



RESEARCH ARTICLE

The promotion and application of green remanufacturing: a case study in a machine tool plant

Boxue Song¹ · Xingyu Jiang¹ · Song Wang² · Qing Liu² · Tianbiao Yu³

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Abstract

Low parts utilization, high resource consumption, and low profit margins have become the main factors hindering the development of machine tool remanufacturing in China. A machine tool manufacturing company was taken as a case to investigate the improvement of the remanufacturing production line. The remanufacturing workshop and production line of the case enterprise have been completely re-planned, adding remaining life assessment, additive manufacturing, quality monitoring, and reassembly quality control. After applying the new production line, the energy consumption and water consumption of each remanufacturing machine tool were reduced by 29.87 kgce and 0.042 m³, respectively, and the pollutants generated were reduced by 4.352 kg. With the increase in remanufactured machine tool capacity, the part reutilization has increased by 26.9%. Despite satisfactory results, machine remanufacturing still faces many difficulties in China. Combined with case enterprises, the current situation of machine tool remanufacturing in China was discussed, and several suggestions for promoting remanufacturing in Chinese manufacturing companies were put forward.

Keywords Machine tool · Remanufacturing · Improvement · Policy

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Highlights

1. New remanufacturing production lines and remanufacturing systems.
2. Achieved energy-saving and material-saving, higher remanufacturing and reutilization rates.
3. Higher remanufactured machine tool sales and profits, and more jobs.
4. Urgent need for more financial and policy support.

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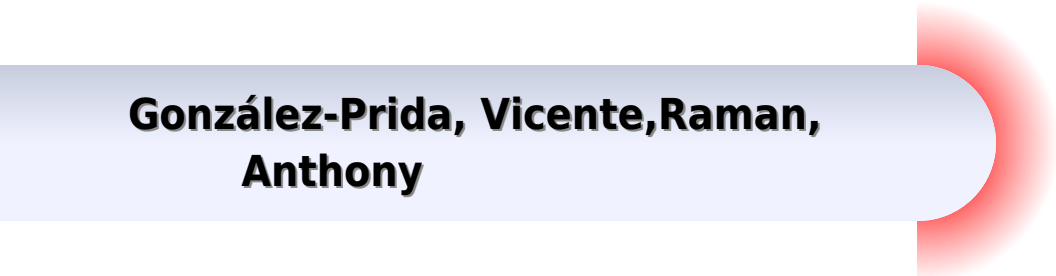
Introduction

Remanufacturing is one of the key players of resource efficiency and has increasingly been applied by countries (Tian et al. 2022a, b, c; Boeda 2017; Low and Ng 2018; Abu et al. 2014). Still, many manufacturers, sellers, and even government have difficulties in promoting remanufacturing. Although recycling at the end of the life cycle has been considered by many products during the initial design phase, this type of “recycling” simply keeps used products in service and their quality of work cannot be guaranteed. Unlike recycling, recycled waste products can be remanufactured for reprocessing, and advanced manufacturing technologies can be used to extend the life cycle with quality assurance. In this trend, the concepts of active remanufacturing (Song et al. 2015) and adaptive remanufacturing (Krystofik et al. 2018) are gradually being applied.

Remanufacturing companies need more accurate capacity planning and pricing strategies. Unreasonable remanufacturing costs and pricing will cause manufacturers to abandon remanufacturing (Xiong et al. 2016). Andrew-Manot and Ibrahim (2013) discussed a remanufacturing inventory adjustment model with variable remanufacturing batch sizes. Li et al. (2015) believed that the random remanufacturing revenue and demand have brought great

Computational Intelligence In Remanufacturing Advances In Environmental Engineering And Green Technologies

**González-Prida, Vicente, Raman,
Anthony**



Computational Intelligence In Remanufacturing Advances In Environmental Engineering And Green Technologies:

Computational Intelligence in Remanufacturing Xing, Bo, Gao, Wen-Jing, 2013-12-31 In attempts to reduce greenhouse gas emissions many alternatives to manufacturing have been recommended from a number of international organizations Although challenges will arise remanufacturing has the ability to transform ecological and business value Computational Intelligence in Remanufacturing introduces various computational intelligence techniques that are applied to remanufacturing related issues results and lessons from specific applications while highlighting future development and research This book is an essential reference for students researchers and practitioners in mechanical industrial and electrical engineering

