



WHITE PAPER

HLA instead of PCBA

How Value Creation in Electronics Manufacturing Is Shifting – and What This Means for Providers Without System Competence

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1. Executive Summary

Traditional PCBA manufacturing is increasingly facing competitive pressure. Standardized SMT processes, high levels of automation and the broad availability of comparable manufacturing technologies reduce the opportunities for differentiation in standardized assemblies. Competition is therefore increasingly based on price, delivery time, quality and available capacity.

At the same time, part of the value creation is shifting towards higher levels of integration. The assembled PCB becomes a tested, configured and mechanically integrated product. The downstream value-added stages – ranging from board-level testing and mechanical box build (HLA) to complex system integration and final end-of-line testing – consolidate electronic assemblies, mechanics, software, and enclosures into a fully verified complete system.

For OEMs, this can reduce the number of interfaces and allow responsibility for manufacturing, integration and testing to be consolidated more strongly with a single partner. For EMS providers, expanding towards HLA creates additional opportunities for differentiation and for taking on further stages of the value chain.

This development is also reflected in the consolidation of the EMS market. Companies such as GBS Electronic Solutions, NOTE and Kitron have recently acquired companies and capabilities that extend beyond pure PCBA manufacturing.

For providers without HLA capabilities, this changes the competitive environment. They must either occupy a clearly defined technological or organizational niche, define their role as a specialized supplier within a larger value chain, or assess whether an expansion of their own capabilities is necessary.

HLA, however, is not simply an extension of the machine park. With the higher level of integration, technical responsibility, material responsibility, testing requirements, capital commitment and organizational complexity increase. At the same time, the economic success of an HLA project is already influenced during product development.

2. Why Standardized PCBA Is Coming Under Increasing Pressure

PCBA remains the central foundation of almost every electronic assembly. The question is therefore not whether PCBA is losing importance. Rather, the issue is how strongly a pure PCBA service can still differentiate itself from comparable offerings by other EMS providers.

Modern SMT manufacturing is highly automated. Pick-and-place machines, solder paste printing, AOI, SPI, reflow soldering and automated testing processes are widely available at professional EMS providers. The required process knowledge is also internationally available.

For standardized products, this leads to increasing comparability of manufacturing performance. An OEM can choose between several qualified providers, provided there are no specific technological, regulatory or logistical requirements.

Competition therefore shifts more strongly towards:

- price
- delivery time
- quality
- capacity
- flexibility
- material availability

Overcapacity in individual regions and market segments can further increase this price pressure.

This does not mean that every PCBA operation becomes a commodity business. Technologically demanding assemblies, small production volumes, high reliability requirements, special materials or particularly short response times can still provide significant opportunities for differentiation.

For standardized PCBA services, however, the following applies. The more interchangeable the pure manufacturing process becomes, the more difficult it is to achieve sustainable differentiation based solely on PCB assembly.

3. What Additional Services HLA and Integration Include

The next stage is to no longer view the PCB in isolation, but to manufacture it as part of a complete product.

Depending on the product, HLA, Box Build and system integration can include services such as:

- mechanical assembly
- installation of the PCBA into a housing
- cable and wiring integration
- displays and controls
- power supplies and power units
- firmware loading
- configuration
- electrical and functional testing
- end-of-line testing
- packaging
- logistics

This changes the role of the EMS provider.

The provider is no longer merely delivering an electronic assembly, but is taking responsibility for a larger part of the industrial implementation of the finished product.

For the OEM, this can reduce the number of interfaces. Instead of coordinating separate suppliers for PCBA, cables, mechanical components, assembly and final testing, several of these services can be bundled with one EMS partner.

For the EMS provider, this creates an additional opportunity for differentiation. Competition is then no longer based exclusively on the ability to assemble a PCB efficiently, but increasingly on the ability to industrialize, assemble, test and deliver a more complex product reliably.

4. Real Market Examples

The development can already be observed in concrete market movements.

GBS Electronic Solutions und productware

In January 2026, GBS Electronic Solutions Group acquired all shares in productware.

productware provides services ranging from development and series production to testing and the manufacture of complete devices and Box Build products.

