

# Evaluation Model for Selection of Advanced Manufacturing Technologies

H. S. C. Perera

**Abstract:** Implementation of Advanced Manufacturing Technologies (AMT) has become a popular strategy among many industries to face the growing competition. Selection of AMT purely based on economic benefits has been challenged due to other factors such as strategic benefits. This paper presents decision making framework for selection of AMT. Factors influenced on Advanced Manufacturing Technology selection were identified under three categories: economic indicators, strategic benefits and risk. Sub-criteria of each category were further identified. Selection of the best AMT led to a multi-criteria decision making problem as alternative technologies should be evaluated based on many criteria. An Analytic Hierarchy Process (AHP) model was developed for ranking the alternative AMTs. An example of a case is presented to show the actual implementation of the AHP model.

**Keywords:** Advanced Manufacturing Technology, Analytic Hierarchy Process, Selection of AMT

## 1. Introduction

Many firms have adopted advanced manufacturing technologies (AMT) to improve operational performance and to achieve competitive success. AMT represents a wide variety of modern, mainly computer-based systems coupled with new organizational practices. Some industrialists and economists believe that AMT has great potential to offer manufacturing companies, with many tangible and intangible benefits [1]. These benefits include earlier entrance to market, ability to respond more quickly to changing customer needs and higher quality products with improved consistency and reliability among other things [2]. However, results of several empirical studies indicate that implementing AMT has often not been either as successful or as straight forward as expected [3, 4, 5, 6]. Among the many reasons for failure, there is some indication that faulty or inadequate investment justification practices can result in firms not recognizing or considering some benefits which the AMT may indeed be capable of bestowing [6, 7, 8].

The benefits of AMT are significant but there are several internal and external factors inhibiting the success of AMT investment decisions. Lack of readily accessible and acceptable methods for appraising all the benefits offered by the AMT is one of the major problems [1]. Moreover, some manufacturers hold the view that the adoption of AMT involves a high level of investment, and

its payback period is usually longer than that traditionally required by business enterprises. Due to this reason, management may adopt a rather conservative policy, and hence refuses to consider AMTs, even though they could potentially benefit the firm [9]. Because of the potentially high investments in AMT and the moderate-to-high risk involved in adopting these technologies, there should be an adequate economic analysis and justification method to assist companies in selecting the appropriate technology, most suited to their operations and business objectives. What makes the justification process challenging is inability to incorporate both tangible and intangible benefits of AMT investment in the decision making framework. Many benefits expected from these AMT investments lie not only in the area of cost reduction but in areas of strategic benefits such as improved flexibility, shorter time to market and increased adaptability to changing market conditions that are hard to quantify.

Complexity arises due to the large number of decision criteria and the existence of both tangible and non-tangible factors. Use of economic justification methodologies, adequate

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# Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures

**Donald O. Thompson, Dale E. Chimenti**



## **Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures:**

*Selection and Evaluation of Advanced Manufacturing Technologies* Matthew J. Liberatore, 2012-12-06 Matthew J. Liberatore Department of Management Villanova University Villanova PA 19085 1 BACKGROUND The weakening competitive position of many segments of u s manufacturing has been analyzed debated and discussed in corporate boardrooms academic journals and the popular literature One result has been a renewed commitment toward improving productivity and quality in the workplace The drive to reduce manufacturing related costs while meeting ever changing customer needs has led many firms to consider more automated and flexible manufacturing systems The extent to which these new technologies can support business goals in productivity quality and flexibility is an especially important issue for manufacturing firms in the u s and other Western nations Problems have arisen in developing performance measures and evaluation criteria which reflect the full range of costs and benefits associated with these technologies Some would argue that managerial policies and attitudes and not the shortcomings of the equipment or manufacturing processes are the major impediments to implementation Kaplan 1984      **Technology Assessment** Tugrul U. Daim, 2011 Understanding the technology dynamics is a required capability in today s technology driven industries This volume focuses on three areas technology assessment technology forecasting and technology diffusion It shows an introduction to different types of assessment methods and applications from different sectors including energy healthcare and communications technology forecasting and foresight and a review of conventional and emerging methods and the diffusion of technologies by exploring adoption of products and services from different sectors Back cover      **Proceedings of The International Conference on Inter Disciplinary Research in Engineering and Technology 2015** Kokula Krishna Hari Kunasekaran, Vignesh R, 2015-04-30 Welcome to the International Conference on Inter Disciplinary Research in Engineering and Technology ICIDRET 2015 in DSIIDC Government of NCT New Delhi India Asia on 29 30 April 2015 If this is your first time to New Delhi you need to look on more objects which you could never forget in your lifetime There is much to see and experience at The National Capital of Republic of India The concept of Inter Disciplinary research was a topic of focus by various departments across the Engineering and Technology area Flushing with major areas this ICIDRET 15 has addressed the E T areas like Mechanical Engineering Civil Engineering Electrical Engineering Bio Technology Bio Engineering Bio Medical Computer Science Electronics Communication Engineering Management and Textile Engineering This focus has brought a new insight on the learning methodologies and the terminology of accepting the cross definition of engineering and the research into it We invite you to join us in this inspiring conversation I am pretty sure that this conference would indulge the information from the various parts of the world and could coin as a global research gathering With more and more researchers coming into ICIDRET this event would be as an annual event This conference is sure that this edition and the future edition will serve as a wise platform for the people to come with better research methodologies integrating each and every social component

