

Premier Reference Source

Opportunities and Strategic Use of Agribusiness Information Systems



**Ferdinand Ndifor Che, Kenneth David Strang,
and Narasimha Rao Vajjhala**

IGI Global
PUBLISHER OF TIMELY KNOWLEDGE

Opportunities and Strategic Use of Agribusiness Information Systems

Ferdinand Ndifor Che
W3-Research, USA & APPC Research, Australia

Kenneth David Strang
W3-Research, USA & APPC Research, Australia

Narasimha Rao Vajjhala
University of New York Tirana, Albania



A volume in the Advances in Business Information
Systems and Analytics (ABISA) Book Series

Copyrighted material

Table of Contents

Preface	xiv
Chapter 1	
Introduction to Agricultural Information Systems.....	1
<i>Narasimha Rao Vajjhala, University of New York Tirana, Albania</i>	
Chapter 2	
Agribusiness and Innovation Systems in Africa: A Survey of Evidence.....	13
<i>Osman Mohammed Babikir, IGAD Centre for Pastoral Araes and Livestock Development, Kenya</i>	
Chapter 3	
Agriculture Business Problems: Analysis of Research and Probable Solutions in Africa	33
<i>Kenneth David Strang, APPC Research, Australia</i>	
<i>Ferdinand Ndifor Che, W3-Research, USA & APPC Research, Australia</i>	
<i>Narasimha Rao Vajjhala, University of New York Tirana, Albania</i>	
Chapter 4	
Assessment of E-Readiness Challenges of Farmers and Extension Workers in North-East Nigeria ...	59
<i>Rajasekhara Mouly Potluri, College of Business, Al Ghurair University, Dubai, UAE</i>	
<i>Narasimha Rao Vajjhala, University of New York Tirana, Albania</i>	
Chapter 5	
Agribusiness in South Asia: Current Status, Obstacles, and Policy Options	73
<i>Md. Hashmi Sakib, EXIM Bank Agricultural University Bangladesh, Bangladesh</i>	
<i>Md. Safiul Islam Afrad, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh</i>	
<i>Ahmed Harun-Al-Rashid, Sylhet Agricultural University, Bangladesh</i>	
<i>A K M Golam Kausar, EXIM Bank Agricultural University Bangladesh, Bangladesh</i>	

Chapter 6	
Agricultural Information Systems and Sustainable Food Value Chain Development: Strategies Towards Innovative Application of ICTs	93
<i>Bashir Garba Muktar, Federal University, Dutse, Nigeria</i>	
<i>Norsida Man, Universiti Putra Malaysia, Malaysia</i>	
<i>Martins Olusegun Orifah, Federal University, Dutse, Nigeria</i>	
Chapter 7	
Agricultural Information Systems (AGRIS) as a Catalyst for Sustainable Development Goals (SDGs) in Africa: A Critical Literature Review	109
<i>Lukman Raimi, American University of Nigeria, Nigeria</i>	
<i>Ferdinand Ndifor Che, W3-Research, USA & APPC Research, Australia</i>	
<i>Rufai Mohammed Mutiu, Yaba College of Technology, Nigeria</i>	
Chapter 8	
Role of Agri-Food Value Chains in Bolstering Small and Marginal Farmers in India	134
<i>Dipanjan Kashyap, Assam Agricultural University, India</i>	
<i>Sanjib Bhuyan, Rutgers University, USA</i>	
Chapter 9	
Enhancing Agricultural Entrepreneurship Through Mobile Applications in Greece: The Case of a “Farm Management” Application.....	151
<i>Alexandra Pliakoura, Department of Business Administration of Food and Agricultural Enterprises, University of Patras, Greece</i>	
<i>Grigorios N. Beligiannis, Department of Business Administration of Food and Agricultural Enterprises, University of Patras, Greece</i>	
<i>Achilleas Kontogeorgos, Department of Business Administration of Food and Agricultural Enterprises, University of Patras, Greece</i>	
Chapter 10	
Addressing Risk Associated to ICT-Based Technology: Estimation of Financial Parameters.....	174
<i>Marco Medici, University di Bologna, Italy</i>	
<i>Maurizio Canavari, Università di Bologna, Italy</i>	
Chapter 11	
Agribusiness Technology Transfer and Innovation as a Catalyst for Food Security in Developing Countries: Case of Kenya	185
<i>Samwel Macharia Chege, University of Science and Technology Beijing, Beijing, China</i>	
<i>Daoping Wang, University of Science and Technology Beijing, Beijing, China</i>	
Chapter 12	
Design of a Digital Kissan Hub Prototype for Farmer Produce Organizations to Empower Agribusiness.....	207
<i>Sreekantha Desai Karanam, NMAM Institute of Technology, India</i>	
<i>Anantha Padmanabha Achar, JKSH Institute of Management Studies, India</i>	
<i>R. V. Kulkarni, CSIBER, India</i>	

