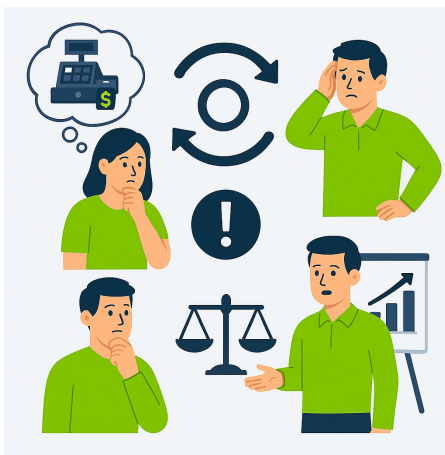
The ongoing relationship with customers also becomes more integrated. Unlike traditional sales models, where customer interaction is largely limited to the purchase and occasional service agreements, PPU requires continuous engagement. Providers remain responsible for machine uptime, performance, and service, fostering a stronger, service-oriented relationship with users. This allows for additional revenue streams through maintenance, software updates, and complementary services that enhance machine efficiency.

Machine ownership staying with the provider means they must rethink asset management. Instead of transferring ownership and risk to customers, they retain responsibility for the machines throughout their lifecycle. This requires careful planning around depreciation, financing strategies, and ensuring that machines remain operationally viable for as long as possible. The ability to refurbish and redeploy machines at multiple customer sites extends the asset lifecycle and maximizes returns.

Another major advantage is data access. Since providers continuously monitor machine usage, they gain insights into operational patterns, wear-and-tear trends, and customer behaviors. This data is invaluable for optimizing service schedules, improving future machine designs, and even developing predictive maintenance models. The ability to proactively address performance issues not only enhances service quality but also strengthens customer loyalty.

## Why PPU is Often Discussed but Rarely Implemented

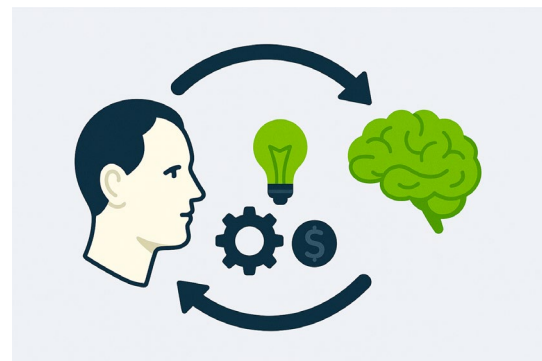
The idea of Pay-Per-Use in manufacturing has gained attention as a model that promises financial flexibility, lower entry barriers, and more efficient asset utilization. Yet, despite the discussions around its potential, adoption remains slow. The transition from ownership to usage-based pricing is not just a shift in how machines are paid for. It fundamentally changes business relationships, financial structures, and operational responsibilities. Many companies recognize the potential advantages, but when it comes to real-world implementation, they face a series of challenges that are not easily overcome.



A major barrier is the fundamental difference in expectations between providers and users. Customers see PPU as a way to reduce costs by only paying for what they need, avoiding large upfront investments and the risks of ownership. Providers, however, must ensure that the model remains profitable over time. They carry the financial burden of machine procurement, maintenance, and operational risks, making it necessary to structure pricing in a way that secures long-term returns. If both sides optimize for their own benefit, one aiming for cost savings and the other for higher revenue, this misalignment makes it difficult to establish fair pricing models.

Trust is another key issue. Traditional purchasing models are straightforward. A machine is bought, and ownership transfers entirely to the customer. With PPU, this dynamic changes. Users must rely on the provider for ongoing service, and pricing is dependent on data-driven calculations that determine usage. This creates uncertainty.

Customers may question whether providers are inflating costs or structuring contracts in a way that ultimately makes PPU more expensive than ownership. On the other hand, providers must trust that users will utilize the equipment in a way that makes the investment worthwhile. Digitalization has the potential to increase transparency through real-time tracking, but many manufacturing environments still lack the infrastructure to collect and process usage data with the required accuracy. Without reliable data, neither side can fully commit to long-term agreements with confidence.



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Beyond these commercial concerns, financial and accounting complexities pose additional hurdles. PPU requires manufacturers to shift from one-time sales to recurring revenue models, fundamentally altering how they manage cash flow, taxation, and depreciation. Many companies are structured around capital investments, and transitioning to service-based revenue requires rethinking how costs are accounted for and how financial planning is handled. This shift is not just a matter of adopting a new pricing model. It impacts everything from sales incentives to balance sheet management, making it a far more complex transition than it might appear on the surface.

Additionally, a significant but often overlooked challenge lies in the internal mindset shift required within manufacturing organizations themselves. For many, adopting PPU is not only a commercial or technical transformation, but a cultural one. Sales teams must adapt from product-based selling to service-oriented engagement. R&D departments need to design with long-term usability, monitoring, and serviceability in mind. Even service planning shifts focus - from isolated interventions to continuous support. This transition can be difficult and slow, and for some companies, the organizational effort around these changes is a key reason why they hesitate to offer PPU at all.

Technology also plays a critical role in determining whether PPU can be successfully implemented. Unlike digital services, where consumption is easy to track, manufacturing equipment requires precise monitoring to determine usage, performance, and maintenance needs. This demands a robust digital infrastructure, including IoT-enabled tracking systems, automated payment mechanisms, and secure data exchange between provider and customer. Payment structures require careful integration, as transactions must be handled reliably even in industrial environments where connectivity issues can occur. Offline payment capabilities can help bridge the gap. Besides the advantages of token payment (a digital unit of value) methods, offline payment capabilities have to be addressed. The need for secure and standardized systems remains a key challenge, as many existing industrial setups lack the necessary digital infrastructure to support seamless PPU transactions.

