FROM PROTOTYPING TO MANUFACTURING

Guidelines for using 3D printing within a company

BMW used 3D printing to manufacture prototype parts for concept cars as far back as the early 1990s. Because the technology enabled ideas to be visualized significantly faster and less expensively than with plywood, molded or polystyrene models. This 'prototyping' function of the technology has now developed far beyond the boundaries of R&D. Conventional technologies like milling, molding, drilling and turning can be replaced by 3D printing.

Networked with 3D printer: Arduino boards with sensors for measuring light, temperature and movement in the ROI IoT Fab

"3D printing technologies are creating opportunities for companies as 'manufacturers' to shape their production structures more openly and flexibly," says Hans-Georg Scheibe, Member of the Management Board of ROI Management Consulting AG. "Effects of scale are a thing of the past. 3D printing is overhauling conventional manufacturing logic, according to which a product only becomes profitable in large series. At the same time, less material and energy are being wasted as there is no machining waste as in drilling or milling operations." Companies should focus on customer requirements and follow the steps set out below when developing 3D printing sample construction solutions:

- Create a proof of concept (PoC) for the desired parts with all the key factors such a size, properties, surface, form, tolerances. Strictly observe a period of five weeks to complete the process.
- Divide PoC and implementation work into small experiments with explicitly defined tolerances.
- Systematically develop the required skills in a cross-functional core team with few hierarchy levels.

The core team should bundle all the required skills from the beginning of the first project and should possibly involve external service providers. Particularly important competencies are: design expertise in digital direct manufacturing and know-how in machine operation for in-house manufacturing, materials expertise, supply chain expertise, quality management, product management and training skills for digital direct manufacturing. Skills bought-in from outside can then be gradually replaced with internal skills as the number of projects and the share of additive manufacturing grow.

"How quickly and how well 3D printing can be implemented will of course depend on the degree of expertise already available in the company," says Anselm Magel, expert for 3D printing at ROI Management Consulting AG. "When only little experience is present, a core team should start defining just a couple of basic elements of digitalized production and approaches to additive manufacturing. It will soon become clear what can be realized quickly with the customer – and what needs to be deferred for the time being as vision."

Checklist: nine checkpoints for digitalized production and approaches to additive manufacturing.

1. Examination of active tools, functional parts and sub-assemblies. What can be produced using additive manufacturing and what are the benefits in terms of cost, time, quality and functionality?
2. Design optimization and lightweight construction design. How can functional parts and sub-assemblies be improved?
3. Simulation-driven additive manufacturing. How can tools, functional parts and sub-assemblies be produced without empirical tests?
4. Design certification. How can functional parts and sub-assemblies be certified before they are generated?
5. Object procurement. Can the desired design object be purchased on the market?
6. License management. Is a secure object search ensured as well as a transfer to printer and other systems?
7. Local production. What printers are required and available at which locations?
8. In-line process & quality control. How will produced parts be tested during the process?
9. Automation of post-processing. How can the automated manufacturing of parts be successfully completed with full traceability?