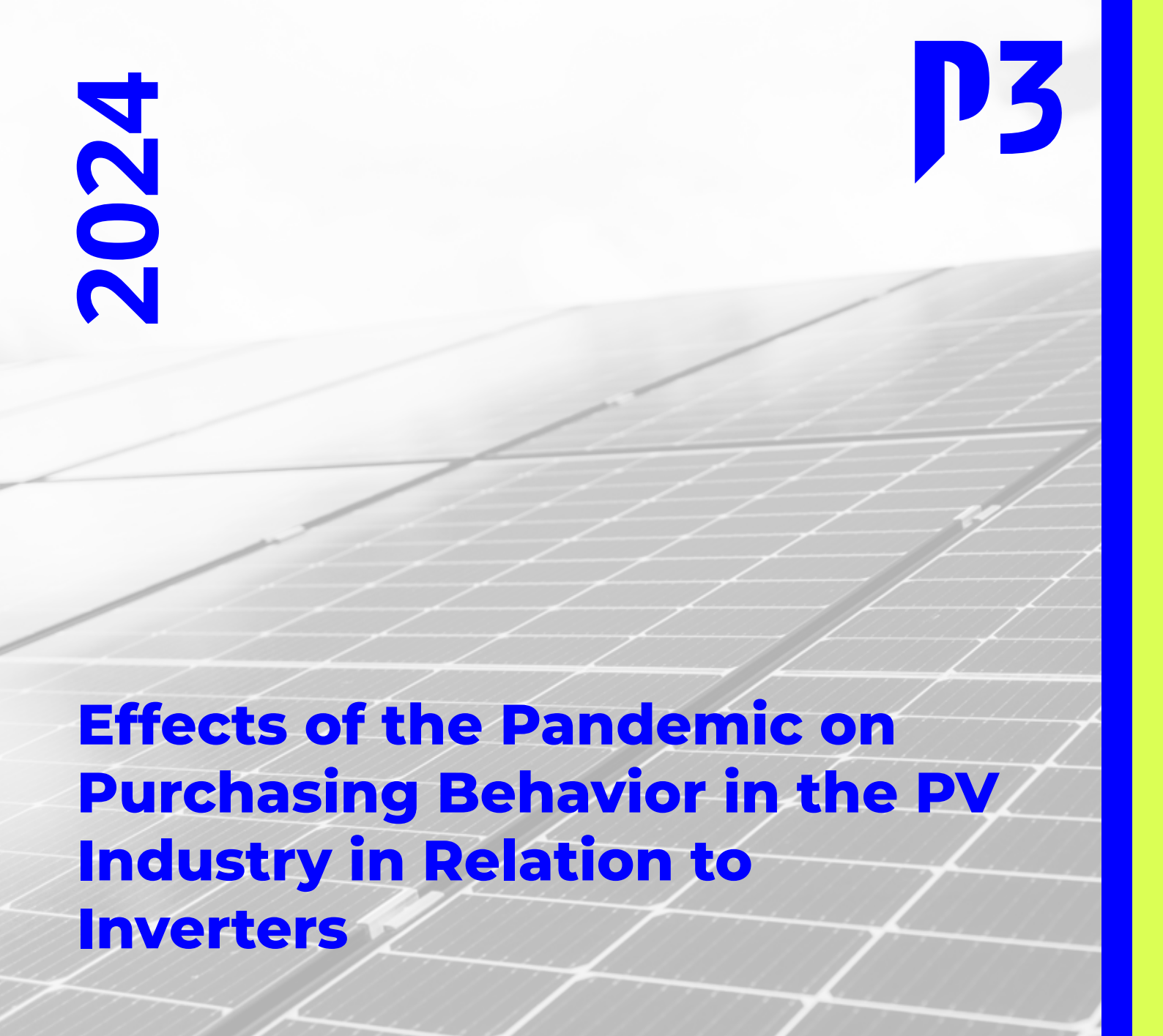


2024

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# **Effects of the Pandemic on Purchasing Behavior in the PV Industry in Relation to Inverters**