Handbook of Research on Advancements in Environmental Engineering Gaurina-Medjimurec, Nediljka, 2014-11-30 The protection of clean water air and land for the habitation of humans and other organisms has become a pressing concern amid the intensification of industrial activities and the rapidly growing world population The integration of environmental science with engineering principles has been introduced as a means of long term sustainable development The Handbook of Research on Advancements in Environmental Engineering creates awareness of the role engineering plays in protecting and improving the natural environment Providing the latest empirical research findings this book is an essential reference source for executives educators and other experts who seek to improve their project s environmental costs

Soft Computing Applications for Renewable Energy and Energy Efficiency Cascales, Maria del Socorro García, Lozano, Juan Miguel Sánchez, Arredondo, Antonio David Masegosa, Corona, Carlos Cruz, 2014-10-31 As the climate and environment continue to fluctuate researchers are urgently looking for new ways to preserve our limited resources and prevent further environmental degradation The answer can be found through computer science a field that is evolving at precisely the time it is needed most Soft Computing Applications for Renewable Energy and Energy Efficiency brings together the latest technological research in computational intelligence and fuzzy logic as a way to care for our environment This reference work highlights current advances and future trends in environmental sustainability using the principles of soft computing making it an essential resource for students researchers engineers and practitioners in the fields of project engineering and energy science

Computational Intelligence Methods for Green Technology and Sustainable Development Yo-Ping Huang, Wen-June Wang, Hieu-Giang Le, An-Quoc Hoang, 2024-12-23 This book is presented in two volumes featuring peer reviewed research papers from the 7th International Conference on Green Technology and Sustainable Development GTSD held in Ho Chi Minh City Vietnam from July 25 to 26 2024 It highlights original research by experts from both academia and industry centered on the theme of Green Technology and Sustainable Development in the Industrial Revolution 4.0 The book underscores the critical importance of sustainability in education technology and economic development while also showcasing the vital role of technological innovation in creating a greener future The papers documented in this book

cover a broad range of topics including renewable energy systems smart grids artificial intelligence robotics and intelligent systems and computational intelligence all with a focus on sustainable development climate change mitigation and environmental policy These studies showcase cutting edge technologies and innovative ideas related to green technology offering actionable insights for advancing sustainable development across various sectors The authors present research based on both experimental and numerical methods offering solutions to current problems and optimizing existing methods The insights and findings provided are valuable for industry experts research institutions universities and anyone interested in advancing global sustainable development

Advances of Artificial Intelligence in a Green Energy Environment Pandian Vasant,Joshua Thomas,Elias Munapo,Gerhard-Wilhelm Weber,2022-05-20 *Advances of Artificial Intelligence in a Green Energy Environment* reviews the new technologies in intelligent computing and AI that are reducing the dimension of data coverage worldwide This handbook describes intelligent optimization algorithms that can be applied in various branches of energy engineering where uncertainty is a major concern Including AI methodologies and applying advanced evolutionary algorithms to real world application problems for everyday life applications this book considers distributed energy systems hybrid renewable energy systems using AI methods and new opportunities in blockchain technology in smart energy Covering state of the art developments in a fast moving technology this reference is useful for engineering students and researchers interested and working in the AI industry Looks at new techniques in artificial intelligence AI reducing the dimension of data coverage worldwide Chapters include AI methodologies using enhanced hybrid swarm based optimization algorithms Includes flowchart diagrams for exemplifying optimizing techniques

Green Technology and Smart Materials for Engineering Applications Jashanpreet Singh,Hitesh Vasudev,Ankit Sharma,Murali Mohan Cheepu,2025-08-08

Sustainability and technological advancements are rapidly gaining traction on a global scale and are becoming increasingly prominent across a wide range of industries as evidenced by current market trends Companies are making significant investments in the research and development of smart materials that can adapt to their surroundings in real time thereby improving their performance and productivity The heightened interest in environmentally friendly and intelligent materials can be attributed to the recent surge in research conferences and patent applications in this field highlighting the need for a comprehensive resource that can provide a thorough explanation of these developments *Green Technology and Smart Materials for Engineering Applications* provides a thorough examination of smart materials including their unique properties and applications in sustainable construction It explores the versatile uses of green materials in different industries emphasizing sustainable manufacturing practices and resource efficient materials The integration of eco design and innovation is looked at for the creation of sustainable materials highlighting the importance of green and smart materials in optimizing energy consumption Additionally the book offers insights into reuse and recycling techniques that promote circular economy principles and sustainable business models related to green and smart materials Real world examples and

success stories are used to illustrate the environmental and economic impacts of implementing smart and green materials in various industries This book is intended to serve as a comprehensive reference guide for academics researchers scholars and professionals working in the fields of manufacturing processing material science and environmental engineering The primary objective of this book is to showcase sustainability by emphasizing the diverse array of green and smart materials utilized in various engineering applications Through this publication readers will gain valuable insights into the importance of incorporating environmentally friendly materials into their work ultimately contributing to a more sustainable future

