

The AgEcon Frontiers

DIGITAL AGRICULTURE AND ECONOMIC TRANSFORMATION



*A Significant step towards advancing research at the
intersection of technology, agriculture and economic development*

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*Dedicated to all the worthy
contributors and all the well
wishers*

Preface

Currently agriculture is in a time of technological disruption, environmental risk and socio-economic change. Digital technological innovations are transforming agriculture, agricultural value chains, financial networks, governance systems and rural livelihood in ways never seen. Artificial intelligence, precision farming, climate and smart technologies, digital finance, satellite analytics, automation, geospatial technologies and agricultural ecosystem-based platforms are shaping the future of food production, distribution, financing and governance. Meanwhile, these changes bring together some pertinent issues of equity, access, sustainability data ownership, gender inclusion and future of rural societies.

The book reflects the awareness that digital agriculture is more than a technology shift and that it is a multi-dimensional socio-economic process that has global implications for farmers, institutions, markets and communities. The book aims to look at the opportunities and challenges of digital transformation in agriculture in a critical development perspective with a specific reference to developing economies, vulnerable farming systems and marginalised rural populations.

The chapters of this book span a wide range of digital agriculture and rural transformation themes together. The first part sets the theoretical framework, including the digital divide, structural exclusion, the transformation of the agricultural systems in the digital age, robotics applied to small agriculture and new post-harvest technologies. In the first part, the concept of digital divide and structural exclusion is examined, as well as the evolution of agricultural systems in the digital era, robotics applied in small agriculture and emerging post-harvest technologies. These dialogues represent essential knowledge of understanding the socio-economic and institutional contexts of technological shifts.

The rest of the sections highlight the use of ICTs at the farm and market level. The book is an overview of the trends in digital governance, climate-smart agriculture, agri-fintech, Agriculture 4.0 technologies, big data, agritech entrepreneurship and artificial intelligence for productivity, resilience, sustainability and financial inclusion goals. The importance of the Himalayan region, smallholder farming systems, women's financial inclusion and digitally enabled rural transformation is given special focus.

The book also tackles key topics on agricultural markets, logistics, value chains, digital finance and how agri-fintech systems are experienced cross-country. It also examines the social dimensions of agricultural change, with an emphasis on youth engagement, involvement of females, rural farmers' resilience and the livelihoods of farmers. These themes build on themes that working towards sustainable agricultural change needs to be inclusive, participatory and socially responsive.

The last part of the book addresses more general policy and governance issues such as coherence in climate-informed governance, algorithmic sovereignty in agriculture, algorithmic policy design, institutional support systems, and digital governance reforms, specifically geoinformatics integration. These discussions are especially timely in the context of the increasing influence of "data-driven" systems in agriculture decision-making, and policy implementation.

The book is designed to give an interdisciplinary perspective to researchers, academia, policymakers, development workers, students and professionals in agriculture and rural development, sustainability, economics, governance and digital innovation. The authors of this book are drawn from various academic and professional disciplines, adding complimentary cross-disciplinary perspectives and insights.

This volume reflects the scholarly dedication and contributions of all of its contributors, and our grateful thanks go to them all. We also thank all academic institutions, reviewers, colleagues and well-wishers for their encouragement and support in this process. We hope that this book will make a meaningful contribution to the debates and the research agenda of digital agriculture, inclusive development, climate resilience and sustainable agrifood futures.

The digitalization of agriculture is accompanied by great opportunities but also presents a variety of challenges. This book aims to contribute to the effort towards creating resilient, just, and sustainable agriculture as a process for future generations, through critical reflection, interdisciplinary partnership, and with evidence-based knowledge and understanding.

Main Editor and Team

Foreword

The twenty-first century has ushered in an era in which agriculture is no longer defined solely by land, labor, water, and climate, but increasingly by data, digital intelligence, connectivity, and technological innovation. Across the world, agricultural systems are undergoing profound transformation through the integration of artificial intelligence, big data analytics, geoinformatics, climate-smart technologies, fintech ecosystems, automation, and digital governance frameworks. Yet, alongside these advances, serious concerns remain regarding structural inequalities, digital exclusion, gender disparities, algorithmic power, and uneven access to technological resources. The challenge before scholars, policymakers, innovators, and farming communities is therefore not merely technological adoption, but the creation of equitable, resilient, and inclusive agrifood systems.

This edited volume makes a timely and significant contribution to this global discourse by bringing together diverse scholarly perspectives on digital agriculture, rural transformation, financial inclusion, climate resilience, governance, and social change. The book is carefully structured into five thematic sections that collectively provide a comprehensive understanding of the evolving agricultural landscape in the digital era.

The opening section establishes the conceptual and theoretical foundations of digital agriculture by examining the digital divide, structural exclusion, emerging agricultural systems, robotics, and post-harvest innovations. The second section explores transformative digital technologies at the farm level, including artificial intelligence, agritech entrepreneurship, climate-smart agriculture, digital horticulture, and gender-responsive financial inclusion frameworks. The third section extends the discussion to markets, logistics, value chains, agri-fintech systems, and digital finance, highlighting the growing role of technological integration in agricultural commercialization and financial access.

Equally important is the book's attention to the human and social dimensions of agricultural transformation. The fourth section focuses on youth engagement, women's participation, rural livelihoods, farmer resilience, and evidence-based research synthesis, thereby emphasizing that technological progress must remain socially grounded and people-centered. The final section provides critical insights into governance, policy frameworks, institutional support systems, geoinformatics, climate-smart policy evaluation, and algorithmic sovereignty, presenting important pathways for building adaptive and inclusive agricultural futures.

One of the greatest strengths of this volume lies in its interdisciplinary nature. The contributors successfully bridge economics, agricultural sciences, social sciences, policy studies, technology, environmental sustainability, and rural development. Such integration is essential because contemporary agricultural challenges cannot be addressed through isolated disciplinary approaches. The volume also combines conceptual discussions with empirical evidence, case studies, policy analysis, and practical technological applications, making it relevant to both academic inquiry and policy formulation.

This book will serve as a valuable resource for researchers, academicians, students, policymakers, development practitioners, agri-entrepreneurs, and institutions engaged in rural and agricultural transformation. It not only documents ongoing transitions in digital agriculture but also critically interrogates the inequalities and governance questions that accompany technological change.

I congratulate the editors and contributors for producing a scholarly work of considerable depth, relevance, and contemporary significance. I am confident that this volume will stimulate meaningful academic debate, encourage innovative policy thinking, and contribute toward the development of sustainable, inclusive, and technology-enabled agricultural systems for the future.

Prof. M. H. Wani

Formerly Registrar and Prof. Rajiv Gandhi Chair,

SKUAST-Kashmir

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