

Digital Technologies for Food Loss and Waste Prevention and Reduction in Agri-Food Supply Chains: A Systematic Literature Review and Research Agenda

Caterina Trevisan  and Marco Formentini 

Abstract—Despite the benefits resulting from the use of Industry 4.0 technologies in the agri-food sector, the adoption of digital technologies for preventing and/or reducing food loss and waste (FLW) across the agri-food supply chain is still under investigation. In fact, enhancing and optimizing agri-food supply chain operations through digital technologies would just represent a partial effort if FLW prevention and reduction are not effectively addressed. Although companies are starting to adopt digital technologies for eliminating FLW from their operations, the implementation process and the achieved results are generally presented at a superficial level and practical guidance is still missing. This systematic literature review contributes to theory by developing a framework analyzing the state-of-the-art of adoption of each Industry 4.0 technology across the agri-food supply chain, and providing a research agenda structured around the main themes of research design, digital technologies, contextual differences, governance, and sustainability. Eventually, the study also informs managers in the agri-food industry about the potential implementation of digital technologies for preventing and reducing FLW in across the agri-food supply chain.

Index Terms—Agri-food supply chain (AFSC), digital technologies, digitalization, food loss and waste (FLW), industry 4.0.

NOMENCLATURE

List of Abbreviations

AFSC	Agri-food supply chain.
AI	Artificial intelligence.
BDA	Big data analytics.
CRM	Customer relationship management.
DT	Digital technologies.
EIS	Enterprise information system.
ERP	Enterprise resource planning.
FLW	Food loss and waste.

FW	Food waste.
GPS	Global positioning system.
ICT	Information and communication technology.
IoT	Internet of Things.
ML	Machine learning.
PLM	Product lifecycle management.
RFID	Radio-frequency identification.
RPA	Robotic process automation.
SLR	Systematic literature review.
WMS	Warehouse management system.

I. INTRODUCTION

As a growing number of people is facing food insecurity and the global food systems have been severely tested by a combination of health crisis, climate-related issues, and conflicts, still too much food is lost or wasted throughout the AFSC. Between 25% and 50% of food produced does not reach the consumers, with the majority of losses occurring from the producers to the retailers point in the supply chain [1]. Wasting food has significant negative consequences on social, economic, and environmental sustainability: wasted food in landfills generates about 8%–10% of global greenhouse gas emissions [2], not to mention blue water footprint, land footprint, and biodiversity reduction [3]. Moreover, it leads to an economic cost of around 143 billion euros per year in the 28 European countries alone [4]. Halving per capita global food waste by 2030 is the objective of target 12.3 of UN sustainable development goal [5]; thus, reducing FLW represents a relevant and timely issue.

Several strategies of reducing FLW have been identified, depending also on the supply chain stages considered [6]. Despondi [1] individuates the adoption of technology as one key aspect for food loss reduction, especially in the upstream part of the supply chain. For instance, Industry 4.0 (I4.0) solutions, such as blockchain or IoT, allow the monitoring of the ambient conditions of food products from the harvest until the selling stage, thus detecting their deterioration stage and improving the operations along the entire AFSC [7], [8], [9]. Even in the downstream supply chain stages (i.e., consumption, food service, and food sharing), digital technologies are frequently adopted to avoid or reduce food waste, such as digital platforms

Manuscript received 5 May 2022; revised 31 January 2023; accepted 21 April 2023. This work was supported by the Project “Consumere è Coordinare a Condividere, Bando interno 2020, Covid-19, Università di Trento.” Review of this manuscript was arranged by Department Editor M. Shukla. (Corresponding author: Marco Formentini.)

The authors are with the Department of Information Engineering and Computer Science, University of Trento, 38123 Povo, Italy (e-mail: caterina.trevisan@unitn.it; marco.formentini@unitn.it).

Digital Object Identifier 10.1109/TEME.2023.3273110

Reduction In The Abstract Sciences

K Payea



Reduction In The Abstract Sciences:

Unveiling the Power of Verbal Beauty: An Psychological Sojourn through **Reduction In The Abstract Sciences**

In some sort of inundated with screens and the cacophony of instant transmission, the profound power and psychological resonance of verbal artistry often disappear in to obscurity, eclipsed by the regular barrage of sound and distractions. However, situated within the lyrical pages of **Reduction In The Abstract Sciences**, a fascinating perform of fictional brilliance that impulses with natural feelings, lies an memorable trip waiting to be embarked upon. Written with a virtuoso wordsmith, that mesmerizing opus instructions readers on a psychological odyssey, lightly revealing the latent possible and profound influence embedded within the intricate internet of language. Within the heart-wrenching expanse of the evocative analysis, we can embark upon an introspective exploration of the book is central subjects, dissect their fascinating publishing fashion, and immerse ourselves in the indelible impression it leaves upon the depths of readers souls.

