2nd International Conference

Food Security and Value Chain Systems:

Challenges and Opportunites in Emerging Economies (ICFSVC-2024)

BOOK OF ABSTRACTS

- Inclusive and Sustainable Agriculture for regional Food Security
- Climate Smart Food Systems and Prospect for Growth
- Value Chains, Marketing, and Entrepreneurship in Agribusiness
- Outreach, Agricultural Extension and Continuing Education
- Next-Gen Agriculture with AI

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Muhammad Nawaz Shareef University of Agriculture Multan

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2nd International Conference

Food Security and Value Chain Systems:

Challenges and Opportunities in Emerging Economies (ICFSVC-2024)

December 9 - 10, 2024

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Muhammad Nawaz Shareef University of Agriculture Multan

Faculty of Social Sciences and Humanities

MNS University of Agriculture Multan

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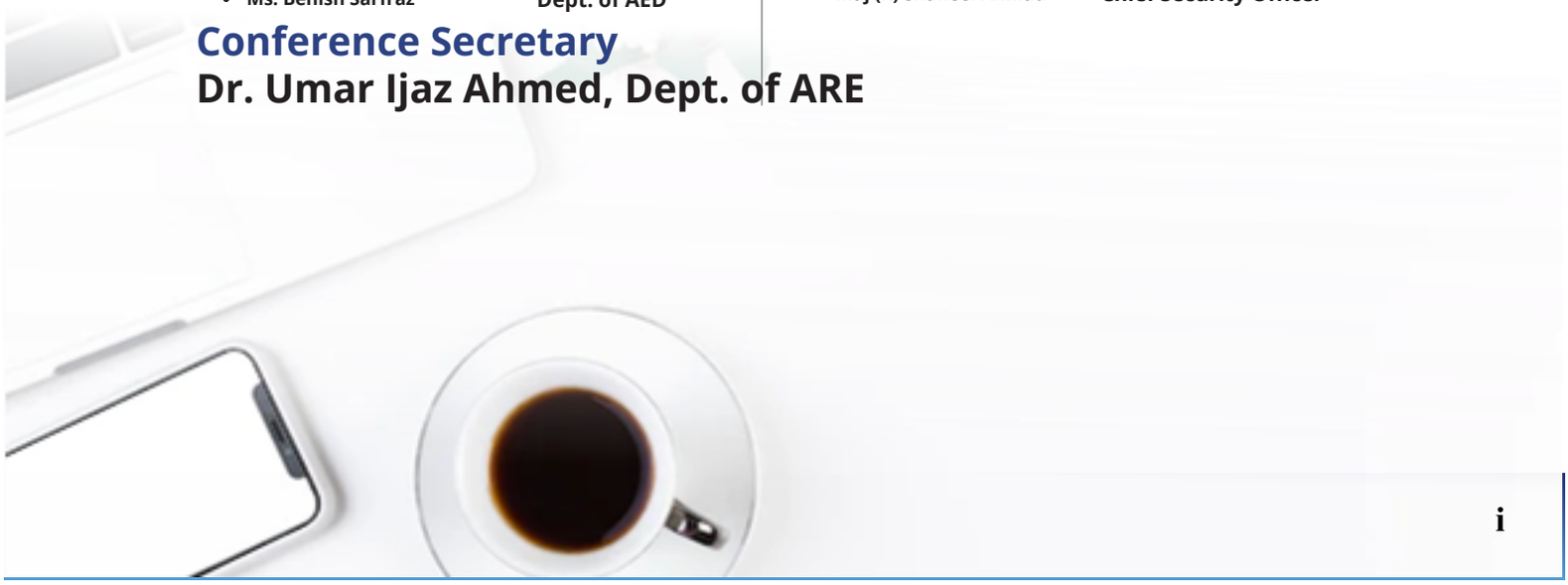

Faculty of Social Sciences and Humanities

MNS-University of Agriculture, Multan

Introduction

MNS-University of Agriculture, Multan (MNS-UAM) established in 2012, is a fast-growing public sector university. During the short period of its existence, the University has made rapid progress in terms of expansion of its academic programs, students, enrolment, physical infrastructure, campus network, and hiring of highly quali ed and experienced academic and administrative staff. MNSUAM has been recognized as one of the fastest-growing academic institutions in the country. The vision of the university is to develop a world-class university in agricultural and allied sciences by providing effective systems and leadership for professional learning, research, entrepreneurship, and community service.

The Faculty of Social Sciences and Humanities was established in 2017 at MNS-UAM. Keeping in view the current scenario of the world and our own country for ensuring food security, improving quality of life, alleviation of poverty, and overall development in the rural areas. The faculty has three departments i.e. Department of Agricultural and Resource economics, Department of Agribusiness and Entrepreneurship Development and Department of Outreach and Continuing Education. The Faculty of Social Sciences and Humanities is aware of changing scenarios of the sector and emerging challenges of the rural economy of Pakistan and is committed to equip young social and agricultural scientists and agribusiness specialists with updated knowledge and the latest research skills enabling them to handle economic, social, and environmental challenges in achieving the goal of sustainable rural development.

The faculty is currently running undergraduate and postgraduate degree programs in Agricultural & Resource Economics, Farm Management, Agribusiness and Agricultural Extension along with short courses under continuing education. Competent faculty and excellent skills are the basic strengths of the faculty to produce technically sound graduates to meet industrial and community requirements.