The acquisition therefore expands the service portfolio beyond traditional PCBA manufacturing.

NOTE und STI

In 2026, NOTE acquired all shares in STI Enterprises Holdings Limited in the United Kingdom.

STI has capabilities in Advanced PCBA, Box Build and testing and is particularly active in the defence sector.

The acquisition strengthens NOTE's position in the defence business while also expanding its existing capabilities in higher-integrated electronic products.

Kitron und DeltaNordic

Kitron acquired DeltaNordic, a Swedish provider of advanced electronics and electrical systems with a strong position, among other areas, in the defence sector.

DeltaNordic operates production facilities in Sweden and China and serves customers in defence, mining and infrastructure, among other sectors.

This example also shows that the strategic expansion of an EMS provider does not have to focus exclusively on additional PCBA capacity.

4.1 Geopolitics and Sovereign Manufacturing

The shift towards HLA is further supported by changes in security-critical markets.

In areas such as defence, aerospace and other critical technologies, factors beyond cost and manufacturing capacity can be decisive. These can include:

- local production capabilities
- qualified and auditable sites
- traceability
- specific quality requirements
- controlled access to sensitive information
- export control requirements
- customer-specific approvals
- long-term availability of technical capabilities

In such markets, the ability not only to manufacture a PCBA but also to integrate and test a complete electronic product can therefore become more strategically relevant.

The acquisitions of STI by NOTE and DeltaNordic by Kitron show that, particularly in the defence environment, the focus is not exclusively on additional assembly capacity. Customer relationships, technical capabilities, qualified sites and market positions are also acquired.

This does not mean that HLA must generally be produced locally or exclusively in Europe. Rather, for certain products and markets, requirements relating to location, security, qualification and control can have a greater influence on the choice of manufacturing partner.

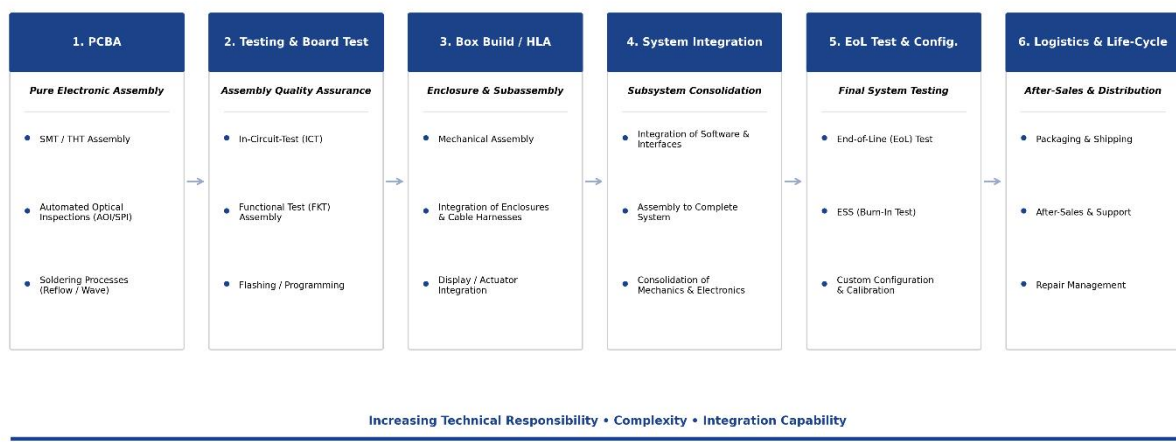
5. HLA as a Value-Added Stage

The development can be illustrated in simplified form as a series of value-creation stages.

PCBA → Board-Level Test → Box Build / HLA → System Integration → EoL Test & Config. → Logistics & Life-Cycle

From Component to System: The 6 Phases of Modern Electronics Manufacturing

Schematic course of industrial value creation and capability depth



Note: Schematic representation of the scope of services. Actual value creation potentials vary depending on product mix and quantities.

Source: EMS Strategy Group

With each additional stage, the technical and organizational requirements increase. The EMS provider takes on additional interfaces, technical responsibility and production management. At the same time, the interchangeability of the pure manufacturing process can tend to decrease.

