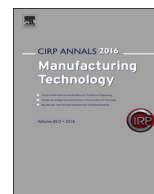




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# Value creation in production: Reconsideration from interdisciplinary approaches

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### ABSTRACT

This paper presents reconsideration of value creation in production from various aspects of value viewpoints in several disciplines such as production engineering, social sciences, and human sciences. The focal point of investigations is value co-creation by the provision of products and services in and for society. In the past, some methods of social sciences and others proved to be useful in making production more efficient. At present, such methods must help to realise value creation. In fact, production must become more effective in response to human needs in social, economic, and environmental dimensions. Along with the theoretical apparatus, this paper presents some case studies indicating the importance of value creation in production, followed by future perspectives of value co-creation in production.

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## 1. Introduction

### 1.1. Recent topics surrounding production engineering

The growing intensification of worldwide business competition has compelled companies not only to dominate a market but also to expand their businesses to assure sustainable growth. For the last few decades, manufacturing industries have struggled with commoditisation of products and the resulting price competition. Service industries such as retail and logistic industries have fought with severe price competition between companies in the same market. Consequently, competition in both industries has sometimes brought adverse results such as reduced productivity or shrinking of the job market.

Recently, with increasing intra-industry and inter-industry mergers, industry boundaries have become more blurred in terms of value creation in society. Accordingly, the role of production is also changing. An artefact that is intentionally made or produced by humans should satisfy various purposes for humans, society, and the environment, respectively. However, we often confront a tradeoff or dilemma of value involving different aspects. We must rethink value

creation in production for the realisation of more sustainable society. Actually, the conventional producer-consumer model is being replaced by the concept of value co-creation, as discussed herein.

This paper presents a discussion of important related issues for value creation in society. It includes interdisciplinary approaches to value, useful methodologies that are originally developed in disciplines other than production engineering, and study examples. Finally, some discussions of recent important research topics related to future value co-creation are presented.

### 1.2. Expanding the conventional manufacturing research framework from pursuit of efficiency to value creation in society

Although an issue of value has been discussed in manufacturing industries from various points of view during more than two decades, the traditionally held view is that the main source for creating value is originated from 'pursuing efficiency'. If manufacturing costs are reduced by pursuing efficiency, it undoubtedly brings profit, so that it shall be regarded as some sort of value. Consequently, the emphasis of improvements in production systems has still often been translated into enhancing the efficiency of system performance. Accordingly, consideration of customer satisfactions, sustainability, social responsibility, and other factors that are important for modern production systems have not been fully addressed explicitly at scientific studies in the field of manufacturing science and production engineering.

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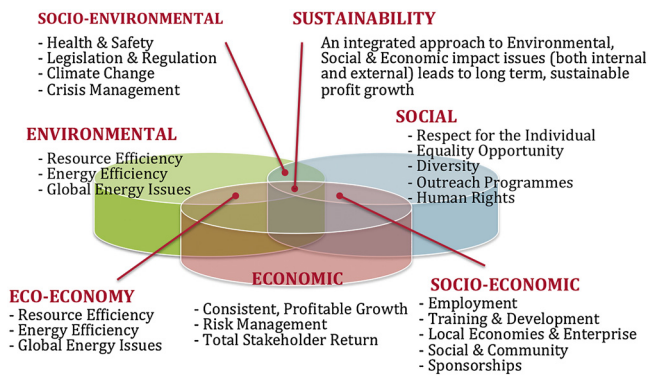


Fig. 1. Triple bottom line of manufacturing value creation [50].

The primary mission of manufacturing shifts from today's generating wealth through price and cost margins to the broader bottom line in social and environmental dimensions, as suggested by Altin in Fig. 1. Society expects manufacturing not only to provide economic returns, but also to create value to society by adding job opportunities, improving quality of life, safety, and being benign to the environment.

Shifting orientation from the cost to the value of manufacturing is not a simple transformation of outputs. It touches the difficulty of our ability to address the wider agenda of human needs. Consequently, it creates a number of challenging research issues for production research, including the following.

1.2.1. Expanding scope

Manufacturing must not only address issues related to physical outputs and efficiency of operations, but also to include customer value and other social and environmental impacts such as human development, learning, and sustainability. These factors are not often considered within the realm of manufacturing research. Consequently, new approaches are necessary to include new factors, which are more difficult to quantify and analyse, into the scope of production systems. It is also a grave issue how to align requirements of sustainable society with those of industrial competitiveness. What social institutions of continuous value creation can help resolve this ever changing but prevalent conflict?