2nd International Conference

Food Security and Value Chain Systems:

Challenges and Opportunities in Emerging Economies

The 2nd International Conference on Food Security and Value Chain Systems is of paramount relevance and scientific significance, particularly for emerging economies facing the dual challenge of ensuring food security and developing efficient value chains. The conference provides a critical platform for researchers, policymakers, and industry stakeholders to exchange ideas, present research findings, and discuss innovative solutions to food security issues. As emerging economies grapple with climate change, population growth, and resource constraints, this conference addresses the urgent need for sustainable agricultural practices, resilient supply chains, and effective food distribution systems. The discussions and collaborations fostered at this conference can lead to the development of policies and technologies that enhance food production, reduce post-harvest losses, and improve market access for smallholder farmers. Additionally, by focusing on value chain systems, the conference highlights the importance of creating economic opportunities and improving livelihoods through better integration of agricultural markets. Overall, the event plays a crucial role in advancing scientific knowledge and practical solutions, contributing to the global goal of achieving food security and sustainable development.

The conference help lining stakeholder across emerging economies amid:

1: Provide an avenue for sharing initiatives and experiences in addressing food insecurity, climate change impacts and poverty.

2: Facilitate sharing of information; practices, knowledge and skills generated from research and development activities.

3: Create awareness on the role of the emerging economies in promoting inclusive and sustainable food supply & agriculture system vis- à-vis improving community resilience against the threats of climate change.

The 2nd International Conference on Food Security and Value Chain Systems had a significant impact on society by addressing the critical challenges and opportunities in emerging economies. It fostered global collaboration, shared innovative strategies, and promoted sustainable practices in food security and value chain systems. The conference also highlighted the importance of integrating technology, policy, and local knowledge to enhance food security and support economic growth in developing regions. The insights and solutions discussed are expected to influence policymakers, researchers, and practitioners in advancing food security initiatives globally.

The geo-strategic position of MNS-University of Agriculture, Multan (MNSUAM) is very important to address the above-described issues as it is located in South Punjab, which is the new agricultural hub of Pakistan. The importance of MNS-UAM has increased many folds due to its strategic location with respect to rural economic activities, access from all provinces, and especially with respect to CPEC. This is one of the emerging agricultural universities of the country where students from across the country are pursuing their degrees in the disciplines related to rural economy. The university has a rich culture of working with the rural communities, agribusinesses and policymakers including agriculture departments, policy think tanks, and opinion leaders. Considering these advantages of MNS university of agriculture, we are taking the lead in organizing a conference on the subject of global as well as regional concerns.

Faculty of Social Sciences and Humanities at MNS University of Agriculture Multan are working for the aims to present varied situations and discourses across the BRI countries which can help achieve the conference objectives and will help policymakers, researchers, practitioners, academicians and community to realign the approach to better understand environmental, nutritional, agricultural, demographic, socio-economic, political, technological and institutional drivers, costs and outcomes of current and future food security. Interactions with contextual factors including climate change, urbanization, greening the economy, and data-driven technologies will be central.

Themes:

- Inclusive and Sustainable Agriculture for regional Food Security
- Climate Smart Food Systems and Prospect for Growth
- Value Chains, Marketing, and Entrepreneurship in Agribusiness
- Outreach, Agricultural Extension and Continuing Education
- Next-Gen Agriculture with AI

Theme I:

Inclusive Agriculture for Regional Food Security

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Organic Farming: A Pathway to Sustainable Agriculture and Enhanced Food Quality

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Abstract

Organic farming is a sustainable agriculture system that utilizes ecologically based pest control methods and biological fertilizers primarily derived from animal and plant wastes as well as nitrogen fixing cover crops. It is a cost-effective and ecologically friendly production method that promotes soil and human health as well as the ecology and sustainability of agriculture. The literature reviewed agrees that organic farming significantly improves soil quality through the use of organic manures and composts along with a legume-based diversified cropping system. Using more organic materials in agriculture practices can mitigate negative environmental impacts by preserving the natural recovery cycles. Additional organic farming may improve food quality. Combining organic farming with new technologies is essential for overcoming the limitations and challenges associated with organic agriculture. Innovative methods and new approaches are shaping new trends in sustainable farming and boosting agriculture productivity. Simply organic farming represents the eco-friendly principle of agriculture worldwide.

Keywords: Organic farming, Ecofriendly, Synthetic fertilizer.

Organic Agriculture for Sustainable Soil Health and Wheat Growth: Implications for Food Security

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Abstract

Soil health is fundamental to sustainable agriculture and food security. Organic agriculture has gained increasing recognition for its capacity to promote sustainability by improving soil health and quality. This study evaluates the effects of organic versus conventional farming practices on soil health indicators and wheat growth parameters. The treatments used in organic agriculture included farmyard manure (FYM) and vermicompost (VC), while conventional (inorganic) agriculture used urea (U) and diammonium phosphate (DAP). The objectives of the study were to: (1) assess the impact of organic practices on soil health and (2) analyze the potential role of organic agriculture in enhancing food security. Results revealed significant improvements ($P < 0.05$) in

both soil health and wheat growth under organic farming practices compared to conventional methods. Overall, the soil health index increased by 25% in organic plots relative to conventional plots. Organic matter content increased by 40%, while microbial biomass carbon (MBC), nitrogen (MBN), and phosphorus (MBP) were enhanced by 30%, 28%, and 35%, respectively. The microbial community also showed considerable improvements, with bacteria, fungi, and actinomycetes populations increasing by 45%, 50%, and 38%, respectively. Enzymatic activities were markedly higher in organic plots, with phenoloxidase (40%), peroxidase (45%), catalase (50%), dehydrogenase (35%), urease (30%), and invertase (32%) showing significant increases. Wheat plants grown under organic conditions exhibited enhanced growth, with root length increasing by 20%, shoot length by 25%, and seedling biomass by 30%. Physiological parameters, including chlorophyll a and b, carotenoid content, and protein content, increased by 15%, 18%, and 20%, respectively. Additionally, photosynthesis rate (Pn), transpiration rate (E), and stomatal conductance (gs) improved by 20%, 22%, and 18%, respectively. These findings suggest that organic agriculture significantly enhances soil health, wheat growth, and, consequently, long-term food security.

