TECHNICAL PAPER

Author: Tobias Gleichmann
techpaper@finetech.de

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How Finetech's "Prototype to Production" Approach Supports an Efficient Transition from R&D Processes to Series Production

When transferring from prototype to production assembly, valuable time is often lost and costs increase when R&D equipment and production machines differ greatly. Many processes require a second development loop to ready them for automated production lines, and there may be a loss in flexibility. Higher and possibly riskier initial investments are often required, and staff must be intensively trained in the operation of the different machines.

This is where Finetech's technological ecosystem comes into play. Our "Prototype to Production" approach makes it possible to consider all future automation steps as early as the development stage and then transfer the development processes in all their technological diversity to the production environment with ease. This is possible due to a cross-system machine architecture, a unified process module platform, and identical software and operation. This approach enables fast, creative and flexible product development with a comparatively low initial investment and elegantly supports an efficient realization of product ideas.

FINDING THE RIGHT STRATEGY

On the demanding journey from product concept to market, manufacturers typically strive to build demonstrators or prototypes as quickly as possible to prove feasibility before going into production. These prototypes not only serve to develop the final variant, but also to acquire potential investors.

For the development and subsequent transition of the assembly processes into a production environment, manufacturers pursue very different strategies. Some use simple manual assembly workstations specifically for development and then set up processes again for production, while others develop immediately using their production equipment/lines. Depending on the manufacturer, industry and product, there are numerous combinations in between, but the two very different strategies show clearly, which compromises and risks are associated with the respective decision.

PRODUCT DEVELOPMENT ON MANUAL ASSEMBLY WORKSTATIONS

Manual assembly workstations are generally simple to operate and can be quickly prepared for new tasks. In the best case, processes can be evaluated and adapted immediately. However, automation is not possible with a manual system, and this is essential for volume production.

Particularly for startups and smaller companies, the manual assembly approach can be less risky compared to the decision to invest in a costly automated solution at the very beginning of product development. The demonstrators or prototypes are built by hand, and if this is successful, they may try to transfer the process to a manual die bonder system. This is where problems begin, as the machine's manipulator may not be able to replicate all the steps that a human operator performs by hand.

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Fig. 1: Manual workstation with tweezers and microscope

Once these problems have been solved or bypassed, the revised process is usually transferred again to increase capacity - this time to an automated production system. The prerequisite here is that automation makes economic sense in the first place.

The step towards automation is often intimidating, time-consuming and frequently requires a second development loop. This is because the manual process cannot ultimately be automated as planned.

The tip of the iceberg parable is apt when it comes to turning a product idea into reality. The true challenges in product development arise in the process details.

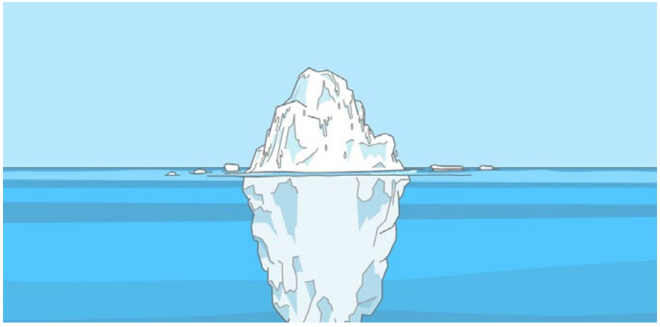

Fig 2: Many challenges in product development are not visible at first

Here is an example from our practical experience: A manufacturer of material analysis equipment produces small detectors in TO sockets. The process was developed on their own assembly stations with a high degree of operator involvement and then optimized systematically. Among other things, proprietary fixtures, tweezer alignment methods, operator-controlled heating foils and long oven curing cycles are used. As volumes increased and after a long start-up period with many successful product fabrications, the company wanted to automate this process. Unfortunately, this was very difficult and one of the working steps was so expensive that it was no longer economically viable. Therefore, the process remained manual and increasing production volume was only possible with a great deal of effort - i.e. new employees were hired, which results in a longer learning curve.

PRODUCT DEVELOPMENT ON AUTOMATIC PRODUCTION LINES

In contrast, other manufacturers chose to begin product development using automated production systems where clearly defined (single-purpose) processes are automated and traced.