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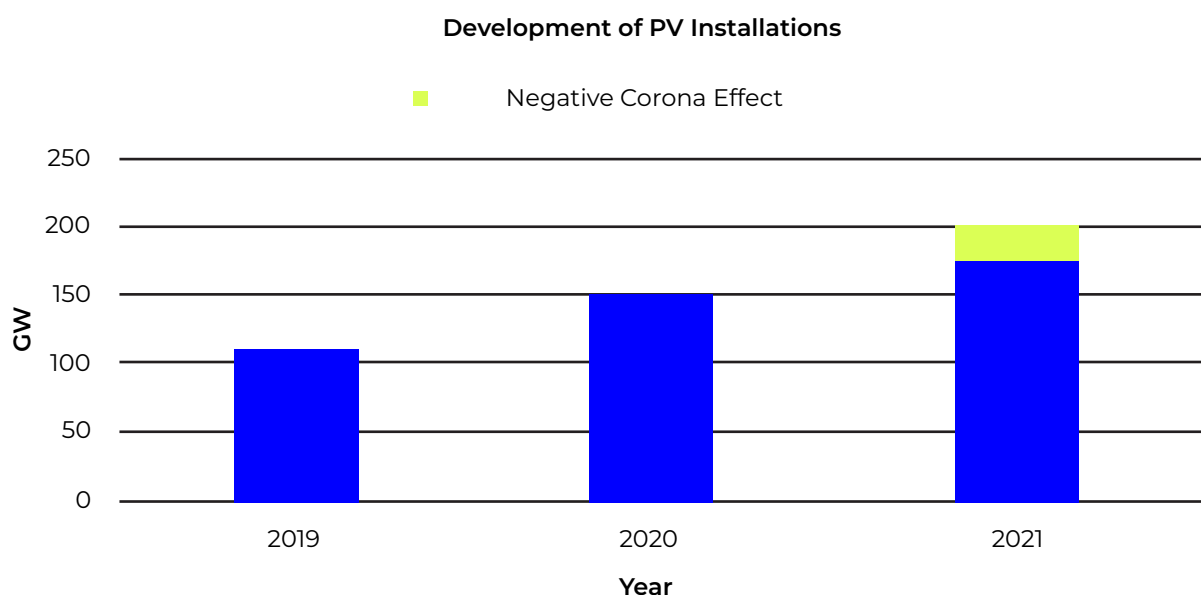
## 1. Management Summary

1. The pandemic led to 10% less growth in the installation of PV systems in 2021.
2. Installer in the PV industry are changing their single-sourcing strategy to dual or multiple sourcing due to the supply difficulties caused by the pandemic.
3. Due to the minimal losses from non-compliance with delivery schedules, deliveries were awaited at the onset of the pandemic.
4. As the pandemic progressed, numerous short- to medium-term measures were nevertheless taken, such as the search for alternative suppliers, the expansion of communication with existing suppliers, over-ordering and the adjustment of the model configuration.
5. With the return to pre-pandemic conditions, there were no structural changes in purchasing.

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## 2. Current Situation

Renewable energy is emerging as a focal point of global energy policy due to a convergence of environmental imperatives and geopolitical dynamics. The ascendance of solar and wind power is particularly notable, and the role they play in the transition to cleaner energy sources is of paramount importance. Evidence of this trend is provided by the trajectory of annual photovoltaic installations worldwide, which have seen a sustained increase over recent years.



The importance of solar energy within the renewable energy sector is growing and is becoming increasingly important in the quest for diversification and sustainability of energy supply. Empirical data shows that the installation of PV systems has been steadily increasing in recent years, emphasizing the resilience and strategic value of the sector.

Even during the global adversity brought about by the coronavirus pandemic in 2020, the sector maintained its growth momentum. This resilience illustrates the robustness of the solar industry and its crucial role in the energy strategy. However, it must be recognized that, according to calculations, 25 GW fewer PV systems were installed in 2021 due to the pandemic. This deviation may be due to the supply chain disruptions caused by the pandemic, which led to a shortage of essential components for PV systems.

The link between the lack of PV installations and supply chain challenges is an interesting topic for further investigation. Analyzing this link could lead to insights on how to improve the resilience of the solar energy supply chain and ensure installation forecasts are met even in the face of global disruptions. Future studies should aim to quantify the impact of supply chain variables on renewable energy deployment and develop strategies to mitigate these risks.