Furthermore, PPU does not eliminate fixed costs entirely. Machines still require provisioning, transport, installation, and regular servicing, all of which need to be factored into the pricing model. A purely usage-based approach often fails to cover these underlying costs, making it necessary to introduce hybrid models that combine a base leasing fee with variable usage charges. However, finding the right balance is difficult. If base costs are too high, customers lose the flexibility that makes PPU attractive in the first place. If they are too low, providers take on excessive risk and struggle to make the model financially viable.

## What Is Needed to Start?



Shifting to a Pay-Per-Use model in manufacturing requires a solid operational and financial framework that supports real-time monitoring of service delivery, while also integrating essential functions like invoicing, payments, and financial reporting. To make this work, existing ERP systems, accounting platforms, and treasury management systems need to be integrated smoothly to ensure accurate transaction recording, cash flow visibility, and reliable financial reporting. At the core of this setup is data visibility. Machines must be equipped with sensors or software capable of tracking key usage metrics, such as operating hours, produced parts, or cycle counts. This data must be collected, stored, and processed efficiently in a secure and trusted environment. A scalable data infrastructure, whether cloud-based or on-premise, is necessary to handle these continuous data streams and enable accurate invoicing and payments.

Implementing Pay-Per-Use cases can be approached in several ways, depending on how transactions are structured. Each method of settling transactions comes with its own strengths and limitations.

One option is to rely on machine counting with existing processes. The main advantage is that this requires minimal adjustments to existing processes and system environments. However, this approach may not be ideal for working with untrusted partners, as it relies on transaction records that reflect expected usage rather than actual service delivery. This creates inconsistencies and requires reconciliation efforts to align records with real-world activity.

Another approach involves token-based payment at the point of service delivery. This model works well with untrusted parties because service cannot be delivered without payment, which guarantees transaction accuracy. Records reflect actual service delivery rather than projections, reducing the need for reconciliation. Token-based payments can be implemented in different ways. For example, pre-purchased tokens can support both online and offline transactions, maintaining service continuity even during technical disruptions. Alternatively, a fully integrated online payment system can enable real-time transactions. Tokens could represent different forms of payment, including Central Bank Digital Currency (CBDC), CBMT, or stablecoins, allowing flexibility in financial settlement.

Beyond choosing a payment method, integrating data collection and processing into existing business systems remains critical. ERP and financial systems need to support flexible billing models rather than fixed purchases. This means handling variable billing cycles, managing usage fluctuations, and ensuring that pricing logic aligns with contract

terms. The sales process also changes significantly, as customers no longer purchase machines outright but enter into service agreements, which requires well-defined terms around usage limits, maintenance responsibilities, and cost structures.

The payment system itself must be frictionless. Instead of relying on manual invoicing, automated payment processing should be in place, potentially involving direct bank transactions, digital wallets, or tokenized payment methods like regulated stablecoins or tokenized deposits. These digital solutions enable faster transactions and greater flexibility. Accurate reconciliation between machine usage data and financial transactions is essential to prevent disputes and maintain stable cash flow.

From an operational perspective, Pay-Per-Use shifts the responsibility for machine performance to the provider. Since revenue depends on machine uptime, providers need to ensure continuous operational efficiency through predictive maintenance, remote monitoring, and fast service response. Unlike traditional sales models, where the provider's responsibility ends after delivery, PPU demands ongoing management to ensure long-term viability.

Finally, legal and contractual structures must evolve to support this model. Since ownership remains with the provider, issues around liability, insurance, and risk-sharing need to be clearly defined. Data-sharing agreements are also critical to maintain transparency while respecting customer confidentiality. Many companies hesitate to adopt PPU due to the complexity of managing these legal and operational factors, but without them, establishing a sustainable PPU model becomes difficult.

## Conclusion

The shift toward Pay-Per-Use in manufacturing is no longer just a theoretical discussion but a development that will continue to gain traction. Companies are under growing pressure to reduce capital commitments, maintain financial flexibility, and ensure their production capacity aligns with real demand. Traditional ownership models often tie up resources unnecessarily, making it harder to adapt to changing market conditions. Pay-Per-Use offers an alternative by linking costs directly to usage, reducing financial risk while still enabling access to the latest technology. A similar shift has already proven successful in the digital world, particularly in the online sector. Services like computing power, storage, and cloud platforms from providers such as AWS, Azure, and Google have demonstrated how effective and scalable usage-based models can be. This success could serve as a wake-up call for the manufacturing industry, highlighting the potential for PPU to become a competitive advantage once the necessary infrastructure becomes widely available.

That said, PPU is not a universal fit. For businesses operating only a handful of machines or with unpredictable low-volume production, the financial advantages may not always outweigh the complexity. The real potential unfolds at scale, where usage variations balance out across a fleet of machines. This makes it particularly interesting for companies looking to enter new markets without committing large upfront investments or for those aiming to shift toward service-driven revenue models. Early adopters who embrace PPU in a structured way can strengthen customer relationships and differentiate themselves in an increasingly competitive market.

At the Open Industry 4.0 Alliance, we see PPU as part of a broader shift in how industrial assets are managed, financed, and connected. It's not just about changing payment models but about integrating machines into smarter, data-driven ecosystems. Through our network of technology providers and users across various industries, we can share experiences, define best practices, and develop standardized solutions to address common challenges. The transition to PPU requires collaboration, and those who engage early will be in the best position to shape the future of industrial business models.