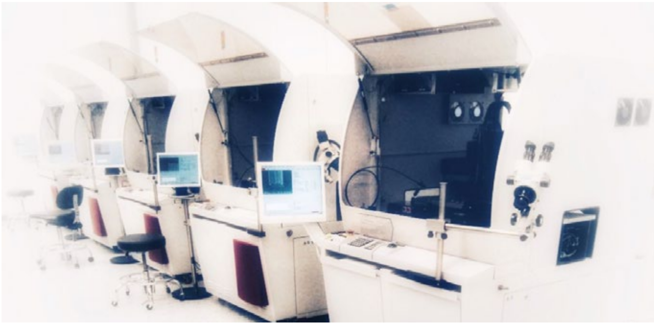

Fig. 3: Automated production lines have a high programming effort and limited flexibility

Larger companies usually have the resources to also run their development tasks through their automated equipment. However, this strategy is not optimal because processes developed on production systems are much more difficult to adapt due to the high programming effort and the often limited flexibility. As a result, the development dynamic suffers. Add to this the significantly higher initial investment if

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automatic production systems are not available in house. And if they are, there is usually a need to fully utilize them with production tasks. So how are they supposed to take on additional development tasks?

Here is another example from our customer base:

For many years, a prominent manufacturer of positioning systems has been developing its products on production lines. And although the development work had largely been successful and their market position had strengthened, these concepts were always difficult to implement. The use of the production line by the R&D department must be well organized so that customer orders are not delayed. The production department often had to set up the production processes again, and the R&D department would be frustrated by technological and process restrictions imposed on them by the equipment. This conflict ultimately led to less innovation and longer development times.

Ultimately, the customer decided to move its development work to a separate flexible, semi-automated placement and assembly system from Finetech. This gives them much more freedom in process design and no longer interferes with production processes.

PRODUCT DEVELOPMENT = HIGH COSTS

To avoid developing processes twice or blocking production facilities, another option is to purchase an automated assembly system used specifically for R&D tasks. But this can be a costly investment and not an option for many manufacturers due to uncertainty if the product concepts will progress beyond the development phase or if the product is likely to be successful on the market.
The bottom line is that the typical product development process, including transfer to series production, is very often characterized by risks and uncertainties, is time consuming and yields a rather low return. This leads to high costs.

So how can costs be reduced and risk minimized?

Fig. 4: A typical product development process leads to high costs

SEAMLESS TRANSITION FROM R&D TO PRODUCTION

Fig. 5: 1:1 process transfer from R&D to production

To optimally support our R&D customers in the process transfer to production, we have strategically developed our placement and assembly systems. "Prototype to Production" stands for a variety of technical innovations that optimally support the transition process from R&D to production.

The new-generation FINEPLACER® product line now provides a portfolio that includes manual,

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semi-automatic and fully automatic placement and assembly systems with consistent process modules and tools across the entire product family.

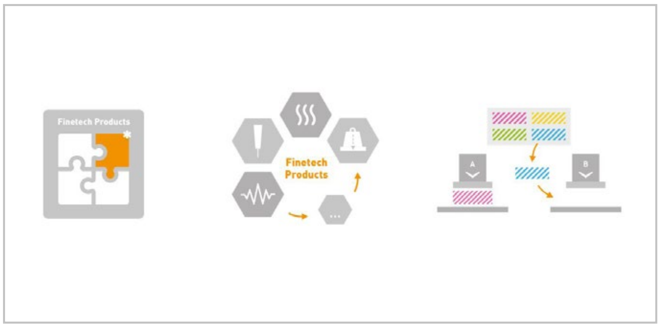

Fig. 6: Cross-system unified hardware and software platform

By using similar modules and tools, process transfer costs are reduced. In addition, thanks to the modular platform architecture, a wide range of bonding technologies and processes can be easily retrofitted, converted, expanded and replaced. Thus, a FINEPLACER® machine is optimally prepared for future requirements and projects throughout its entire service life-built-in future-proofing!