### 3. Purchasing Strategy

In academic literature, the dynamics of procurement are integral to supply chain management, encompassing a range of strategies informed by the interplay between various entities within a business network. These entities, which include manufacturers, suppliers, and wholesalers, operate in a fluid market milieu characterized by volatility and often intense pressures. Strategic choices in procurement are driven by a multiplicity of factors such as cost, quality, risk, and sustainability, all of which are subject to modification in response to evolving market needs.

Criteria Purchasing Strategy	Lower Costs	Better Performance	Lower Risk	Greater Flexibility
Single Sourcing	X	X		
Dual Sourcing	X		X	
Multiple Sourcing	X		X	X
Local Sourcing			X	X
Global Sourcing	X	X	X	X
Modular Sourcing	X	X		
Just-In-Time	X	X		

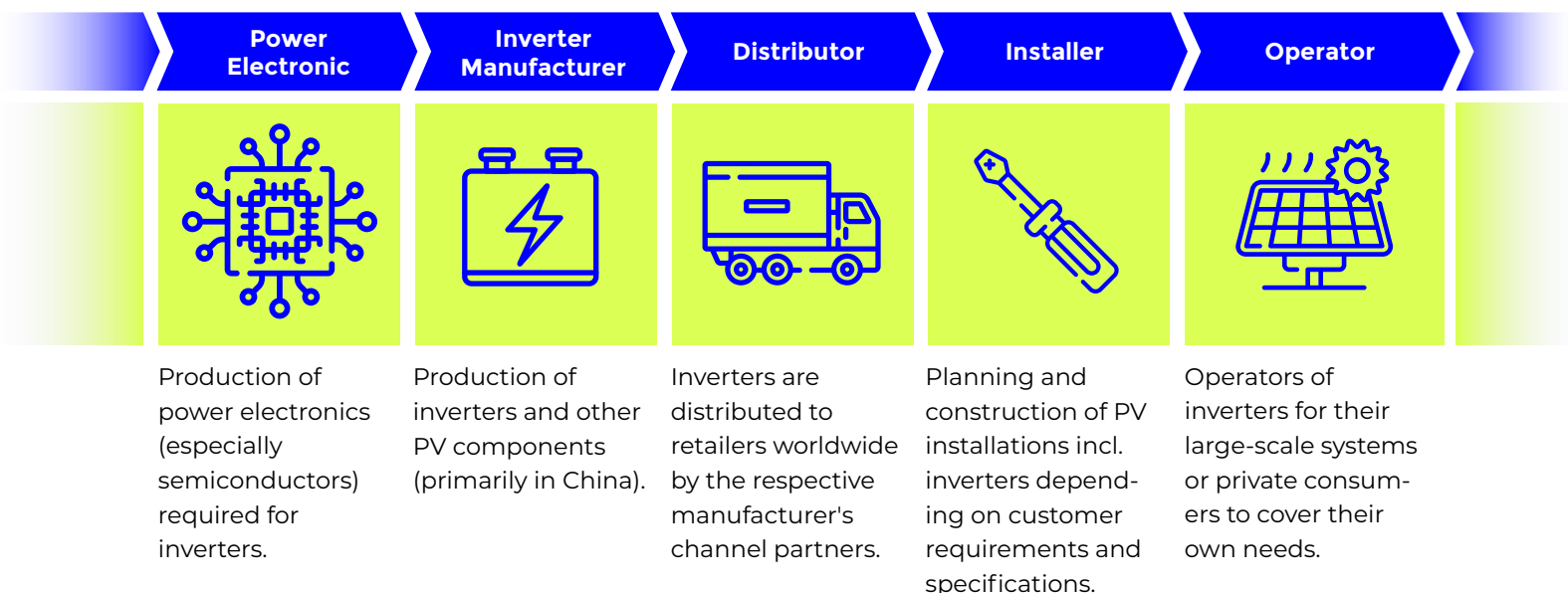
The spectrum of procurement approaches for inverters extends from single sourcing to multiple sourcing, primarily distinguished by the number of supplier relationships a firm engages in.

As firms increase the number of their suppliers, they generally observe a corresponding decrease in risk and an increase in operational flexibility. Conversely, single sourcing can enhance performance through the development of deep, collaborative, and long-standing relationships with suppliers.

The dichotomy between local and global sourcing is predicated on the geographical spread of the supplier network. Global sourcing, with its ability to tap into a worldwide supplier base, often yields enhanced performance and cost efficiency, leveraging the global market to compare and select optimal suppliers.

