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Momentum for Growth

How to accelerate the industrialization of Additive Manufacturing

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Thesis 1

Involving experienced AM specialists in the product development process as early as possible provides great opportunity to leverage the full benefits of AM.

The integration of AM into industrial processes is mainly decided in the design phase of a product. To lift components manufactured in AM over the "commodity" hurdle, two things are required: first, a design process in which a multi-disciplinary approach involving engineering, quality and procurement, all familiar with AM, is integrated right from the start. Second, leadership that recognizes the strategic benefits of AM and consistently decides in favor of AM, even if the conventional purchasing strategy appears to promise a higher return in the short term. If management is always looking to make a quick profit, additive manufacturing will not become established, nor will its benefits be realized.

Explanation:

Before determining the design of an industrial product, it is important to weigh the advantages of AM versus a traditional manufacturing method. The focus should be on the long-term product goals, or marketing strategy. AM requires new ways of thinking when it comes to functionalities, design possibilities, material properties, life cycle planning or the possibilities of individualization.
The advantages that AM offers here must be analyzed in detail. To this end, it makes sense to inform the decision makers in the purchasing department at an early stage about the possibilities of AM for the specific application in each case and to discuss the long-term perspectives in an interdisciplinary dialog with sales, marketing and the R&D department.

Ultimately, it depends on whether management is willing to go one step further to create added value for their own company, the purely financial benefits of which may only become visible after a start-up phase. A current example of this would be a resilient, decentralized and local supply chain that is not affected by an "Ever Given"- disaster.

Thesis 2

Adjusted curricula at universities and specific training programs will help to better educate engineers on the potential of AM.

Today, engineering education is largely oriented towards traditional technologies for industrial production. Engineering skills needs to change radically to take more advantage of the disruptive possibilities of AM in industrial production. This does not only pertain to engineers coming from university, but especially for those who have many years of experience in traditional engineering and are now in decision-making positions. In contrast to an evolutionary, generation-driven change of mindset, a disruptive new technology requires the active training of the workforce with all levels of expertise, which is not the case today.

Explanation:

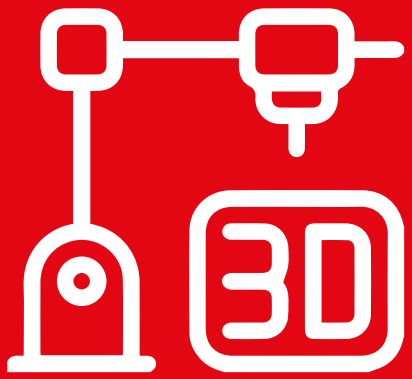
The fact that product design is still oriented toward proven feasibility is partly related to the education of engineers and product designers. In engineering curricula today, “classical” training still predominates, such as design theory, strength analysis and manufacturing theory. And beyond that, education was and still is oriented towards the three focal points of industrialization: quantity, quality and price. All play a decisive role and form the framework for today’s teaching and training. That means that in addition to students, a lot of engineers with many years of experience in traditional engineering and now in key decision-making positions, are not yet informed on the advantages of AM.

Therefore, neither the advantages of the additive manufacturing process (for example, design freedom, function integration and individualization), nor the advantages of a completely digital manufacturing chain (such as process simplification, short development times, improved delivery, resilient supply chain) come into play today.
A rethink is needed here. Special curricula and training programs are needed. They should be designed in such a way that considerations in production technology are no longer oriented only to scaling and price, but also to long-term advantages, such as new market opportunities through design freedom, individualization possibilities and material improvements (weight reduction and better stability).

The new possibilities offered by additive manufacturing remove the boundaries between classic engineering tasks. They require interdisciplinary and holistic thinking. Therefore, traditional engineering roles need to be challenged and adapted to their new tasks.

Thesis 3

Further developing today's versions of the 3D printer will support having more AM products in the markets.



3D printer manufactures pushed inventions significantly in the past. The next stage needs a more customer centric approach incorporating the different needs of the customers. The outcome might be that suppliers focus more on different industry segments instead of a one solution approach for all.

