Sustainable Manufacturing
Sustainable Manufacturing

Shaping Global Value Creation
Preface

The annual series of Global Conferences on Sustainable Manufacturing (GCSM) sponsored by the International Academy for Production Engineering (CIRP) is committed to excellence in the creation of sustainable products and processes, which conserve energy and natural resources, have minimal negative impact upon the natural environment and society, and adhere to the core principle of sustainability by considering the needs of the present without compromising the ability of future generations to meet their own needs. To promote this noble goal, there is a strong need for greater awareness in education and training, including dissemination of new knowledge on principles and practices of sustainability applied to manufacturing. The series of Global Conferences on Sustainable Manufacturing offers international colleagues opportunity to build effective relationships, expand knowledge, and improve practice globally.

Every year, a country is selected to host the Global Conference on Sustainable Manufacturing, building effective links among the international colleagues, expanding their knowledge, and improving their practice globally. Conferences in this series have previously been held at different countries and locations: At Masdar Institute of Science and Technology, Abu Dhabi University, United Arab Emirates in November 2010, at the Indian Institute of Technology Madras, India in December 2009, at the Pusan National University, Korea in October 2008, at the Rochester Institute of Technology, Rochester, USA in September 2007, at the University of Sao Paulo, Brazil in October 2006, at the Jiao Tong University, Shanghai, China in October 2005, at the Technische Universität Berlin, Germany in September 2004, and in the form of a workshop on Environmentally Benign Manufacturing held in Birmingham, Alabama, USA, in January 2003.

In September 28th – 30th, 2011, St. Petersburg State University of Economics and Finance, and St. Petersburg State Polytechnical University, Russia in cooperation with Vodokanal of St. Petersburg, Russia host the 9th Global Conference on Sustainable Manufacturing under the patronage of Prof. D.Sc. (Phys., Math.) Zhores I. Alferov Vice-President of the Russian Academy of Sciences, Inventor of the heterotransistor and the winner of 2000 Nobel Prize in Physics.

Modern Russia is a strong and rapidly developing state implementing the best of international practices on the fundament of its own rich historical experience. Russian economy aspires for sustainable and innovative advance together with its continental and overseas partners. St. Petersburg being a significant metropolis and business center of Russia welcomes international partners for work and for fruitful exchange of ideas.

Participants from all over the world come together for presenting their research results in sustainable engineering. Contributions are clustered in value creation by sustainable manufacturing, manufacturing processes and equipment, remanufacturing, reuse and recycling, product design for resource efficiency and effectiveness, innovative energy conversion, green supply chain and transportation, adequate environments for entrepreneurial initiative, education for sustainability engineering, and economics for sustainability and development. Tours to industrial companies in the region of St. Petersburg have been arranged to give an impression of the Russian approaches in value creation.
The 9th Global Conference on Sustainable Manufacturing (9GCSM) is geared towards representatives of science and industry from different continents. The conference serves as a forum for international research institutes and industrial companies related to the area of sustainable manufacturing. The conference offers keynote speeches, panel discussions, expert sessions and a poster forum. Discussions and exchange of ideas between the participants are an integral part of the meeting.

This book includes the research papers, which have been accepted at the 9th Global Conference on Sustainable Manufacturing. These contributions are structured in nine chapters covering areas: Value Creation by Sustainable Manufacturing; Manufacturing Processes and Equipment; Remanufacturing, Reuse and Recycling; Product Design for Resource Efficiency and Effectiveness; Innovative Energy Conversion; Green Supply Chain and Transportation; Adequate Environments for Entrepreneurial; Engineering Education for Sustainability; and Economics for Sustainability Development.

My special thanks go to Prof. Dr. Felix V. Karmazinov, Director General Vodokanal of St. Petersburg, Russia and Prof. Alexander Karlik for their support and hospitality in preparation and execution of the conference. In addition, I want to thank Prof. D.Sc. (Econ.) Igor A. Maksimtsev, Rector of St. Petersburg State University of Economics and Finance, Russia; and Prof. D. Sc. (Eng.) Andrey I. Rudskoy, Rector of St. Petersburg State Polytechnical University, Russia for their continuous support in organizing the conference. Finally, I thank MSc. BEng. Sadiq AbdElall, M.LL.P Julia Melikova, Dr. Irina Vostrikova, and Prof. Olga Borozdina for their never-ending patience and persistence in letting the conference become reality.

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Chapter 1:
Value Creation by Sustainable Manufacturing
1.1 Sustainable Manufacturing for Global Value Creation

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Abstract
Sustainability in the three dimensions of economic competitiveness in market environment, of ecological resource efficiency and effectiveness and of social development in education, health and wealth for humans in the global village has become a guideline for mankind’s future existence on earth. An architecture of sustainable manufacturing for global value creation is specified in challenges and approaches to cope with them. Activities at Technische Universität Berlin with respect to a major integrated interdisciplinary research project are presented.

Keywords: Collaboration, Competition, Strategies, Production equipment

1 Introduction
Engineering is exploiting potentials for useful applications. Manufacturing, as a specific discipline in engineering, starts from human thinking and imagination, from knowledge about natural scientific phenomena, from physical materials and shapes value creation via processes in management and technology, objectified in tangible and intangible products, in physical artefacts and services. This research intends to demonstrate how sustainable manufacturing embedded in global value creation proves to be superior to traditional paradigms of management and technology.

Sustainability has become an urgent requirement and challenge for mankind’s survival on earth and for their future development, considering the limits of resources and growth and the unequal distribution of wealth. Sustainability here is interpreted in ecological, economic and social dimensions. Ecologically, non-renewable resources must not be disposed anymore but regained in product and material cycles. Chances of substituting them by renewables must be exploited, but only to the extent that renewables can be regained. Economically, wealth can be achieved in the different areas of human living without increasing physical resource consumption by selling functionality rather than tangible products. In the social dimension, a global village with less than one billion out of currently close to seven billion people consuming more than four fifths of global resources is hardly acceptable for living peacefully together. Teaching and learning for a global culture, wealth and health become vital tasks for the global human community. If the lifestyles of upcoming and also developed communities will be shaped in the future by the existing, actually predominating technologies, then the resource consumption will exceed every accountable ecological, economic and social bound.

2 Sustainability Engineering
Sustainable engineering represents a new scientific approach to cope with this challenge. The dynamics of global competition and cooperation shall be utilized for lending wings to processes of innovation and mediation towards the reasonably demanded sustainability on our globe. A special focus lies on condensing engineering to sustainable manufacturing, thus specifically addressing artefact generation for shaping human living.

The current research combines the breadth of systemic reference in pathways for sustainable technology, their assessment, valuation and mathematical modelling with exemplary in depth realization of manufacturing processes and equipment, virtual systems for product development and organization of sustainable value creation in product and material cycles on different levels of aggregation. These two perspectives are merged for methods and tools creating social capital enabling humans for learning and teaching help for self-help (Fig. 1.1.1).

Fig. 1.1.1 From saturated markets bridging the gap to hungry markets

Although there are differences in the single items of the research area, the overall focus is on identifying potentials in Germany and Europe for initiatives in driving the global village to awareness and activity for sustainable development. Contributions from emerging communities shall be identified for exchange in a cooperative environment with continuous innovation empowered by fair trade and competition. Further cases may specify the implementation of global sustainable value creation in mutual exchange of knowledge between partners from different communities. As knowledge is the only resource not being reduced but expanding by utilization a strong leverage can be expected from the manifold contents of knowledge management. Consequently services on information infrastructure or on public awareness for mutual exchange of ideas with societal