Chapter 13

Design of an Agribusiness Innovative and Autonomous Robot System for Chemical Weed Control for Staple Food Crops Production in Sub-Saharan Africa 234

Jibril Abdullahi Bala, Department of Mechatronics Engineering, Federal University of Technology, Minna, Nigeria

Olayemi Mikail Olaniyi, Department of Computer Engineering, Federal University of Technology, Minna, Nigeria

Taliha Abiodun Folorunso, Department of Mechatronics Engineering, Federal University of Technology, Minna, Nigeria

Emmanuel Daniya, Department of Crop Production, Federal University of Technology, Minna, Nigeria

Chapter 14

Internet of Things-Enabled Agribusiness Opportunities in Developing Countries: Agribusiness Engagement Opportunities in Nigeria 263

Bamigboye Funmilayo, Afe Babalola University, Nigeria

Ojo Emmanuel Ademola, Independent Researcher, UK

Compilation of References 277


About the Contributors 324

Index 331


Chapter 13

Design of an Agribusiness Innovative and Autonomous Robot System for Chemical Weed Control for Staple Food Crops Production in Sub-Saharan Africa

Jibril Abdullahi Bala

 <https://orcid.org/0000-0003-4886-3924>
*Department of Mechatronics Engineering,
Federal University of Technology, Minna, Nigeria*


Olayemi Mikail Olaniyi

 <https://orcid.org/0000-0002-2294-5545>
*Department of Computer Engineering, Federal
University of Technology, Minna, Nigeria*

Taliha Abiodun Folorunso

*Department of Mechatronics Engineering,
Federal University of Technology, Minna, Nigeria*

Emmanuel Daniya

 <https://orcid.org/0000-0001-5493-3672>
*Department of Crop Production, Federal
University of Technology, Minna, Nigeria*

ABSTRACT

Agriculture and agribusinesses suffer from many challenges, despite their significance to global economic growth. One of the challenges is the lack of appropriate technology to drive the industry to the next level of development. This technological gap contributes to reduced yield and profit without a reduction in manual labour, cost, and stress. Robotics have been explored to boost agricultural production and improve agribusiness productivity. Several weed control robots have been developed for research and field uses, but these systems are not suitable for weed control in large commercial farms or lack control schemes for navigation and weed control. This study presents the design of an autonomous robot system for chemical weed control. The system uses control theory, artificial intelligence, and image processing to navigate a farm environment, identify weeds, and apply herbicide where necessary. Upon implementation and adoption, this system would increase agricultural productivity with minimal human input, thereby leading to an increase in revenue and profit for agribusinesses.

DOI: 10.4018/978-1-7998-4849-3.ch013

INTRODUCTION

The concept of Agribusiness is the sum of all operations involved in the production and distribution of farm produce, farm production operations, storage, processing, and distribution of farm commodities (Ikenwa, Sulaimon, & Kuye, 2017). It is a generic term for different businesses involved in the production and along the value chain of an agricultural commodity which includes but not limited to subsistence and mechanized farming, the supply of seeds, fertilizers, manure, chemicals, machinery, marketing, and financing of the agricultural industry (Munonye & Esiobu, 2017).

In recent times, there has been increased pressure on the agricultural industry and agribusinesses to operate and deliver more efficiently and effectively due to an increase in the world's population (Munonye & Esiobu, 2017). Agribusiness has the capacity and potential to provide increased employment, poverty reduction, higher income, and food security (Tersoo, 2013). Nevertheless, given the sector's ability to revolutionize the sub-Saharan African region's agricultural commodity production, agribusiness suffers from numerous constraints. The challenges associated with agribusinesses in Sub-Saharan Africa include poor policy articulation, inadequate working capital, lack of suitable technology, and inadequate agricultural infrastructure (Munonye & Esiobu, 2017). These challenges limit the revenue and profits generated from the industry.