https://pinsupreme.com/public/uploaded-files/index.jsp/madkours_brucellosis.pdf

Table of Contents Reduction In The Abstract Sciences

1. Understanding the eBook Reduction In The Abstract Sciences
 - The Rise of Digital Reading Reduction In The Abstract Sciences
 - Advantages of eBooks Over Traditional Books
2. Identifying Reduction In The Abstract Sciences
 - 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 Reduction In The Abstract Sciences
 - User-Friendly Interface
4. Exploring eBook Recommendations from Reduction In The Abstract Sciences
 - Personalized Recommendations

- Reduction In The Abstract Sciences User Reviews and Ratings
- Reduction In The Abstract Sciences and Bestseller Lists
- 5. Accessing Reduction In The Abstract Sciences Free and Paid eBooks
 - Reduction In The Abstract Sciences Public Domain eBooks
 - Reduction In The Abstract Sciences eBook Subscription Services
 - Reduction In The Abstract Sciences Budget-Friendly Options
- 6. Navigating Reduction In The Abstract Sciences eBook Formats
 - ePub, PDF, MOBI, and More
 - Reduction In The Abstract Sciences Compatibility with Devices
 - Reduction In The Abstract Sciences Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Reduction In The Abstract Sciences
 - Highlighting and Note-Taking Reduction In The Abstract Sciences
 - Interactive Elements Reduction In The Abstract Sciences
- 8. Staying Engaged with Reduction In The Abstract Sciences
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Reduction In The Abstract Sciences
- 9. Balancing eBooks and Physical Books Reduction In The Abstract Sciences
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Reduction In The Abstract Sciences
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Reduction In The Abstract Sciences
 - Setting Reading Goals Reduction In The Abstract Sciences
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Reduction In The Abstract Sciences
 - Fact-Checking eBook Content of Reduction In The Abstract Sciences

- 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

Reduction In The Abstract Sciences Introduction

Reduction In The Abstract Sciences Offers over 60,000 free eBooks, including many classics that are in the public domain. Open Library: Provides access to over 1 million free eBooks, including classic literature and contemporary works. Reduction In The Abstract Sciences Offers a vast collection of books, some of which are available for free as PDF downloads, particularly older books in the public domain. Reduction In The Abstract Sciences : This website hosts a vast collection of scientific articles, books, and textbooks. While it operates in a legal gray area due to copyright issues, its a popular resource for finding various publications. Internet Archive for Reduction In The Abstract Sciences : Has an extensive collection of digital content, including books, articles, videos, and more. It has a massive library of free downloadable books. Free-eBooks Reduction In The Abstract Sciences Offers a diverse range of free eBooks across various genres. Reduction In The Abstract Sciences Focuses mainly on educational books, textbooks, and business books. It offers free PDF downloads for educational purposes. Reduction In The Abstract Sciences Provides a large selection of free eBooks in different genres, which are available for download in various formats, including PDF. Finding specific Reduction In The Abstract Sciences, especially related to Reduction In The Abstract Sciences, might be challenging as theyre often artistic creations rather than practical blueprints. However, you can explore the following steps to search for or create your own Online Searches: Look for websites, forums, or blogs dedicated to Reduction In The Abstract Sciences, Sometimes enthusiasts share their designs or concepts in PDF format. Books and Magazines Some Reduction In The Abstract Sciences books or magazines might include. Look for these in online stores or libraries. Remember that while Reduction In The Abstract Sciences, sharing copyrighted material without permission is not legal. Always ensure youre either creating your own or obtaining them from legitimate sources that allow sharing and downloading. Library Check if your local library offers eBook lending services. Many libraries have digital catalogs where you can borrow Reduction In The Abstract Sciences eBooks for free, including popular titles. Online Retailers: Websites like Amazon, Google Books, or Apple Books often sell eBooks. Sometimes, authors or publishers offer promotions or free periods for certain books. Authors Website Occasionally, authors provide excerpts or short

stories for free on their websites. While this might not be the Reduction In The Abstract Sciences full book , it can give you a taste of the authors writing style.Subscription Services Platforms like Kindle Unlimited or Scribd offer subscription-based access to a wide range of Reduction In The Abstract Sciences eBooks, including some popular titles.