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BACKGROUND The weakening competitive position of many segments of u s manufacturing has been analyzed debated and discussed in corporate boardrooms academic journals and the popular literature One result has been a renewed commitment toward improving productivity and quality in the workplace The drive to reduce manufacturing related costs while meeting ever changing customer needs has led many firms to consider more automated and flexible manufacturing systems The extent to which these new technologies can support business goals in productivity quality and flexibility is an especially important issue for manufacturing firms in the u s and other Western nations Problems have arisen in developing performance measures and evaluation criteria which reflect the full range of costs and benefits associated with these technologies Some would argue that managerial policies and attitudes and not the shortcomings of the equipment or manufacturing processes are the major impediments to implementation Kaplan 1984      **Sustainable Materials and Manufacturing Technologies** Navneet Khanna,Kishor Kumar Gajrani,Khaled Giasin,J. Paulo Davim,2023-02-27 Materials and manufacturing techniques are a few of the vital processes in production industries Most of the materials processing and manufacturing techniques currently used in industries are a major cause of environmental pollution and are hence unsustainable This book provides in depth knowledge about challenges faced during the processing of advanced materials and discusses possible ways to achieve sustainability in manufacturing This book Covers advances in cryogenic machining optimization and economical and energy assessment of machining Provides case studies and numerical design with analysis using computational fluid dynamics of minimum quantity lubrication mist droplets Reviews metalworking fluids laser micro texturing materials and manufacturing in sustainability biofuels additives nano materials and additive manufacturing of waste plastic Explores the use of artificial intelligence and machine learning based manufacturing techniques and Covers the latest challenges and future trends in sustainable manufacturing Sustainable Materials and Manufacturing Technologies is primarily written for senior undergraduate and graduate students as well as researchers in mechanical manufacturing industrial and production engineering and material science      **Sustainable Production Through Advanced Manufacturing, Intelligent Automation and Work Integrated Learning** Joel Andersson,Shrikant Joshi,Lennart

Malmsköld,2024-05-07 Collaboration between those working in product development and production is essential for successful product realization The Swedish Production Academy SPA was founded in 2006 with the aim of driving and developing production research and higher education in Sweden and increasing national cooperation in research and education within the area of production This book presents the proceedings of SPS2024 the 11th Swedish Production Symposium held from 23 to 26 April 2024 in Trollhättan Sweden The conference provided a platform for SPA members as well as for professionals from industry and academia interested in production research and education from around the world to share insights and ideas The title and overarching theme of SPS2024 was Sustainable Production through Advanced Manufacturing Intelligent Automation and Work Integrated Learning and the conference emphasized stakeholder value the societal role of industry worker wellbeing and environmental sustainability in alignment with the European Commission's vision for the future of manufacturing The 59 papers included here were accepted for publication and presentation at the symposium after a thorough review process They are divided into 6 sections reflecting the thematic areas of the conference which were sustainable manufacturing smart production and automation digitalization for efficient product realization circular production industrial transformation for sustainability and the integration of education and research Highlighting the latest developments and advances in automation and sustainable production the book will be of interest to all those working in the field

