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Shortening Disrupted Supply Chains through the Use of 3D Printing Innovations †

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Abstract: Additive manufacturing utilising 3D printing in an increasing range of materials (plastics, composites and metal alloys) is becoming an important technology for prototyping, critical componet replacement and production of innovative designs that cannot be relicated via reductionist processes (typically cassting and machining). In Australia, universites and industry are investing in these technologies to revitalise manufacturing industries and shorten supply chains.

Keywords: manufacturing; 3D printing; supply chains; biomimicry

1. Objectives

Recent global disruptions have exposed the lengthy and fragile supply chains of many components used in manufacturing, construction, repair, and maintenance across many industries. This has been exasperated in countries where there is a perception that the relevance and extent of the manufacturing sector have decreased. Australia is an example of such a jurisdiction; however, prior to the pandemic, Government actions were in place to address the decline in manufacturing, and research providers such as Universities have responded through innovative equipment acquisition and further development. One such area that can support the cost-effective regional and local manufacturing of complex components has been that of additive manufacturing (3D printing).

2. Methodology

Ref [1,2] have recently reviewed some of the developments in advanced manufacturing, focusing on the 3D printing of composites, metal alloys, and construction materials. The advantages of their adoption and utilization by industries, such as defense, aviation, resources, and agriculture, are apparent. Finally, the opportunity for further innovation and its impact on supply chains is highlighted.

3. Results

Examples are available of where regional industries, which are often remote from major population centers, of have benefited from the adoption of innovative 3D printing technologies, as well as where they will benefit in the future [3,4]. Major reductions in the storage (warehousing) of repair components can be achieved; however, OEMs (Original Equipment Manufacturers) remain concerned about the warranty and safety issues of independently manufactured parts. Necessity remains the mother of invention, and a functioning part is often better than no part or the promise of delivery. SMEs focused on supporting major regional engineering projects are developing their use of Industry 4.0 technologies to supply locally manufactured parts and shorten critical supply chains.

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4. Implications

Additive manufacturing, whether the duplication of parts for repair and maintenance, incorporation of novel or previous waste materials (circular economy), or production of innovative designs, requires a new skill set and paradigm. Educators must respond to these industry expectations through curriculum developments and investment in new equipment. The innovative additive manufacturing processes allow for a wider range of materials to be used more efficiently, plus a greater use of biomimicry in the design process [5,6]. Software simulation of the performance of innovative designs also removes the requirement for the production and testing of all possible options.

5. Originality Value

The review article contains opinions and observations on the adoption of innovative Industry 4.0 technologies, 3D printing in particular, prior to and during recent supply chain disruptions.

6. Contribution

Steve Hall provided the review article and acknowledged the interactions with colleagues and suppliers in the recent procurement and installation of innovative 3D printing equipment at CQ University, Australia.

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