Keywords: Organic agriculture, Soil health index, Wheat growth, Food security.

Sustainable Development in Agriculture: The Role of Fisheries and Forestry

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Abstract

Agricultural sustainable development is essential to addressing global issues like food security, climate change, and ecosystem degradation. Together, agriculture, fishery, and forestry support approximately 1.3 billion jobs worldwide, demonstrating the economic and social importance of these sectors. In order to advance sustainable agricultural systems, this study examines the crucial roles that forestry and fisheries play, emphasizing their contributions to food security, ecological balance, and economic resilience. Over 820 million people depend on fisheries for their food and livelihoods globally, especially in poorer countries where they are an important source of high-quality protein and micronutrients. Fisheries are essential to the world's food systems. Furthermore, fisheries are essential for the cycling of nutrients, improving the quality of the water, and maintaining agricultural ecosystems. With 31% of the Earth's surface covered in forests. Forests store around 662 billion tons of carbon, which helps slow down global warming through carbon sequestration. They also improve soil fertility, enhance biodiversity, and control water

cycles all of which are essential for maintaining agricultural output. Agroforestry and ethical aquaculture are two examples of sustainable management of aquatic and forest resources that can improve ecosystem services, encourage biodiversity, and strengthen rural economies by diversifying sources of income. Fisheries and forests have the ability to increase agricultural productivity over the long term and foster climate resilience, as demonstrated by the examination of successful worldwide case studies. The results show that in order to promote sustainable agricultural development and protect vital natural resources for future generations, it is necessary to collaborate across sectors, innovate, and have well thought-out policies.

Keywords: Sustainable development, Agriculture, Food security, Climate resilience, Ecosystem services.

An Evergreen Revolution: Preparing to Cope Food Insecurity

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Abstract

There were widespread worries about the world's capacity to feed itself. The output of food grains has grown at a slower rate than the population. However, the output of food grains increased significantly as a result of the widespread use of the “green revolution” technologies. While food production more than doubled, the population of the low-income, densely populated nations increased by 80% between 1966 and 1990. The production of high-yielding wheat and rice cultivars was the technological advance cement that brought about the remarkable grains in global food production over the past 30 years. These cultivars have a yield potential that is two to three times higher than the cultivars that were accessible before the green revolution. In addition, these cultivars have multiple resistance against diseases and pests, resulting in stable and high yields. The adoption of the Green Revolution technologies has been easier for the construction of irrigation facilities, the availability of inorganic fertilizers, and the benevolent government policies. There will be severe food insecurity in the coming years if this tendency is not stopped. We must start planning now and develop a strategy and technology to increase farm yield if we are to meet the challenge of feeding the increasing population. Additionally, we need to create strategies for integrated pest control, nutrient management, and effective use of soil and water resources.

Keywords: Green Revolution, Food Insecurity, Technologies, Adoption, Yield Stability, Challenge

Addressing the Healthy Consumption Patterns to Overcome Undernourishment in the Low-income Countries

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Abstract

Undernourishment is characterized by a lack of vital nutrients and inadequate calorie intake to meet the body's fundamental energy needs. It is a serious public health concern, especially in developing countries where poverty and a lack of access to a variety of meals are common. Stunted growth, compromised immune systems, and decreased immunity increase the risk of diseases which results in chronic undernourishment. In low-income countries main source of staple food which a lack of adequate nutrition. To adopt a healthier consumption pattern, proper intake of macronutrients and micronutrients is readily available in the area. To promote healthier eating habits, the proper intake of macronutrients and micronutrients is accessible in the area. In low-income countries, healthy consumption patterns are essential for enhancing public health, especially in the areas where malnutrition and food insecurity are common. A balanced diet is the best consumption pattern which includes nutrient-dense foods and locally accessible prices in these kinds of places. A major factor in encouraging these tendencies is nutrition education. Dietary diversities can be increased by promoting home gardening, enhancing food storage techniques, and aiding local food markets. Additionally, encouraging nursing for infants and fortifying basic foods are good ways to address vitamin deficiencies.

Keywords: Undernourishment, Balanced diet, Nutrition Education, Healthy Consumption Pattern, and low-income Countries.

A Sustainable Farming Approach for Soil Health, Biodiversity, and Food Security

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Abstract

An environmentally friendly farming method that emphasizes the well-being of soils, ecosystems, and humans by reducing the use of artificial inputs and promoting natural processes is organic agriculture. The goal of organic farming is to create and choose seeds that can flourish in a variety of conditions without the use of chemical pesticides, fertilizers, or genetically modified organisms

(GMOs). To preserve soil fertility and naturally control pests, organic farming systems place a strong emphasis on crop rotation, cover crops, composting, and biological pest management. Because choosing durable, nutrient-dense, and locally adapted crop types guarantees greater yield in the face of climatic unpredictability, seeds play a crucial role in organic agriculture. To maximize yields in frequently less regulated circumstances, organic seed breeding places a strong emphasis on characteristics like disease resistance, drought tolerance, and enhanced nutrient uptake efficiency. These seeds are also chosen for their capacity to preserve biodiversity and soil health, two essential tenets of organic farming. Organic farming reduces the environmental impact of food production, encourages sustainable resource use, and helps conserve biodiversity. It lessens pollution from runoff from agriculture and promotes nutrient recycling within the environment. Organic farming is a significant strategy for addressing global food security because of its emphasis on long-term sustainability, soil health, and decreased environmental impact, even though it usually produces lower yields than conventional farming.

