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Project CoA²mPLY: Costing Analysis for Additive Manufacturing (AM) during Product Lifecycle

The goal of this research-project was to understand and rate the cost drivers that act as the largest contributors to unit costs and to provide a focus for future cost reduction activities for the AM technology over the whole lifecycle. The results will help to identify success factors for cost reduction in the field of Additive Manufacturing. An exemplary metal part was used to collect data and to raise the understanding of AM cost drivers. This will help to increase the fields of application for additive manufactured parts focusing on Metal Additive Manufacturing (MAM). A better understanding of the cost structure will help to compare the AM costs with costs of the traditional manufacturing technologies and make it easier to justify the use of the AM technology.

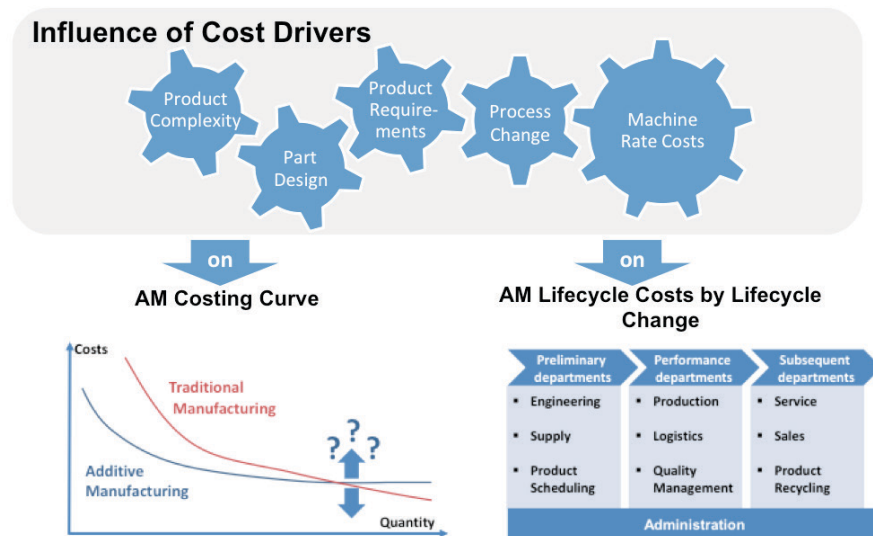


Figure 1: The CoA²mPLY Project in a nutshell

Cost Related Process Modeling

Collection of cost related knowledge in a process model

The modeling of costing relevant AM business processes was the basis for the work in the project. The main purpose was to gain knowledge about the costing processes relevant to the AM technology. All important processes and related cost drivers for AM technologies have been identified and modeled. Interviews with the project partners and with the Direct Manufacturing Research Center (DMRC) were held to identify and to model the costing relevant processes and estimate the needed complexity of these models for the further work.

Development of a costing model and part redesign

On the basis of the gained process knowledge, a costing model for Metal Additive Manufacturing (MAM) has been set up, using activity based costing elements. Therefore a rating concerning the Selective Laser Melting (SLM) process for metals has been made. The costing model started with a focus on the pure production process and was enhanced during project runtime to encompass more steps in a products lifecycle.

The main process steps for MAM have been identified as:

- Design
- Data preparation
- Production process
- Post processing
- Adjustment of mechanical properties

Potential cost reduction opportunities for the future have been identified based on different sample parts. The process was continuously enhanced by further lifecycle processes as usage and others. An exemplary metal component (see figure 2) has been redesigned to reduce weight through efficient structure design and to compare the costing structure and part performance to traditional manufacturing. Furthermore the influence of the designer on the part costs has been investigated.



Figure 2: Sample part redesign of an upright of the formula student series

Lifecycle study and generalization

The product lifecycle costs of AM have been compared with conventional machining technologies. Therefore a case study has been implemented concerning the costing processes in the intrinsic product lifecycle. Furthermore different scenarios show consequences of changing cost structures for AM parts during the complete lifecycle to reveal “hidden saving opportunities”. By understanding the difference between the amounts of costing analysis based on different applications, all DMRC partners may have a better understanding of cost drivers associated with Additive Manufacturing. So the range of potential part candidates has been enhanced. Costing concerned success factors for the AM technology has been pointed out.

The results of the analyses done in this project show a lack of information quality for a reliable calculation and comparison of different AM processes and machines. Therefore these results will be the basis for further research activities. Gathering these needed information and the adaption of the costing model for MAM to the AM processes dealing with polymers will be focused in the follow-up project “CoA²mPLY 2.0”.

Design of a costing model for lifecycle analysis

Understanding and rating of cost drivers associated with AM

The results of CoA²mPLY serve as input for the follow-up project CoA²m-PLY 2.0