1.2.2. Lack of methodology to include value into decision making processes

Issues such as capturing individual customers' value in manufacturing systems can be subjective, volatile, and intangible. However, current thrusts in manufacturing decision processes are mostly based on economic incentives. The monolithic view of cost control often fails to capitalise on the manufacturing sector's flexibility and robust capability to encourage wider participation, and to incorporate environmental protection and other factors into the value-based decision process in manufacturing management.

1.2.3. Need of co-creation to engage diverse stakeholders

Because value creation is no longer a straightforward process of a serial process chain, it requires the engagement of various stakeholders. Some sort of platform is necessary to involve participants, although with differences in value, yet willing and able to contribute proactively. Participants are motivated to provide and collect feedback from others with the understanding that they will be treated fairly so that innovation and intangible benefits can be created. In addition, the economic surplus precipitated from collaboration can then be distributed fairly so that sustainable manufacturing systems can be well maintained.

The key idea is that no value is created without interaction between consumers and providers of goods as well as services. Hence, production engineering should have a wider scope – defined not only by technical but also by human and social sciences – and be aimed at value co-creation, instead of simply satisfying

market demand. Regarding value co-creation, we will discuss about the details in Section 4.

1.3. Recent CIRP trend for issues of value creation

Using the Web of Science database, the growing interest in 'value creation' within the CIRP community was analysed. Fig. 2 shows the number of publications including keywords related to 'value' in 'CIRP Annals—Manufacturing Technology' and 'Procedia CIRP' during 2009–2016. For example, the total number of papers during 2008–2017 which included 'value creation' was 58. Especially, the keynote paper presented by Ueda et al. at 59th General Assembly of CIRP in 2009 [138] gives a systematic discussion of 'value' from an inter-disciplinary viewpoint and argues the importance of the concept of co-creation based on his idea of 'emergent synthesis' to achieve a sustainable society. Subsequently, many researchers started to elucidate the importance of value for humans, the environment, and the economy. Especially in CIRP, value creation has been discussed in relation to some important keywords such as sustainable manufacturing [7]; Product-Service Systems [65]; Cyber-Physical Systems [82]; customisation or personalisation [164]. Results show that concerns related to social issues have been growing. Studies about production engineering confront scholars with circumstances that should be tackled as social issues.

In addition, a recent keynote paper [121] summarised the efforts made, particularly within CIRP but also elsewhere, to describe value creation in the social environment of manufacturing firms. In this article, considering the guideline for Social Life Cycle Assessment (S-LCA), the stakeholder map that is relevant to a manufacturing enterprise within the context of a product lifecycle is summarised as depicted in Fig. 3 [121,135,45]. In relation to that, studies measuring social effects were conducted by authors in the CIRP community as well (e.g. [24,33,42–44,159]). The keynote

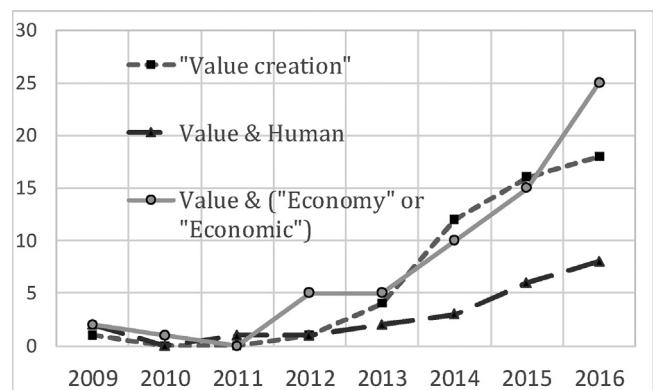


Fig. 2. Statistics of CIRP papers related to value in production.

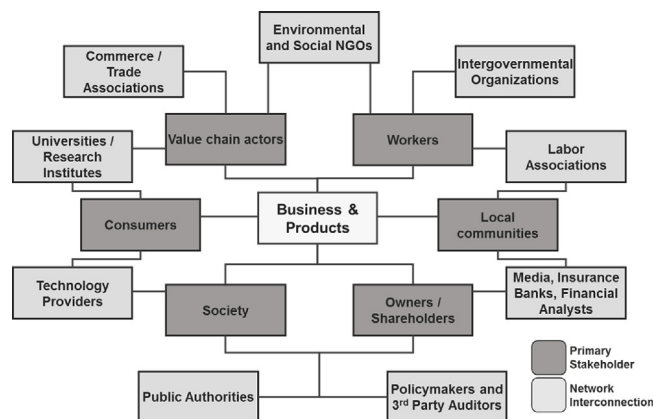


Fig. 3. Hub and spoke diagram of stakeholders affected by and affecting a firm (see Ref. [121]). Adapted from Ref. [133].

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