Keywords: Organic Farming, Global Food Security, Genetically Modified Organisms (GMO), and Biodiversity.

Effect of stored grains insect pests on grain quality and quantity: An estimation of postharvest losses

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Abstract

Stored grains are an important economic asset, especially for developing countries, where these grains are the basic need for food security and income sources. Insect pests significantly challenge global food safety and security by infesting stored grains and causing significant qualitative and quantitative losses in developing countries. Following the poor and insufficient post-harvest management practices in Pakistan this study is planned to estimate the quantitative and qualitative losses of stored grains caused by common storage pests such as *Rhyzopertha dominica, Sitophilus zeamais*, *Sitophilus oryzae*, *Tribolium castaneum and Tribolium confusum*. This research focuses on both quantitative losses (grains damage, weight loss and moisture content) and qualitative losses (crude protein, crude fat and crude fibre) across the agro-climatic zones of Punjab, Pakistan's commonly stored grains like wheat, rice and maize Here is the corrected version, keeping the original words intact: A field survey was conducted to assess the extent of quantitative and qualitative losses caused by insect pests. The results indicated that insect pests cause severe

losses under storage conditions. Over 20-30% weight loss, significant moisture losses, and several grains damaged were observed within 3-6 months of storage, along with additional qualitative losses such as crude protein, crude fat and crude fiber contents due to contamination. Our findings highlighted that the quantitative and qualitative losses were mainly due to the traditional storage system coupled with insect pest infestation. Therefore, there is a need for improvement in storage practices, traditional storage systems and pest control measures to mitigate post-harvest losses. Estimating the economic impact of these losses is crucial for developing policies to enhance grain preservation techniques and ensure food availability.

Keywords: Stored grains, Quality, Tradition storage, Preservation.

Evaluation of different coated materials on diammonium phosphate and subsequent application on cotton crop under arid environment

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Abstract

Cotton (*Gossypium hirsutum L.*) production in arid lands affected by input applications. Fertilizer application stands out as a key factor affecting both yield and quality. The potential for conventional fertilizer losses along with fixation in alkaline soils raises a noteworthy research inquiry. Therefore, different approaches are under deliberation to increase the fertilizer use efficiency (FUE). Thus, this research endeavors to investigate different chemical coatings of di-ammonium phosphate (DAP) and subsequent application on cotton crop. The experiment was carried out under-field conditions. The treatment combination was CK: control-without coating DAP, S-DAP: coated with elemental Sulphur, HA-DAP: coated with humic acid, P-DAP: coated with polymer, and M-DAP: coated with mixture of elemental S+humic acid+polymer. The results revealed that the most significant enhancement was observed with the use of T_5 (M-DAP) which improved the plant height 4 %, chlorophyll content 4%, number of nodes 5%, number of bolls of cotton plant 11%, Cotton yield 12%, as compared to control. When compared to control and other treatments, the maximum availability of phosphorus concentration was 22 % potassium 5 % percent (M-DAP) and then 8.02% (P-DAP). The maximum plant growth in treatment M-DAP chlorophyll content 4 % phosphorous in plant 13 %, nitrogen 9 % and potassium 5 % as compared to control. The data shows a strong positive correlation between plant height, No of bolls, chlorophyll content, cotton yield, phosphorous, potassium, fresh and dry shoot weight. A Principal

Component Analysis (PCA) biplot reveals the most influential variables under different conditions, accounting for 84.96% of the variance. The highest CBR ratio of fertilizer was record in treatment M-DAP 4.17% and HA-DAP 3.63% as compared to control**.** It can be concluded that mixture of elemental S, Humic acid, and polymer (M-DAP) that has been coated has the ability to improve cotton production in the field and can result in high-yield cotton. Enhanced productivity and resource efficiency achieved through the M-DAP, HA-DAP, P-DAP application provide vital steps towards sustainable agriculture, phosphorus conservation and environmental protection. It was determined that (M-DAP) provided P and mineral N to soil for an extended period, and further research should explore higher coating levels.

Keywords: Crop yield, fertilizer use efficiency, agricultural chemistry, alkaline soil, Sustainability

Cultured Meat: A Sustainable Alternative to Traditional Animal Farming

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Abstract

Cultured meat, sometimes referred to as lab-grown or cell-based meat, is a sustainable substitute for conventional animal husbandry and a revolutionary method of food production. By growing animal muscle cells in controlled settings, this cutting-edge method eliminates the need to raise and kill livestock. Cultured meat offers a potential remedy for the ethical, health, and environmental issues related to traditional meat production, while the world's meat consumption is expected to rise sharply by 2050. The environmental effects of animal agriculture, which contributes significantly to greenhouse gas emissions, deforestation, water use, and biodiversity loss, are examined in this research in order to determine whether cultured meat might lessen these effects. It is more sustainable to produce cultured meat since it uses a lot less water and land and produces fewer emissions. In addition, cultured meat can lessen the danger of foodborne infections, zoonotic diseases, and antibiotic resistance associated with intensive livestock rearing, as well as ethical issues about animal welfare. The study also looks at the technological developments in the field, such as developments in bioreactors and cell culturing methods, as well as the difficulties still facing cost reduction and production scaling. Furthermore, it is stated that the future of cultured meat will be shaped by important elements such as consumer acceptance, legal frameworks, and potential nutritional benefits. Cultured meat is a vital part of future global

food security because it allows the food industry to shift towards more compassionate, sustainable, and health-conscious food systems.

Keywords: cultured meat, sustainable food systems, cell-based meat, environmental impact, animal welfare, food security.

