

Press Release

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3D printing: a viable alternative for spare parts

3D printing for spare parts – does it pay off? Yes it does, according to Jakob Heinen, PhD, Kühne Logistics University in Hamburg. Together with Kai Hoberg, Head of the Logistics Department and Professor of Supply Chain and Operations Strategy, he has developed an optimization model that uses real-world data to show how leveraging 3D printing can be advantageous in many cases.

3D printing, also known as additive manufacturing, is already being used in a variety of sectors. Examples include lightweight aircraft components, tailor-made medical devices, and tools made just-in-time. Further, the technology has proven its value when it comes to producing customized spare parts. But does it still pay off on a larger scale? Supply chain experts have developed an optimization model that, for the first time, considers the entire spare-parts portfolio. The model was subsequently applied to a large real-world dataset supplied by a leading material handling equipment manufacturer, which includes more than 50,000 spare parts from nine years.

3D printing reduces inventory costs and improves service

The conclusion of the work: 3D printing offers an economically sensible alternative for a considerable portion of all spare parts, and is especially advantageous for rarely requested parts that are needed in small batch sizes. “In the context of customer service, manufacturers also have to supply spare parts for vehicles that have been phased out of from series production for a long time. In this case, many spare parts are requested less than once a year. And in precisely these cases, 3D printing can offer a cost advantage in comparison to traditional manufacturing,” Heinen explains. “Granted, the production costs per unit are often considerably higher than in traditional manufacturing. But instead of being locked into minimum quantities and having to keep large inventories in stock, companies can simply produce the quantity they actually need, saving them years of warehousing costs.” In addition, the technology can improve service, since it allows companies to more quickly respond to customer requests.

Digitalization calls for vision

“The strategic question of the ideal manufacturing mix shouldn’t be left to chance. 3D printing has a great deal to offer,” summarizes Prof. Kai Hoberg. Nevertheless, decision-makers should always ensure they have a minimum inventory in stock, so as to avoid supply bottlenecks. In addition, the supply chain expert advises decision-makers to pursue a long-sighted approach: “To facilitate the transition to additive manufacturing for spare parts, managers

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should start laying the groundwork today. After all, the digitalization of physical designs is often a stumbling block for smooth production.”

Background information on the model

The model reflects and assesses costs across the supply chain. For example: in traditional manufacturing, costs are incurred whenever a production line has to be refitted for a different spare part. How high these costs are for an individual part type depends on a number of factors, e.g. the number of units needed, actual order quantity, minimum order quantity, and service level. Though certain investments are required for additive manufacturing (e.g. in hardware or technical drawings), substantially smaller quantities can be flexibly produced without any additional costs. For each individual spare part, the model put forward by Heinen and Hoberg calculates the optimal values for parameters like the quantity in stock, delivery time and production costs. The outcomes provide the basis for deciding whether or not to switch production to 3D printing for the spare part in question. If for example the costs of 3D printing were four times as high as those of traditional manufacturing, 3D printing would still be worthwhile for up to 8 percent of all parts.

Publication

Heinen, JJ, Hoberg, K. Assessing the potential of additive manufacturing for the provision of spare parts. *J Oper Manag.* 2019; 65: 810- 826.

According to the Financial Times ranking, the Journal of Operations Management is among the Top 50 management journals, and is number one in the Journal Citation Report ranking for the category “Operations Research & Management Science.” The article is accessible free of charge at <https://doi.org/10.1002/joom.1054>.

About KLU

Kühne Logistics University – Wissenschaftliche Hochschule für Logistik und Unternehmensführung (KLU) – is a private university located in Hamburg’s HafenCity. The independent, state-certified university’s major research areas are Sustainability, Digital Transformation and Value Creation in the fields of Transport, Global Logistics, and Supply Chain Management.

KLU is one of very few private universities in Germany entitled to confer their own PhDs. According to the latest Handelsblatt ranking, KLU is one of the leading research universities for Business Administration in Germany, Austria and Switzerland, based on the research output per professor. In the latest CHE university ranking, KLU obtained the highest marks for all major criteria.

With one BSc and three MSc degree programs, a structured doctoral program, and a part-time Executive MBA, KLU offers its 400 full-time students a high level of specialization and excellent learning conditions. KLU has an international team of 24 professors who teach in English. In open, tailor-made management seminar series, industry specialists and managers alike benefit from the application of academic findings to practical issues.

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