Explanation:

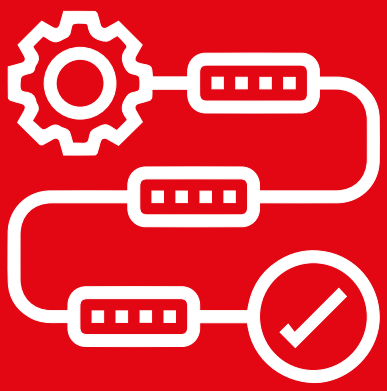
First, it currently seems that printer manufacturers are more concerned with competition among OEMs than with the needs of customers. Performance seems to be the main goal guiding the development of new printers. In doing so, 3D printer manufacturers are partly missing the real needs of the users. Service providers like Oerlikon have to undertake an enormous amount of work to be able to offer consistent and reliable quality as a contract manufacturer. Therefore, they need very reliable hardware. This factor has not had enough focus in the past.

Second, AM customers usually need specialized printers tailored to a specific application. One-size-fits-all printers are not the solution. Instead, they need some kind of platform printer that can be customized according to the needs of the end user.

Third, technology "lock-in" is a concern due to the gap between the printer manufacturer's short innovation cycles on the one hand and the long-term investment plans of the user companies on the other. This situation is made worse by the fact that there are hardly any defined interfaces between individual components and therefore only limited upgrade options.

Thesis 4

Comprehensive interdisciplinary collaboration with end-to-end consideration of all workflows in the AM process is needed to have more AM products in the market.



Additive manufacturing is not a single machine, but an entire process chain. To develop the AM process further, a holistic approach rather than incremental individual solutions is needed. Currently, neither the physical process is considered entirely nor is there a continuous digital thread.

Explanation:

In the physical world, great efforts are made in research to solve selective problems. Taking a holistic view would minimize the efforts required. In parallel, the representation of the process chain by a digital twin has been promoted for years but is not yet there in reality. For example, around 80 different software solutions are needed from metal powder production to the finished component.

The lack of consistency in the AM process has increased over the years. It needs to be addressed urgently in order for AM as a manufacturing technology to compete with traditional technologies in a manufacturing environment. Closer collaboration between the various parts of AM (powder/material, software, hardware, processing) is key to creating a digital thread and necessary to achieving significant progress on the process side.

Thesis 5

The definition of mandatory standards will accelerate the industrialization of AM.

Uniform technical and cross-industry standards are currently lacking at all levels. This creates unnecessary hurdles, additional costs and a lack of comparability between products and thus prevents the establishment of additive manufacturing as an integral part of today's production technologies.

Explanation:

The lack of standards covers the entire AM process. These include standards in determining process parameters such as gas flow and laser power, which relate directly to machine reliability, as well as quality standards that ultimately make AM products comparable. Other standards that are currently lacking relate to safety and software. Finally, standards are missing for machine interfaces. One example of this is powder filling. Here, each printer manufacturer has its own process, which considerably increases time and costs when using different printers.

Thesis 6

A dedicated AM association would offer the chance to represent the interests of all members of the AM community.

The representation of common interests as well as a forum to address cross-industry issues requires institutionalized cooperation. The establishment of a separate association for additive manufacturing would therefore be the right way.

Explanation:

Due to their own interests, companies or research institutions are not very well suited to moderate or clarify cross-industry issues, such as which standards or research and development priorities should be set. Therefore, an institution is required that can act neutrally and find a consensus between the needs and requirements of the individual industries.

This also applies to the external representation of overarching interests of the entire industry. One example of this is the funding policy in Europe. While additive manufacturing receives considerable government support in countries such as the USA and China, this is lacking in most European countries, especially those with a technical focus on 3D printing, such as Germany. Instead of concentrated programs on a holistic AM strategy, public funding is spread across many small channels throughout Germany and the EU that support sustainability topics like the “Green Deal” or in Germany, the “Climate Protection Plan 2050” and “SDG 9.” This watering-can principle is not enough to get AM over major R&D hurdles. And it is far from sufficient to create a balance of power in public funding for AM between America, Asia and Europe.

Establishing a dedicated association for additive manufacturing would be the right way to do this. Currently, AM only plays the role of a sub-sector within national and international industry associations in Europe. For the challenges noted here, such structures, which bundle and moderate interests are not sufficient. The identity-forming effect of an association of its own has already proven itself as a model many times in the past.

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