Exploratory Study of Dietary Patterns and Nutritional Status of Agriculture Sector Employees in Punjab

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Abstract

Present study was aimed at estimating the dietary patterns and general body health status of public sector employees working in agriculture sector. The objectives included the study of first-hand knowledge of respondents about perception of healthy foods and foods eaten in actuality, the estimation of dietary diversity scores and body mass index (BMI) in terms of various categories of respondents. Primary data was collected by interviewing a total of 325 randomly selected respondents at Ayub Agriculture Research Institute (AARI), Faisalabad who were categories into male/female as well as officers and non-officer ranks during year 2022-23. Statistical techniques of chi-square, Mann-Whitney U-test and Garret Ranking were applied according to nature of data. Similarly, BMI was estimated by excluding chronic illness and pregnancy related cases. Data on food items was based on a 24-hour recall method. Results reveal that out of 7 defined food groups, both the genders, ranked cereals and cereal-based products as the healthiest dietary food group while eaten food groups eaten in actuality show that cereals, meat and vegetables were first, second and third food groups in their daily dietary pattern. An overall estimated BMI value of 27 implies that both the genders were at least overweight. Although the majority falls under healthy BMI category yet combined percentage of overweight and obese employees was worrisome enough to invite attention of public health and nutrition experts to overcome problems of overweight and obesity. Females of non-officer rank and males of officer rank were in the danger zone on account of poor health and more severity of over-weight and obesity. Overall dietary diversity score (O-DDS) was almost the same for respondents. Public health and nutrition departments should attend public sector employees to guide them about healthy foods and healthy lifestyles from working to night sleeping patterns.

Keywords: Dietary Patterns, Nutritional Status, Food Groups, BMI, Agriculture Employees, AARI

Reducing Waste, Increasing Value: The Case for Plastic Crates in Tomato Packaging

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Abstract

The study conducts a comparative analysis of plastic and wooden crates for packaging tomatoes in Pakistan, revealing significant statistical findings that underscore the advantages of plastic packaging. It highlights that tomatoes packaged in plastic crates experience a reduction in post-harvest losses by approximately 30% compared to those in wooden crates. This reduction is attributed to the better ventilation and cushioning properties of plastic crates, which minimize bruising and spoilage. The study also found that plastic crates provide improved protection for the tomatoes during transport and handling, leading to a higher percentage of Grade A quality tomatoes - 75% in plastic crates compared to only 50% in wooden crates. This enhanced preservation of tomato quality in plastic crates enables them to command higher wholesale prices, averaging 20% more than those in wooden crates. The findings of this study are consistent with the broader literature on the benefits of plastic packaging in the food industry. The analysis further reveals that 75% of tomatoes packed in plastic crates are classified as Grade A quality, compared to only 50% in wooden crates. This significant difference underscores the superior quality maintenance capabilities of plastic packaging, which better protects the tomatoes from damage and spoilage during handling and transport. Additionally, the study found that tomatoes packed in plastic crates command higher wholesale prices, averaging 20% more than those in wooden crates. This price premium can be attributed to the enhanced preservation of tomato quality enabled by the plastic crates, resulting in a higher proportion of Grade A produce reaching the market. The findings of this study advocate for a transition towards the use of plastic crates in the tomato supply chain, as it has the potential to improve the overall efficiency, profitability, and sustainability of the system, ultimately contributing to enhanced food security in the region.

Keywords: Post Harvest Losses, Plastic Crate, Wooden Crate, Quality Losses, Economic Losses

Resource use Efficiency of Milk Production Across Different Herd Sizes of Buffalo and Cow across South Punjab.

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Abstract
Dairy farmers in south Punjab transition from low input-low output to high input-high output from traditional and subsistence to commercial dairy farming, this study examines how herd size categories affect resource utilization. Resource use efficiency study helps dairy farmers allocate resources without utilizing more resources to increase profitability. In this particular investigation, the methodology that was utilized was a multi-stage random sampling approach, and its primary objective was to evaluate the resource use efficiency of dairy farms. At the beginning of the process, Muzaffargarh is chosen from among the other divisions of South Punjab because it has the biggest population of cattle among all of South Punjab. In this approach, the evaluation of efficiency is carried out with the help of Cobb Douglas, so that each individual involved may be compared to the most efficient counterpart. The findings show that on an average, the costs of human labour, dry fodder, green fodder and concentrates had significant influence on milk yield in small dairy households while costs of green fodder, concentrates and veterinary and medical charges had significant influence on milk yield for medium dairy households. The findings indicate that when there are changes in inputs, small farms have a tendency to experience significant and positive gains in production. Medium farms, on the other hand, exhibit lower levels of responsiveness and have a weaker fit with the model. The total production elasticities (Σbi's) for small farms are nearly 1, particularly 0.99. These findings indicate that small farms are consistently achieving the same level of output as they increase their size of production. Conversely, medium-sized farms have a significantly lower total of production elasticities, measuring at 0.41. This signifies a phenomenon known as diminishing returns to scale, when a proportional increase in all inputs leads to a less than proportional increase in output.
Keywords: Milk production, Coub Douglas production function, Resource use efficiency

Assessing the Impact of Inclusive Agriculture on Regional Food Security: A Comparative Study of Pakistan, India, and China (2010-2022)