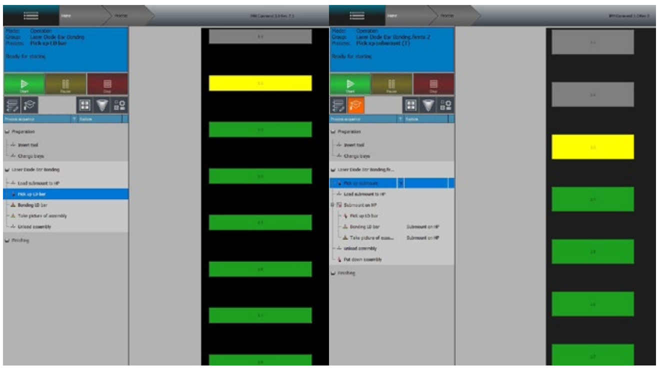

Fig. 7: IPM Command bonding software

In combination with the bonding software, which is identical on all systems, the process profiles and parameters developed during the R&D phase can be transferred almost 1:1 from a manual development system (such as the FINEPLACER® lambda 2) to a fully automated platform (e.g. the FINEPLACER® femto 2). For production purposes, they are merely enhanced with automatic handling steps. Developing assembly processes twice? No longer needed.

The user can also safely and efficiently operate all machines in the product family with minimal training. The software is identical across all systems - with the only difference being that the production systems have extended capabilities for process automation compared to the manual and semi-automatic bonders.

Fig. 8: Consistent machine operation with minimal training requirement

PRACTICALLY PROVEN SUCCESS

Many customers worldwide have successfully transitioned their products developed on Finetech systems into volume production.

For example, Finetech supported the Italian high-power fiber laser manufacturer Convergent Photonics in the development of precision assembly processes for self-developed high-power laser diode pumps, as well as in the transition from prototype status to automated series production.

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In the U.S., Kromek Group plc, a leading developer of radiation detection products for SPECT and more, is successfully using Finetech die bonder systems for prototyping and production of innovative radiation detectors.

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CONCLUSION

In the development of innovative technology products, a short time-to-market is a decisive competitive advantage. Accordingly, product development cycles are becoming increasingly faster, while at the same time many products do not go beyond concept phase. This is because the early phase of product development is characterized by risks and imponderables that can quickly turn a promising product innovation into a failure. Choosing the right product development strategy that minimizes technological and financial risks and ensures a cost-efficient and smooth transfer of prototypes to automatic series production is one of the most important decisions for manufacturers of advanced high-tech products.

This is where Finetech's "prototype-to-production" approach provides critical support, enabling manufacturers to benefit from the advantages of a manual R&D bonder: comparatively low investment costs, high technological flexibility and fast changeover capability for different assembly processes in the risky early phase of product development.

At the same time, all requirements for subsequent production-oriented scaling, in particular process automation, are factored in from the outset.
Thanks to similar process modules and tools and identical software, R&D processes can be transferred from the development system to the production system without any restrictions. Since a second development loop is not required and users need very little additional training to operate the production system, process transfer costs are reduced to a minimum.

This is as flexible, secure, and time- and cost-efficient as moving from product development to series production can get. At the same time, development projects are always executed with the greatest possible momentum and innovative strength.

ABOUT FINETECH

Fig. 9: Finetech headquarters in Berlin, Germany

Finetech is a leading supplier of sub-micron placement and assembly systems as well as hot gas rework equipment for professional rework of SMD assemblies.

Our Germany headquarters with its state-of-the-art development and production center is located in Berlin, with an additional R&D site in Dresden. Worldwide, we have nearly 200 employees at six locations on three continents, and we are represented by industrial distributors in a forty more countries. Our installed machine base currently comprises more than 3,200 units.

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Fig. 10: Finetech locations and representations worldwide

Fig. 11: Engineering and manufacturing of Finetech systems is done completely in house

Finetech machines are 100% "Made in Germany". Being a vertically integrated company, the entire product development and manufacturing chain is in our own hands. This includes machine hardware, electronics, software with in-house developed machine vision systems, tooling, process modules and much more. This approach allows us short response times as well as high flexibility and efficiency in development and manufacturing. One of our great strengths is understanding the needs of our customers and translating them precisely into effective equipment solutions.

We develop a wide range of solutions:
Laboratory equipment for research, development and education, semi-automated equipment for prototyping and pilot series production, and fully automated systems for industrial series production.

Fig. 12: Range of Finetech die bonders for R&D, prototyping and production

The "Prototype to Production" approach of our FINEPLACER® machine family enables flexible product development and manufacturing with a comparatively low initial investment by harmonizing the technological hardware and machine software platforms.