Progressive Engineering Practices in Marine Resource Management Zlateva, Ivelina, Raykov, Violin, Nikolov, Nikola, 2015-04-30 There is overwhelming evidence that marine resources are being overexploited throughout the world In an effort to conserve the natural resources of the world's oceans new methods technologies and practices in fishery and marine resource management must be implemented Progressive Engineering Practices in Marine Resource Management combines scientific ecological and engineering approaches involved in the sustainable management of natural resources Featuring coverage on key topics relating to environmental management maritime spatial planning sustainable fisheries and waste water treatment this publication is a critical reference source for fishery associations scientists environmental management authorities and water management directorates interested in emerging technologies and innovative resource management techniques

Advanced Manufacturing Technology in China: A Roadmap to 2050 Tianran Wang, Yi Zhang, Haibin Yu, Fei-Yue Wang, 2012-03-02 As one of the eighteen field specific reports comprising the comprehensive scope of the strategic general report of the Chinese Academy of Sciences this sub report addresses long range planning for developing science and technology in the field of advanced manufacturing technology They each craft a roadmap for their sphere of development to 2050 In their entirety the general and sub group reports analyze the evolution and laws governing the development of science and technology describe the decisive impact of science and technology on the modernization process predict that the world is on the eve of an impending S T revolution and call for China to be fully prepared for this new round of S T advancement Based on the detailed study of the demands on S T innovation in China's modernization the reports draw a framework for eight basic and strategic systems of socio economic development with the support of science and technology work out China's S T roadmaps for the relevant eight basic and strategic systems in line with China's reality further detail S T initiatives of strategic importance to China's modernization and provide S T decision makers with comprehensive consultations for the development of S T innovation consistent with China's reality Supported by illustrations and tables of data the reports provide researchers government officials and entrepreneurs with guidance concerning research directions the planning process and investment Founded in 1949 the Chinese Academy of Sciences is the nation's highest academic institution in natural sciences Its major responsibilities are to conduct research in basic and technological sciences to undertake nationwide integrated surveys on natural resources and ecological environment to provide the country

with scientific data and consultations for government's decision making to undertake government assigned projects with regard to key S T problems in the process of socio economic development to initiate personnel training and to promote China's high tech enterprises through its active engagement in these areas

Promoting Sustainable Practices through Energy Engineering and Asset Management González-Prida, Vicente, Raman, Anthony, 2015-03-31 Green technologies and energy efficient practices have become two of the most prevalent issues in global society. However, many countries still lack the technology or resources needed to implement sustainable practices within their societies. Promoting Sustainable Practices through Energy Engineering and Asset Management discusses the challenges that the developing world faces when implementing and utilizing environmentally friendly techniques. This publication is a crucial reference source for managers, scientists, technology developers, and engineers interested in the adoption of sustainable practices in developing countries.

Sustainable Manufacturing and Remanufacturing Management Weidong Li, Sheng Wang, 2018-06-29 This book reports on the latest research and applications in the fields of sustainable manufacturing and remanufacturing as well as process planning and optimization technologies. It introduces innovative algorithms, methodologies, industrial case studies, and applications. It focuses on two topics: sustainable manufacturing for machining technologies and remanufacturing of waste electronic equipment. Various methods are covered for each one, including macro process planning, dynamic scheduling, selective disassembly planning, and cloud-based disassembly planning. The experimental analysis provided for every method explains the benefits as well as how they are sustainable for various real-world applications. Further, a theoretical analysis and algorithm design is presented for each, accompanied by the contributors' relevant research, including step-by-step guides, application scenarios, relevant literature surveys, implementation details, and case studies and critical reviews on the relevant technologies. This book is a valuable resource for researchers in sustainable manufacturing, remanufacturing, and product lifecycle management communities, as well as practicing engineers and decision makers in industry and all those interested in sustainable product development. It is also useful reading material for postgraduates and academics wanting to conduct relevant research and a reference resource for manufacturing engineers developing innovative tools and methodologies.

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