FAQs About Reduction In The Abstract Sciences Books

1. Where can I buy Reduction In The Abstract Sciences books? Bookstores: Physical bookstores like Barnes & Noble, Waterstones, and independent local stores. Online Retailers: Amazon, Book Depository, and various online bookstores offer a wide range of books in physical and digital formats.
2. What are the different book formats available? Hardcover: Sturdy and durable, usually more expensive. Paperback: Cheaper, lighter, and more portable than hardcovers. E-books: Digital books available for e-readers like Kindle or software like Apple Books, Kindle, and Google Play Books.
3. How do I choose a Reduction In The Abstract Sciences book to read? Genres: Consider the genre you enjoy (fiction, non-fiction, mystery, sci-fi, etc.). Recommendations: Ask friends, join book clubs, or explore online reviews and recommendations. Author: If you like a particular author, you might enjoy more of their work.
4. How do I take care of Reduction In The Abstract Sciences books? Storage: Keep them away from direct sunlight and in a dry environment. Handling: Avoid folding pages, use bookmarks, and handle them with clean hands. Cleaning: Gently dust the covers and pages occasionally.
5. Can I borrow books without buying them? Public Libraries: Local libraries offer a wide range of books for borrowing. Book Swaps: Community book exchanges or online platforms where people exchange books.
6. How can I track my reading progress or manage my book collection? Book Tracking Apps: Goodreads, LibraryThing, and Book Catalogue are popular apps for tracking your reading progress and managing book collections. Spreadsheets: You can create your own spreadsheet to track books read, ratings, and other details.
7. What are Reduction In The Abstract Sciences audiobooks, and where can I find them? Audiobooks: Audio recordings of books, perfect for listening while commuting or multitasking. Platforms: Audible, LibriVox, and Google Play Books offer a wide selection of audiobooks.
8. How do I support authors or the book industry? Buy Books: Purchase books from authors or independent bookstores. Reviews: Leave reviews on platforms like Goodreads or Amazon. Promotion: Share your favorite books on social media or recommend them to friends.

9. Are there book clubs or reading communities I can join? Local Clubs: Check for local book clubs in libraries or community centers. Online Communities: Platforms like Goodreads have virtual book clubs and discussion groups.
10. Can I read Reduction In The Abstract Sciences books for free? Public Domain Books: Many classic books are available for free as they're in the public domain. Free E-books: Some websites offer free e-books legally, like Project Gutenberg or Open Library.

Find Reduction In The Abstract Sciences :

~~madkours brucellosis~~

~~macromedia flash mx studio with cdrom~~

macmillan spelling student textbook grade 4

~~mad cooler~~

made for life a compelling story of the human spirits quest for fulfilment

~~mad libs halloween trick or treat night of the living - monster~~

made for his pleasure ten benchmarks of a vital faith

~~mad dog killer~~

macmillan/mcgraw-hill math grade 2- intervention handbook

~~mafie and the persian pink petunias~~

madburger by

~~magia de la television argentina 2 la~~

~~macroeconomic policy growth and poverty reduction~~

maclarens men

~~macromedia flash mx 2004 game design demystified~~

Reduction In The Abstract Sciences :

Correctional Officer Test This practice test is divided into three (3) areas: General Knowledge; Basic Skills; and Career-Specific Aptitude on professional standards, facility operations ... Louisiana Correctional Officer Test | Online 2023 ... Study and pass the 2023 Louisiana Correctional Officer Test! Practice questions, flashcards, full-length exams, study guides, and more! Louisiana Correctional Officer Test-2023 Online Test Prep ... Pass the 2021 Test. We offer the best study program. Police Test Guide was created out of to fill the need for an online police test prep website that ... Louisiana POST Study Guide