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Abstract
This research explores the significant role of inclusive agriculture in enhancing regional food security across Pakistan, India, and China over the period from 2010 to 2022. The study emphasizes how different agricultural and socioeconomic factors impact food security, particularly in developing nations. The dependent variable in this study is Regional Food Security, which is measured through three key dimensions: the availability of food supplies, the accessibility of food

to the population, and the stability of food production over time. To investigate this, five independent variables are thoroughly examined. The first independent variable is Agricultural Productivity, which encompasses crop yield, livestock output, and the adoption of modern agricultural technologies. Rural Infrastructure Development forms the second independent variable, focusing on road density in rural areas, access to essential irrigation systems, and the electrification of agricultural zones. The third variable, Land Ownership Patterns, examines the distribution of land holdings, the effectiveness of land reform policies, and women's access to agricultural land. The fourth variable, Government Subsidies and Support, covers the availability of fertilizer and seed subsidies, crop insurance programs to mitigate risks, and financial aid for smallholder farmers. Finally, Access to Financial Services focuses on agricultural loans, microfinance availability, and favorable interest rates for farmers to improve investment in agriculture. Data for this research is sourced from international databases such as the World Bank, IMF, and WDI, and a panel data analysis is conducted to assess the relationships between these variables and food security outcomes. Through a comparative analysis of the three countries, the study highlights how inclusive agricultural policies, combined with infrastructural improvements and enhanced financial services, contribute to achieving sustainable food security in the region. The results suggest that a combination of inclusive policies, infrastructure investments, and financial support are essential for sustainable food security in developing economies. The results suggest that a combination of inclusive policies, infrastructure investments, and financial support are essential for sustainable food security in developing economies.

Keywords: **F**ood security, Agricultural productivity, Rural infrastructure, Land ownership, Government subsidies, Financial services, Pakistan, India, China.

Recognizing and Valuing Women's Labor Participation in Agriculture: A Case Study of Muzaffargarh District, Punjab

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Abstract

Both women and men play an equally vital role in feeding the world through their participation in agricultural activities. Pakistan, with the 9th largest labor force globally, sees women's roles and responsibilities in agriculture vary significantly depending on geographic location, customs, and

traditions. Many of these contributions remain unpaid, and women often face numerous barriers that hinder their ability to assert their rights. Without the participation of women in the labor force, meeting the growing food demands of an increasing population and remaining competitive on a global scale would be impossible. This study examines the factors influencing female labor force participation in agriculture and their impact on household economies. Primary data was gathered through field surveys using questionnaires in Muzaffargarh District, Punjab. Logistic and multiple regression models were employed for analysis. The findings reveal that factors such as education, age, experience, marital status, female-headed households, family income, and family support significantly affect women's participation in agriculture. Women's involvement in the labor force enhances household living standards, financial independence, and access to improved education and healthcare services, ultimately contributing to the financial stability of the household.
Keywords: Labor force, Population, Agriculture, Muzaffargarh, Punjab

Understanding Land Renting Dynamics in Punjab, Pakistan: A Focus on Key Socio-Economic Variables

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Abstract
Agricultural land renting increases farm output and efficiency without purchasing the land outright. The objective of this study is to examine the causes of agricultural land renting, particularly in Punjab, Pakistan, focusing on the districts of Nankana Sahib, Bhakkar, Toba Tek Singh, and Lodhran. It addresses the research gap in understanding how various factors influence farmers' decisions regarding land tenancy. The primary data was collected from 556 farmers in Punjab using a structured questionnaire and multinomial logit model employed. The results show that education, farming experience, and land rent significantly affect farmers' likelihood of being owner-cum-tenants and tenants' category. Variables such as cultivated area and livestock ownership also play important roles in renting decisions. The findings show that facilitating forums where experienced farmers can share knowledge or success stories about managing owned land effectively.
Keywords: Land Renting, Agriculture, Multinomial logit, Punjab, Pakistan

Land Tenure and Agricultural Profitability: Analyzing the Impact of Investment Decision and Land Management in Punjab, Pakistan

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Abstract
Optimal investment decisions and effective land management practices are important for increasing agricultural profitability and driving economic growth. The research investigates the effect of land management practices and investment decisions on farmers' profitability under different land tenure systems in Punjab. Existing literature lacks comprehensive research on how these factors interplay across different land tenure arrangements. The primary data was collected from 434 farmers in Punjab using a structured questionnaire. A multivariate probit model was employed to estimate the determinants of investment decisions and land management practices and the PSM approach to evaluate their impact on profitability. Results showed significant variations in profitability and land management practices among land tenure systems. Generally, owner-farmers are better than owner-cum-tenants and tenant categories. Key profitability factors include soil fertility, water quality, green manure, and fertilizer. The research concludes that better investment decisions and land management practices can increase profitability under different land tenure systems.

Keywords: Investment decisions, Land management practices, Farmer's profitability, Land tenure system, and Punjab.

Absentee Landlordism and Its Effect on Land- Water Management and Technology Uptake: Evidence from Punjab

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Abstract
The effective land and water management practices and technology adoption increase crop yields and efficiency. Despite the extensive research on land tenure systems, a gap exists in understanding how absentee landlords influence land and water management practices and technology adoption. So, the study aims to examine the implications of absentee landlords on technology adoption and land and water management practices in agriculture. The primary data was collected from 556 farmers in Punjab using a structured questionnaire. An ordered probit model examined the factors influencing technology adoption and land and water management practices. The results show the

owner-farmers exhibit higher levels of technology adoption and land and water management practices than owner-cum-tenant and tenant categories. Variables like age, education, farming experience, and weather information significantly affect these practices. The targeted policies to support the owner-cum-tenants and tenants could increase agriculture productivity and sustainability.