Productivity in agriculture and agribusinesses can be increased by appropriate, accurate, and usable information and knowledge. Agricultural information interacts with agricultural productivity in a variety of ways, influencing it. It helps inform land, labor, livestock, capital, and management decisions. Consequently, the processing of agricultural information (through extension facilities, research, and education programs) is most mostly handled by agricultural organizations that build information systems to disseminate knowledge to farmers (Demiryurek, 2008). This knowledge enables the farmers to make informed decisions to take advantage of market incentives and handle constant improvements in their production processes. Information obtained from farms can be collected using systems that employ the concepts of Precision Agriculture, Artificial Intelligence, and Robotics. These devices rely on the use of sensors to obtain environmental data which can then be analyzed using a variety of software tools.

Globally, there has been an increase in the application of robotic systems to automate agriculture-based problems (Roldán et al., 2018). According to the United Kingdom Robotics and Autonomous Systems (UK-RAS) Network, robotics and autonomous systems will transform numerous global industries including the agricultural sector through the development of technologies aimed at maximizing profit and increasing yield (UK RAS Network, 2018). In addition, advancements in precision agriculture have resulted in the utilization of intelligent machines to minimize human involvement while increasing agricultural output. The development of robots and their application in agriculture has increased leading to the exploration of possibilities to adapt rational mobile robot solutions based on behavioral approaches (Pedersen, Fountas, & Blackmore, 2008).

A major problem faced by farmers is the prevalence of weeds. A weed is any unwanted crop that grows in an unwanted area. Weeds reduce not only yield but also the confidence of farmers by creating a poor return on investment. Weeds also result in higher production costs and lead to seedling contamination. Manual weed control with hand-held hoes and manual application of herbicides with knapsack sprayer is labor-intensive and exhausting. This fatigue-inducing weed control approach discourages a lot of people from moving into crop farming (Olaniyi, Daniya, Kolo, Bala, & Olanrewaju, 2020). In a quest to improve agricultural productivity, attempts have been made to introduce robotic systems for weed management. However, these systems have drawbacks such as inadequacy for vast outdoor fields,

27 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the product's webpage:
www.igi-global.com/chapter/design-of-an-agribusiness-innovative-and-autonomous-robot-system-for-chemical-weed-control-for-staple-food-crops-production-in-sub-saharan-africa/266584?camid=4v1

This title is available in Advances in Business Information Systems and Analytics, e-Book Collection, Business and Management e-Book Collection, Business Knowledge Solutions e-Book Collection, Computer Science and Information Technology e-Book Collection, Computer Science and IT Knowledge Solutions e-Book Collection, Environmental, Agricultural, and Physical Sciences e-Book Collection, Business, Administration, and Management e-Book Collection, Science, Engineering, and Information Technology e-Book Collection, Evidence Based Acquisition (Preselection), E-Access. Recommend this product to your librarian:
www.igi-global.com/e-resources/library-recommendation/?id=73

Related Content

Consumer Co-Operatives and Perceptions of Food Safety: Shaping Markets in Post-Fukushima Japan

Catherine Burns, Kumiko Katayama and Robin E. Roberts (2019). *Urban Agriculture and Food Systems: Breakthroughs in Research and Practice* (pp. 210-231).

www.igi-global.com/chapter/consumer-co-operatives-and-perceptions-of-food-safety/222390?camid=4v1a

Impact of Overpopulation on Land Use Pattern

Shivani Garg (2020). *Environmental and Agricultural Informatics: Concepts, Methodologies, Tools, and Applications* (pp. 1517-1534).

www.igi-global.com/chapter/impact-of-overpopulation-on-land-use-pattern/233025?camid=4v1a

World Market of Organic Food Products

Inga Ryumkina and Sergey Ryumkin (2020). *Handbook of Research on Globalized Agricultural Trade and New Challenges for Food Security* (pp. 63-86).

www.igi-global.com/chapter/world-market-of-organic-food-products/241214?camid=4v1a