However, this should not create the impression that a higher level of integration automatically leads to higher margins. HLA can enable additional value creation and differentiation, but it also requires investment, engineering, material responsibility, testing capabilities and capital commitment.

The decisive economic question is therefore not whether HLA is fundamentally more profitable than PCBA. What matters is whether the additional value creation justifies the resulting costs, risks and higher capital commitment.

6. What the Move to HLA Means for EMS providers

For EMS providers, expanding towards HLA creates interesting opportunities. They can take on a larger share of the value creation and position themselves more strongly as manufacturing and integration partners for the OEM.

The move from PCBA to HLA, however, is considerably more demanding than simply expanding the machine park. In addition to production space and equipment, capabilities in mechanical assembly, cable assembly, testing, configuration and production control are required. At the same

time, responsibility for material availability, quality and the timely delivery of the complete system increases.

These advantages are accompanied by significant requirements. System integration requires investment in mechanical assembly, customer-specific test adapters and qualified personnel, which can only be amortized over a sufficient order volume. The complexity of the supply chain also increases because, in addition to electronic components, housings, cable harnesses and mechanical purchased parts must be coordinated.

Providers that take this step without a sufficient order base run the risk of building capacity that cannot be kept permanently utilized.

6.1 Working Capital Becomes a Strategic Factor

Entering HLA also changes the working capital structure of the business.

Depending on the business model, a significant part of material responsibility in traditional PCBA projects may remain with the OEM or relate to relatively predictable electronic components. With HLA, the EMS provider often also has to procure and pre-finance housings, cables, power supplies, mechanical components and packaging materials.

This increases not only the capital tied up in the business, but also inventory and obsolescence risk. Long customer payment terms can further reinforce this effect.

For smaller EMS providers, financing this growth can therefore become just as important a hurdle as investment in production space and equipment.

6.2 HLA Begins in Design

Another important aspect is that the economic success of HLA manufacturing is already influenced during product development.

A technically functional OEM design is not automatically an economically optimized manufacturing design.

Poor component placement, difficult-to-access assembly points, unnecessary manual assembly steps, difficult cable routing or a lack of efficient testing options can significantly increase assembly costs.

An EMS provider with HLA capabilities should therefore be involved in product development and industrialization as early as possible.

Design for Assembly (DfA) and Design for Test (DfT) thus become important components of the business model.

The EMS provider increasingly develops from a pure manufacturing service provider into an industrialization partner.

6.3 The Economic Consequence

HLA is therefore not simply a matter of adding further manufacturing steps.

The EMS provider simultaneously takes on greater technical responsibility, greater material responsibility and greater financial risk.

The model is successful only if the additional value creation justifies the resulting costs, risks and higher capital commitment.

7. What It Means for EMS Providers Without HLA

Not every EMS provider can or wants to expand towards HLA.

Reasons may include insufficient production space, limited financial resources, a lack of engineering capabilities or a deliberate specialization in specific manufacturing processes.

That alone is not a strategic mistake.

It becomes problematic when a provider has neither a clear technological niche nor a sufficiently strong position within a larger value chain.

For standardized PCBA services, price pressure can then increase. At the same time, OEMs may increasingly tend to bundle manufacturing, integration and testing with a single partner.

A pure PCBA provider can consequently gradually move from being a direct OEM partner to becoming a supplier to a larger HLA or system integration provider.

This can also reduce direct access to the OEM and influence over product design.

7.1 The Alternative – Specialization

A pure PCBA strategy can continue to work if the provider has capabilities that are not readily interchangeable.

These can include:

- demanding small-series production
- prototypes and rapid production ramp-ups
- specialized substrates
- high reliability requirements
- specialized manufacturing processes
- complex repair and rework capabilities
- specific industry approvals
- particularly short response times

What matters is not necessarily whether every EMS provider must offer HLA, but which capabilities will continue to make the provider difficult for the OEM to replace. Such differentiation can be achieved through additional integration capabilities as well as through clear technological or organizational specialization.

7.2 The Position Within the Value Chain

Research into global value chains shows that the organization of electronics production is strongly shaped by modularity and the separation of individual value-creation stages.