Keywords: Absentee landlords, Water management, Technology adoption, Ordered probit, Punjab, Pakistan

Association between Nutritional Status and Agricultural Work Performance among Female Cotton Pickers in the Southern Punjab

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Abstract

Pakistan has a high prevalence of under nutrition and obesity among women that may impact their daily work performance. In this scenario, present study was designed to study the relationship between agricultural work performance and nutritional status (measured through anthropometric variables of height, weight and body mass index) of the female cotton pickers. Cross-sectional data were collected from 120 randomly selected cotton pickers from four major cotton growing districts (Multan, Khanewal, Lodhran and Vehari) of the Southern Punjab. Descriptive statistics, F test and chi-square test were used in data analysis. Moreover, derived parameter of body mass index (BMI) was calculated for each respondent based on height and weight data. Following World Health Organization (WHO), four groups (underweight, normal weight, overweight and obesity) on the basis of BMI were derived. According to their self-perception, 85% cotton pickers reported themselves as healthy. However, on the basis of BMI, only 63 % were in healthy category. Female cotton pickers on an average spent 4.8 hours daily in picking with slightly more hours by healthy category as compared with other categories. Daily average earning was Rs.280.8 with significantly higher earning among women of healthy weight category. Female cotton pickers falling under healthy weight (category spent significantly more days in picking as compared with other categories. On the basis of chi-square test, there was a highly significant association between health status and work performance (daily earning). It means seasonal earning among healthy women was significantly higher as compared to underweight and obese categories. These results imply that women may be motivated to keep their weight under healthy category by eating nutritious foods for better work performance in agriculture sector.

Keywords: Nutrition, cotton picking, height, weight, BMI, Punjab

Innovating for Sustainable Agriculture in Pakistan: Business Challenges and Opportunities

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Abstract

Pakistan's agriculture sector, accounting for 20% of the country's GDP, faces pressing sustainability challenges. This study explores the impact of innovation on agricultural sustainability, highlighting business challenges and opportunities in Pakistan. A mixed-methods approach, combining surveys, interviews, and case studies, investigated the role of innovation in enhancing agricultural sustainability. Findings reveal that innovative technologies, such as precision agriculture, drip irrigation, and solar-powered systems, significantly improve crop yields, reduce water consumption, and mitigate climate change impacts. However, business challenges persist, including high upfront costs, limited access to credit, and inadequate infrastructure. Moreover, smallholder farmers' adoption of innovative practices is hindered by lack of awareness, training, and institutional support. Despite these challenges, opportunities exist for innovative businesses to 1) Develop affordable, context-specific solutions, 2) Foster public-private partnerships for technology transfer, 3) Enhance farmers' capacity through training and extension services and 4) Promote sustainable agriculture practices through market-based incentives. Notably, innovative agricultural businesses in Pakistan have achieved significant economic and environmental benefits, including increased revenue, reduced waste, and improved resource efficiency. This research contributes to the existing literature on agricultural innovation and sustainability, informing policymakers, business leaders, and scholars on strategies to promote sustainable agriculture in Pakistan.

Keywords: Agricultural innovation, sustainability, business challenges, opportunities, Pakistan.

Evaluating the Role of Urban Farming Within a Circular Economy Framework to Reduce Carbon Footprint and Enhance Food Security in Pakistan

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Abstract

As urban populations in Pakistan continue to swell, the imperative to develop sustainable food systems has never been more pressing. This study comprehensively explores how integrating agricultural activities in urban centers within a circular economy framework can reduce carbon emissions and strengthen food security. By applying the ReSOLVE model, the research identifies pathways to incorporate urban farming into existing food systems. The findings will inform evidence-based policy interventions that facilitate the implementation of urban agriculture initiatives, fostering economic resilience and environmental sustainability. The implications of this research extend beyond theoretical discourse. It offers actionable insights for policymakers, practitioners, and scholars engaged in sustainable urban development and food security initiatives.
Keywords: Urban Farming, Carbon emissions, Food security, Circular economy, ReSOLVE model, Sustainable food systems.

Socioeconomic Determinants of Female Labor Force Participation and Its Impact on Household Food Security in Faisalabad District

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Abstract

A nation's growth potential is significantly boosted by the participation of women in the workforce, which is crucial for economic progress. Female engagement in the labor market refers to the proportion of women who are actively employed for compensation. The involvement of women in the workforce has substantial effects on families, including increased income levels and enhanced economic stability. This, in turn, improves living standards, facilitates better access to healthcare and education, and empowers women. However, decisions regarding female labor market participation are complex, influenced by a range of personal and familial factors in addition to labor market conditions. Variables such as the number of children, marital status, family income, place of residence, and the educational background of the household head can negatively impact women's workforce involvement. In this study, data from 180 female workers in the textile industry is collected using a random sampling method and analyzed through a multiple linear regression model. A well-structured questionnaire is used to gather detailed information on respondents' socio-economic characteristics, work environment, and personal and family dynamics. Key variables assessed included age, marital status, education, family size, income, and access to resources. The analysis demonstrated that factors such as age, marital status, education, family

size, work experience, and monthly expenditures significantly influence female labor force participation. Findings revealed that while education positively correlates with workforce involvement, age and distance to work have a negative impact. The regression model, which accounted for 72 percent of the variance in female labor force participation, highlights the significant effects of socio-economic factors. Policy recommendations include addressing socio-economic barriers, improving resource access, and enhancing workplace conditions to boost female labor force participation and foster broader economic benefits.