Flashcards Study with Quizlet and memorize flashcards containing terms like Miranda vs. Arizona, Mapp v. Ohio, Terry vs. Ohio and more. POLICE OFFICER To pass the examination and be considered for employment, you must score 75 or above. HOW TO USE THIS BOOKLET. You may practice your test taking skills by ... Law Enforcement and Protective Services (LEAPS) Exam Study each sample question carefully so that you will be familiar with questions ... Louisiana State Civil Service. LEAPS Sample Test Questions. Page 9 of 12. B ... Assessment ACT State Testing Website · Assessment Guidance Library · DRC INSIGHT (will open in new tab) · ELPT Portal · LEAP 360 · Louisiana Data Review · Louisiana School ... Correctional Officer Exam - Free Practice and Study Guide On this page you will find a comprehensive and reliable study guide with sample questions and detailed explanations to practice for your upcoming exam. We ... Correction Officer Study Guide and Practice Test Questions ... Taking the Correctional Officer test? Want to get a good score? Written by Test Prep Books, this comprehensive study guide includes: Quick Overview. Test-Taking ... Louisiana Order Forms ... guides and practice tests are available for purchase at [https://www.ApplyToServe.com/Study/for police officer, firefighter or corrections officer positions](https://www.ApplyToServe.com/Study/for%20police%20officer,%20firefighter%20or%20corrections%20officer%20positions). Thermodynamics : An Engineering Approach, 7th Edition Thermodynamics : An Engineering Approach, 7th Edition. 7th Edition. ISBN ... This book is an excellent textbook for Mechanical Engineers studying thermodynamics. Thermodynamics An Engineering Approach | Rent COUPON: RENT Thermodynamics An Engineering Approach 7th edition (9780073529325) and save up to 80% on textbook rentals and 90% on used textbooks. An Engineering Approach... by Yunus A. Cengel Thermodynamics : An Engineering Approach 7th (seventh) Edition by Yunus ... This book is an excellent textbook for Mechanical Engineers studying thermodynamics. An Engineering Approach 7th Edition by Yunus; Boles ... [REQUEST] Thermodynamics: An Engineering Approach 7th Edition by Yunus; Boles, Michael Cengel published by Mcgraw-Hill Higher Education (2010). Thermodynamics : An Engineering Approach, 7th Edition - ... Thermodynamics : An Engineering Approach, 7th Edition by Yunus A. Cengel; Michael A. Boles - ISBN 10: 007352932X - ISBN 13: 9780073529325 - McGraw-Hill ... Thermodynamics : An Engineering Approach, 7th Edition Thermodynamics : An Engineering Approach, 7th Edition ; Author: Yunus A. Cengel ; Publisher: McGraw-Hill ; Release Date: 2010 ; ISBN-13: 9780073529325 ; List Price: ... Thermodynamics: An Engineering Approach Thermodynamics Seventh Edition covers the basic principles of thermodynamics while presenting a wealth of real-world engineering ... No eBook available. Amazon ... Thermodynamics: An Engineering Approach Thermodynamics: An Engineering Approach, 9th Edition. ISBN10: 1259822672 | ISBN13: 9781259822674. By Yunus Cengel, Michael Boles and Mehmet Kanoglu. An Engineering Approach Seventh Edition in SI Units | ... Thermodynamics: An Engineering Approach Seventh Edition in SI Units. 2023-09-04 1/2 thermodynamics an engineering approach ... Sep 4, 2023 — Ebook free Thermodynamics an engineering approach 7th ... You could buy guide thermodynamics an engineering approach 7th ed or get it as soon as. Health Care Finance: Basic Tools For... by Baker, ... This is the most practical financial management text for those who need basic financial management knowledge and a better understanding of healthcare ...

Health Care Finance: Basic Tools for Nonfinancial ... Health Care Finance: Basic Tools for Nonfinancial Managers 3RD EDITION [Baker] on Amazon.com. *FREE* shipping on qualifying offers. Health Care Finance: ... Health Care Finance: Basic Tools For Nonfinancial ... Synopsis: This is the most practical financial management text for those who need basic financial management knowledge and a better understanding of healthcare ... Baker's Health Care Finance: Basic Tools ... Baker's Health Care Finance: Basic Tools for Nonfinancial Managers, Sixth Edition is the most practical and applied text for those who need a basic and ... Health Care Finance Basic Tools For Nonfinancial Managers By ... Webfuture challenges in health care. Students of health administration, public administration, public health, nursing and other allied health. Health Care Finance: Basic Tools for Nonfinancial Managers This is the most practical financial management text for those who need basic financial management knowledge and a better understanding of healthcare ... Health Care Finance Baker, Judith J. Health care finance : basic tools for nonfinancial managers / Judith Baker, R.W. Baker. — 3rd ed. p. ; cm. Includes bibliographical ... Basic Tools for... book by Judith J. Baker Health Care Finance: Basic Tools for Nonfinancial Managers is the most practical financial management text for those who need basic financial management ... Basic Tools for Nonfinancial Managers, Sixth Edition Baker's Health Care Finance: Basic Tools for Nonfinancial Managers, Sixth Edition · 10 pages. \$1.90, Color. \$1.60, B&W. \$0.90 · 12 pages. \$2.28, Color. \$1.92, B&W. Baker's health care finance basic tools for nonfinancial ... Introduction to healthcare finance ; Five things the healthcare manager needs to know about financial management systems ; Using Excel -- Part II. Assets, ...