Sturgeon and Kawakami describe, among other things, the interaction between lead firms, contract manufacturers and platform leaders in the electronics industry, as well as the importance of modular value chains.

For EMS providers, this means that individual manufacturing stages can in principle be performed by different companies. However, the more additional technical and organizational services are integrated, the greater the strategic importance of the partner within the value chain can become.

For a PCBA specialist, it is therefore essential to consciously decide which role it wants to occupy in the future.

Specialist, HLA partner or supplier to a system integrator.

8. Consequences for OEMs

The situation is also changing for OEMs.

The decision between a pure PCBA provider and an HLA or system integration partner should not be based exclusively on the unit price of the assembly.

Instead, OEMs should examine which services actually remain with the selected EMS provider and which tasks are in turn assigned to other suppliers.

Relevant questions include:

- Who procures housings and mechanical components?
- Who is responsible for cables and wiring?
- Who performs final assembly?
- Who develops and operates the test systems?
- Who is responsible for firmware loading and configuration?
- Who carries the inventory risk?
- Who is responsible for final product quality?
- Which services are actually performed in-house?
- Which services are merely coordinated by the EMS provider?

This makes the difference between a genuine integration partner and a provider that merely passes additional services on to other suppliers transparent.

For OEMs, an HLA model can provide advantages if it reduces interfaces, internal effort and responsibilities.

However, it can also make sense to assign individual highly specialized manufacturing or integration steps separately.

What matters is therefore not the designation “HLA”, but the actual depth of services provided and the overall economic situation.

9. Conclusion

Value creation in electronics manufacturing is not shifting because PCBA is becoming obsolete. PCBA remains the technological foundation of electronic products. What is changing, however, is where differentiation and responsibility arise within the value chain. Standardized PCBA services are increasingly exposed to international competition, and as manufacturing processes become more comparable, additional technical and organizational capabilities become increasingly important.

HLA, Box Build and system integration offer EMS providers an opportunity to take on additional stages of the value chain and strengthen their position as a partner to the OEM. At the same time, this move is demanding. It requires additional technical capabilities, engineering involvement already during product development, suitable testing and integration capabilities, additional production space, a capable supply chain, sufficient financing and a solid order base. HLA therefore cannot be viewed simply as an extension of existing PCBA production, but as a broader change in the responsibilities and risk structure of the EMS business.

For providers without HLA capabilities, this development does not automatically mean the end of their business model. They must, however, clearly define their strategic position. A PCBA-focused strategy can remain viable where an EMS provider offers capabilities that are difficult to replace, whether through technological specialization, demanding applications, short response times or other distinctive competencies. Providers that can neither offer HLA nor occupy a technologically difficult-to-replace niche must, however, expect their position within the value chain to change.

For OEMs, this development makes it increasingly important to look beyond the PCBA price when selecting an EMS partner. The actual depth of services, the distribution of responsibilities, the capital structure, the integration capabilities and the extent to which services are performed internally all need to be considered when evaluating the overall value of a manufacturing relationship.

The decisive question is therefore increasingly not simply who can assemble the PCB, but who can reliably turn that PCB into a finished, tested and production-ready system while taking on the necessary technical, economic and strategic responsibility.

10. Further Reading

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About the Author

Dirk Kaussen is Founder and Managing Director of EMS Strategy Group. With around 40 years of experience in the electronics industry — including founding and managing his own electronics manufacturing company in Germany — he brings deep expertise in manufacturing processes, EMS partner selection, supply chain stability, relocation projects, and risk management. His approach combines practical solutions with a direct connection to industrial reality.

About the EMS Strategy Group

EMS Strategy Group supports industrial enterprises in the strategic and operational advancement of their electronics manufacturing. Our core expertise lies in the strategic relocation of manufacturing volumes, the selection of qualified EMS partners, the establishment of new production capacities, and the expansion of existing manufacturing structures.

Furthermore, we design resilient supply chain frameworks, conduct comprehensive risk assessments, and guide dual-sourcing strategies, with operational support through to a successful series production ramp-up.

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