**Review of Progress in Quantitative Nondestructive Evaluation** Donald O. Thompson,Dale E. Chimenti,2012-12-06 These Proceedings consisting of Parts A and B contain the edited versions of most of the papers presented at the annual Review of Progress in Quantitative Nondestructive Evaluation held at Snowmass Village Colorado on July 31 to August 4 1994 The Review was organized by the Center for NDE at Iowa State University in cooperation with the Ames Laboratory of the US DOE the Materials Directorate of the Wright Laboratory Wright Patterson Air Force Base the American Society of Nondestructive Testing the Department of Energy the National Institute of Standards and Technology the Federal Aviation Administration the National Science Foundation Industry University Cooperative Research Centers and the Working Group in Quantitative NDE This year's Review of Progress in QNDE was attended by approximately 450 participants from the U S and many foreign countries who presented over 360 papers The meeting was divided into 36 sessions with as many as four sessions running concurrently The Review covered all phases of NDE research and development from fundamental investigations to engineering applications or inspection systems and it included many important methods of inspection science from acoustics to x rays In the last eight to ten years the Review has stabilized at about its current size which most participants seem to agree is large enough to permit a full scale overview of the latest developments but still small enough to retain the collegial atmosphere which has marked the Review since its inception

*NASA authorization for fiscal year 1979* United States. Congress. Senate. Committee on Commerce, Science, and Transportation. Subcommittee on Science, Technology, and Space,1978 Fourth International Conference on Factory

2000 - Advanced Factory Information, 3-5 October 1994 Institution of Electrical Engineers. Computing & Control Division, 1994 The proceedings of the October 1994 conference comprise technical papers in sessions on expert systems implementation of factory automation strategic and scheduling considerations technology transfer and quality issues simulation and modeling two sessions knowledge based systems manufacturing systems two sessions quality two sessions manufacturing processes and concurrent engineering There are also 39 poster papers Reproduced from typescripts No index Distributed by INSPEC Annotation copyright by Book News Inc Portland OR *Hearings, Reports and Prints of the Senate Committee on Commerce, Science, and Transportation* United States. Congress. Senate. Committee on Commerce, Science, and Transportation, 1978 **Innovative Developments in Design and Manufacturing** Paulo Jorge da Silva Bartolo, Mateus Artur Jorge, Fernando da Conceicao Batista, Henrique Amorim Almeida, Joao Manuel Matias, Joel Correia Vasco, Jorge Brites Gaspar, Mario Antonio Correia, Nuno Carpinteiro Andre, Nuno Fernandes Alves, Paulo Parente Novo, Pedro Goncalves Martinho, Rui Adriano Carvalho, 2009-09-22 Essential reading on the latest advances in virtual prototyping and rapid manufacturing Includes 110 peer reviewed papers covering 1 Biomanufacturing 2 CAD and 3D data acquisition technologies 3 Materials 4 Rapid tooling and manufacturing 5 Advanced rapid prototyping technologies and nanofabrication 6 Virtual environments and Grey Systems Analysis Sifeng Liu, Yingjie Yang, Jeffrey Yi-Lin Forrest, 2022-12-08 The book covers up to date theoretical and applied advances in grey systems theory from across the world and vividly presents the reader with the overall picture of this new theory and its frontier research Many of the concepts models and methods in the book are original by the authors including simplified form of grey number general grey number and the operations of grey numbers the axiomatic system of buffer operators and a series of weakening and strengthening operators a series of grey relational analysis models including grey absolute relative synthetic similarity closeness negative and three dimension degree etc grey fixed weight clustering model grey evaluation models based on center point and end point mixed possibility functions original difference grey model ODGM even difference grey model EDGM discrete grey model DGM fractional grey models self memory grey models multi attribute intelligent grey target decision models weight vector group with kernel and the weighted comprehensive clustering coefficient vector and spectrum analysis of sequence operators etc This book will be appropriate as a reference and or professional book for courses of grey system theory for graduate students or high level undergraduate students majoring in areas of science technology agriculture medicine astronomy earth science economics and management It can also be utilized by researchers and practitioners in research institutions business entities and government agencies **Evaluation of U.S. Air Force Preacquisition Technology Development** National Research Council, Division on Engineering and Physical Sciences, Air Force Studies Board, Committee on Evaluation of U.S. Air Force Preacquisition Technology Development, 2011-03-01 From the days of biplanes and open cockpits the air forces of the United States have relied on the mastery of technology From design to operation a project can stretch to 20 years and more with