In the realm of modular sourcing, the focus shifts to the procurement of complex assemblies, which, compared to the acquisition of individual parts, can offer considerable reductions in both cost and coordination efforts.

## 4. Photovoltaic Industry



The photovoltaic sector experienced significant expansion by the end of 2021, with the global PV market boasting a capacity of 946 GW. Within just the last year of that period, an impressive 175 GW was installed, signaling robust growth despite the challenges posed by the pandemic and the economic turbulence experienced, particularly within China's borders. Notably, had it not been for the pandemic, projections had set the installation capacity at an even higher threshold of 200 GW for the year 2021.

### Deep dive: Solar inverters

Photovoltaic installations consist of a small number of essential components: Inverter, solar panel, mounting system and cables. These can be supplemented by other optional components such as battery storage. The inverter is referred to as the centerpiece of the system due to its important tasks.

Solar inverters perform several crucial functions. They facilitate the conversion of power from DC to AC, essential for integrating solar electricity into the public grid. They continuously optimize power through Maximum Power Point Tracking (MPPT) and incorporate integrated cooling systems to avoid overheating. Furthermore, they ensure precise coordination and control of power feed-in, maintaining adherence to stringent grid specifications.

The core components of a solar inverter include the H-bridge, which is instrumental in switching the current, filters that enhance power quality by removing interference, control electronics that oversee system monitoring and efficiency, and heat sinks that provide thermal protection.

The industry features various types of inverters, each serving different functions within PV systems. Hybrid inverters support both battery storage and grid supply, micro-inverters cater to individual modules, string

inverters manage multiple modules, and central inverters are deployed for large-scale ground-mounted systems.

## 5. Method & Implemented Measures

### Method:

During the coronavirus pandemic, the photovoltaic industry encountered significant supply chain disruptions, leading to a shortfall in the number of PV installations relative to projections. A field investigation was conducted at the 'Solar Solutions' exhibition in Düsseldorf, where interactions with exhibitors yielded valuable data on the mitigation strategies deployed by the industry. To supplement the findings from the exhibition, a series of in-depth interviews were held with seasoned experts who have experience within the PV sector.



## Implemented measures:

Amidst the pandemic-induced delivery challenges for inverters, affected companies in the photovoltaic industry adopted a multitude of strategies to mitigate the repercussions.

A primary course of action was to await deliveries, as the absence of components resulted in relatively marginal losses. Nonetheless, firms actively sought alternative supply sources, enhanced communication with existing suppliers, placed substantial over-orders, and bolstered their understanding of their supplier networks. Furthermore, companies adapted their model configurations based on the availability of components, resorted to combining parts from various producers, and elevated the pandemic's implications to a central point of discussion in all routine meetings.

Despite the difficulties, more drastic steps like the establishment of a 'task force', enlisting external third-party assistance, or initiating direct engagement with sub-suppliers were not pursued. This was attributed to the relatively compact nature of the PV network and the minimal loss levels associated with component shortages.

## 6. Conclusion

The solar sector, in tandem with wind energy, constitutes a cornerstone of the renewable energy industry. Despite achieving remarkable growth in the past years, the sector has faced its share of setbacks due to the pandemic, notably in supply chain disruptions.

The prevalent strategy has been a patient approach, weathering comparable losses across the board. In response, the industry has occasionally implemented various strategies: seeking out new suppliers, enhancing dialogue with current providers, substantially increasing orders, broadening understanding of internal supply networks, and tailoring product designs to match the availability of resources. With conditions stabilizing to a pre-pandemic state, the necessity for extensive and permanent strategies has subsided.

At P3, our profound understanding and forward-thinking approach in the photovoltaic realm set us apart. We extend an invitation for you to explore our comprehensive suite of services. Aligning with us opens the door to a repository of knowledge, pragmatic strategies, and cutting-edge solutions that will empower and elevate your understanding and proficiency in solar technology.

## 7. List of Abbreviations

<b>GW</b>	-	<b>Gigawatt</b>
<b>JIT</b>	-	<b>Just-in-time</b>
<b>MPPT</b>	-	<b>Maximum Power Point Tracking</b>
<b>PV</b>	-	<b>Photovoltaic</b>





## 7. Contact/P3 group

Contact for questions and remarks



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