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PRESS INFORMATION

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Creating a data base for sustainable production

Position paper presented at WGP Autumn Conference

Aachen, November 9, 2020 - *"The debates on sustainable production are currently often conducted rather emotionally than rationally, because there is a lack of an objective basis for discussion," explains Prof. Wolfram Volk, head of the Science Committee of the WGP (Scientific Society for Production Engineering), on the occasion of the autumn conference held as a web conference on November 4 and 5. The WGP is therefore working on a quality-assured database that will enable the potential environmental impact of products and production processes to be evaluated using a sound assessment methodology. "As announced last year, we have compiled the state of the art in research on sustainable production and identified urgent needs for action. A working basis has been created that enables companies to develop a solution approach together with the WGP institutes," says Volk, who is also head of the Chair of Metal Forming and Casting (utg) at the Technical University of Munich. The position paper will be published at the beginning of the next year and is the first step towards a guideline for companies that want to meet the challenge of an ecologically more sustainable production.*

Internalize life cyle thinking

The manufacturing industry is one of the largest emitters of greenhouse gases in Germany and in that regard even ahead of the transport sector. In addition to the global warming potential, the acidification potential, abiotic resource consumption,

human toxicity and ozone depletion potential may also be relevant. Thus, there is an urgent need for action and an increasing number of companies define their own strategies for climateneutral production, for example. "The climate targets, which were also set by German politicians and in the European Green Deal, are ambitious, but they are absolutely realistic," emphasizes Prof. Christoph Herrmann, member of the WGP working group "Objectification" and coordinator of the position paper. "With the document we have now written, we do not only highlight the need for action to create the systematic conditions for companies to achieve sustainable production. With our research activities, we also want to address the problems that have not been solved yet. This requires to understand production as a component of the life cycle of products and to internalize life cycle Thinking.

Do not simply shift environmental damage

In view of shorter innovation cycles of products and processes and the rapidly advancing digitalization, we are in the midst of a dynamic change in production. In the course of creating innovative products and technologies and new production processes and systems, environmental impacts can easily be shifted from one life cycle phase or from one environmental impact category to another. This creates new hotspots and unwanted environmental damage. This can only be prevented by including the entire life cycle of a product into calculation of potential environmental impacts, from the extraction of raw materials to product use and recycling - in the best case in the form of a new product as part of a circular economy. "When calculating the environmental impacts, however, the decisive factor is how the system boundaries are set," explains Herrmann. "This is one of the challenges we face. For example, whether I include the charging stations in the life cycle assessment of an electric car or exclude them is of course a significant factor in the result. Additive manufacturing processes are also a vivid example to illustrate the necessity of life cycle thinking on the one hand and the determination of the limits of the considered process on the other. Whether or not industrial 3D printing is defined as more ecological than conventional processes depends not only on the technology and the materials used, but also on the question of whether or not the manufactured component using additives offers advantages in the utilization

phase, for example, due to a lighter construction. "However, undesirable or unintended consequences can also occur, for example when additive processes are used to manufacture products with a rather short service life. Here, the approaches from the so-called Consequential Life Cycle Assessment (CLCA), which take into account the consequences of decisions, must be made manageable for companies and thus practical.

Facilitating the handling of data flood

There are already numerous approaches to improve life cycle assessments. "Individual manufacturing processes can already be analyzed and balanced systematically using quality-assured data," Herrmann sums up. "But against the background of the multitude of manufacturing processes and technologies, there is a lack of a cross-organizational approach that collects and provides data in a quality-assured manner in cooperation between science and companies. This means that data must be systematically collected and consolidated.

Also in view of the immense amounts of data that come together in this way, life cycle assessments for companies are associated with a high expenditure of time and know-how. According to Herrmann, however, both can be reduced with the Integrated Computational Life Cycle Engineering (IC-LCE) approach, a computer-aided calculation model in which sub-models are coupled in such a way that results are obtained much more quickly. In this way, a large number of different boundary conditions can be included in the calculation, such as differences in waste disposal systems or geographically specific conditions at the respective production site, such as the outside temperature. Only with such fast approaches can life cycle assessments of highly complex production systems be analyzed and evaluated in virtual experiments before the product is manufactured. "In vivid terms, this is like a virtual crash simulation for cars before they are released on the road. Once we have a comprehensive database for all production processes, companies can use it to create quality-assured eco-balances for their respective products and processes.

Further information

Text and images can be found on the Internet at www.wgp.de >Press

Figure 1: New technologies of Mixed Reality have the potential to make complex life cycle assessments understandable for everyone, Source: Johannes Wölper / TU Braunschweig

Figure 2: Prof. Wolfram Volk, Head of the Scientific Committee of the WGP and Head of the Chair of Metal Forming and Casting (utg) at the Technical University of Munich, Source: utg Munich

Figure 3: Prof. Christoph Herrmann, Head of the Institute of Machine Tools and Production Technology (IWF) at the TU Braunschweig, source: IWF Braunschweig

Figure 4: Implementation of a live LCA (Life Cycle Assessment) as a cyberphysical production system in a learning factory, Quelle: Hagen J et al: Live LCA in learning factories. Elsevier 2020

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The WGP:

The WGP (Academic Association for Production Technology, Wissenschaftliche Gesellschaft für Produktionstechnik e.V.) is an association of leading German professors of production science. It represents the interests of research and teaching vis-à-vis politics, business and the public. The WGP unites 66 professors from 40 universities and Fraunhofer institutes and represents about 2,000 scientists in production technology. The members enjoy a high reputation in the German scientific community as well as internationally and are networked worldwide.

The laboratories of the members are on a high technical level and allow the WGP professors to carry out top-level research as well as practice-oriented teaching in their respective subject areas.

The WGP has set itself the goal of demonstrating the importance of production and production science for society and for Germany as a business location. It takes a stand on socially relevant topics ranging from Industry 4.0 to energy efficiency and 3D printing.