continuous increases in cost Much of the delay and cost growth afflicting modern United States Air Force USAF programs is rooted in the incorporation of advanced technology into major systems acquisition Leaders in the Air Force responsible for science and technology and acquisition are trying to determine the optimal way to utilize existing policies processes and resources to properly document and execute pre program of record technology development efforts including opportunities to facilitate the rapid acquisition of revolutionary capabilities and the more deliberate acquisition of evolutionary capabilities Evaluation of U S Air Force Preacquisition Technology Development responds to this need with an examination of the current state of Air Force technology development and the environment in which technology is acquired The book considers best practices from both government and industry to distill appropriate recommendations that can be implemented within the USAF

*Advanced Materials, ICAMMP 2011* Jing Long Bu,Zheng Yi Jiang,Si Hai Jiao,2011-12-06 Selected peer reviewed papers from the Second International Conference on Advances in Materials and Manufacturing Processes ICAMMP 2011 December 16 18 2011 Guilin China [AIAA 86-1550](#) - [AIAA 86-1599](#) ,1986

**Advances in Additive Manufacturing Technologies** P Gurusamy,2024-11-25 We are delighted to present the proceedings of the 5th International Conference on Advances in Additive Manufacturing Technologies ICAAMT 2023 This conference serves as a premier forum for researchers practitioners and industry experts to share their latest findings innovations and insights in the field of additive manufacturing The rapid advancements and the increasing adoption of these technologies across various sectors underscore the importance of this gathering The conference was held from November 27 29 2023 in Chennai India and organized by the Department of Mechanical Engineering Chennai Institute of Technology Chennai India

**Application of Lightweighting Technology to Military Aircraft, Vessels, and Vehicles** National Research Council,Division on Engineering and Physical Sciences,National Materials and Manufacturing Board,Committee on Benchmarking the Technology and Application of Lightweighting,2012-04-27 Lightweighting is a concept well known to structural designers and engineers in all applications areas from laptops to bicycles to automobiles to buildings and airplanes Reducing the weight of structures can provide many advantages including increased energy efficiency better design improved usability and better coupling with new multifunctional features While lightweighting is a challenge in commercial structures the special demands of military vehicles for survivability maneuverability and transportability significantly stress the already complex process Application of Lightweighting Technology to Military Vehicles Vessels and Aircraft assesses the current state of lightweighting implementation in land sea and air vehicles and recommends ways to improve the use of lightweight materials and solutions This book considers both lightweight materials and lightweight design the availability of lightweight materials from domestic manufacturers and the performance of lightweight materials and their manufacturing technologies It also considers the trade space that is the effect that use of lightweight materials or technologies can have on the performance and function of all vehicle systems and components This book also discusses manufacturing capabilities and affordable manufacturing

technology to facilitate lightweighting Application of Lightweighting Technology to Military Vehicles Vessels and Aircraft will be of interest to the military manufacturers and designers of military equipment and decision makers      Fabrication  
Techniques for Advanced Reinforced Plastics ,1980



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### **Table of Contents Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures**

1. Understanding the eBook Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - The Rise of Digital Reading Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Advantages of eBooks Over Traditional Books
2. Identifying Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - User-Friendly Interface
4. Exploring eBook Recommendations from Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures

- Personalized Recommendations
- Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures User Reviews and Ratings
- Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures and Bestseller Lists
- 5. Accessing Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures Free and Paid eBooks
  - Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures Public Domain eBooks
  - Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures eBook Subscription Services
  - Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures Budget-Friendly Options
- 6. Navigating Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures eBook Formats
  - ePub, PDF, MOBI, and More
  - Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures Compatibility with Devices
  - Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Highlighting and Note-Taking Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Interactive Elements Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
- 8. Staying Engaged with Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
- 9. Balancing eBooks and Physical Books Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions

- Managing Screen Time
- 11. Cultivating a Reading Routine Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Setting Reading Goals Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Fact-Checking eBook Content of Selection And Evaluation Of Advanced Manufacturing Technologies With 23 Figures
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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