Keywords: Female Labor Force Participation, Gender equality, textile industry, Household Income

Factors Affecting Students' Satisfaction and Learning Experience at Higher Agricultural Education Institutions in Punjab and Their Implications for Food Security

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Abstract

In addition to a number of other variables, service quality is seen as a critical aspect. It ensures students' satisfaction throughout the learning process. It is now essential for institutional management to work towards achieving students' happiness and maintaining it during student's stay at the institution in highly competitive environment of higher education. This study aims to assess the factors which affects the students' satisfaction and how much students are recommending these programs to others. Data were collected using questionnaire from non-random sample of 120 students who were undertaking their study in disciplines at university of agriculture Faisalabad. The findings showed that majority of the students expressed high academic learning experiences and were satisfied with their program of study. Multiple regression analysis revealed that students' rationale for attending university and faculty support had significant positive influence on their satisfaction with the enrolled programs. Moreover, the technology availability shows somewhat partial significant positive influence on the students' satisfaction. In order to enhance the programs in agricultural institution, the major recommendation have seen that higher agricultural education institution should focus on their lab facilities, availability of research facilities, facilities to work with a specific faculty members and the availability of the funding for research because all these items in the variable have played a major role in the students' satisfaction as these items are the part of the variable which is positively influencing the students' satisfaction.

Keywords: students' satisfaction, learning experience, technology, faculty support, agricultural institution

Evaluating the profitability and Groundwater Conservation Paradox of Apple vs. Olive Cultivation under Flood and Drip Irrigation in Upland Balochistan

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Abstract

Balochistan, Pakistan's most water-stressed province, is grappling with a severe groundwater crisis, with water levels in key areas like the Pishin Lora and Zhob River basins declining by 10 to 40 feet annually due to over-extraction for high-water-demand crops such as apples. Apples, which require approximately 1200 mm of water per year, have become increasingly economically and environmentally unsustainable. This research evaluates the economic feasibility and sustainability of substituting high-delta crops with low-delta alternatives, specifically comparing apple cultivation using flood irrigation to olive cultivation under flood and drip irrigation methods. Findings indicate that apple cultivation with flood irrigation incurs the highest total variable cost of 410,151 rupees per acre, yielding a gross margin of 101,544 rupees and a Benefit-Cost Ratio (BCR) 1.25. In contrast, olive cultivation under flood irrigation significantly reduces costs to 159,999 rupees per acre, with a gross margin of 311,117 rupees and a BCR of 2.94. The most cost-effective approach is olive cultivation using drip irrigation, which lowers costs to 127,199 rupees per acre, resulting in a gross margin of 294,860 rupees and a BCR of 3.32. Given that more than half of Balochistan's agricultural water supply relies on groundwater, shifting from apples to olives, particularly under drip irrigation, offers a sustainable strategy for groundwater conservation and enhancing farmers' economic returns. The study advocates for policy measures that encourage the adoption of low delta crops and efficient irrigation practices to secure long-term agricultural sustainability in the region.

Keywords: BCR, Water Use Efficiency, High Irrigation Efficiency Systems, High Delta crops, Low delta crops

Farmers' Characteristics and their role in effective Crop Residue Management

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Abstract
Crop residue burning is a major contributor to environmental pollution in South Asia, and effective crop residue management is seen as a win-win solution to reduce agricultural pollution. Various approaches have been introduced to address agricultural waste pollution. This study explores farmers' understanding of sustainable crop residue management and their preferences for adopting these practices at the farm level. Primary data was collected from the Gujranwala, Faisalabad, and Rahim Yar Khan districts of Punjab, Pakistan, through a structured questionnaire. The results show that raising awareness of the harmful effects of burning can increase crop residue recycling. Additionally, access to credit, machinery availability, and extension services were strongly linked to the adoption of sustainable practices. The study concludes that successful policies aimed at enhancing farmers' perceptions and adaptive capacity can promote both actual and intended adoption of sustainable practices. Effective adaptation strategies require collaboration among multiple stakeholders, including local communities and farmers.

Keywords: Punjab, Recycling of crop residues, Farmers, Adoption

Determinants of Food Security and Effect of Institutional Credit in Enhancing Food Security among Farming Households in Kano State Nigeria

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Abstract
In most of the low to medium-income countries, inadequate resources, poor market accessibility, and limited access to credits are among the major factors that affect small farming household food security. This study was conducted to determine the determinants of food security and the Effect of Institutional credit in enhancing food security among farming households in Kano State Nigeria.

The sample was farming households from twenty-eight words in six local government areas of the state. A two-stage sampling procedure was used. The initial household sample was 800, however, 745 filled questionnaires were retrieved and 739 were analyzed after data cleaning. The data were analyzed using descriptive statistics, food consumption score, Chi-square, and logit regression analysis. The result indicated that 352 (47.63%) are food secured, 195 (26.39%) are on the borderline and 192 (25.98%) are food insecure. When we disaggregate the food security status by access to credit, the result shows that 72.22% of those with high accessibility to credit are food secure, and 58.46% of those with accessibility to credit are food secure. Of those that have partial accessibility to credit, 41.61% are food secure while only 30.14% of those that have no access to credit are food secure. The result of the chi-square analysis shows that there is a significant difference in terms of food security among those with access to credit and those with no access. The logit regression model shows that access to credit and market, farm size, income, and farm experience was positive and significantly affected the food security status of the household in the study domain.

Keywords: Food security, Institutional credit, Food consumption score, Chi-square, Logit regression

Risk Associated with Dairy Production and Management in Central Punjab of Pakistan

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Abstract

Pakistan is regarded as one of the world's top raw milk producers. Livestock has a fundamental role in economic growth and enhance development of rural areas. This sector provided 60.84 per cent of the agricultural value added and 14.63 per cent of the national GDP during 2024. The objectives of this study were to identify and investigate the different sources of risks involved in dairy production, their perceptions by the dairy farmers and to estimate the influence of production risks, marketing risks, financial, institutional and human risks on different components of the dairy sector in the Central Punjab, Pakistan. The study also analyzed the coping measures which farmers adopted to cope these risks. The study was conducted from Central Punjab where majority of the population is earning their livelihood from livestock rearing. The multistage sampling technique was used to collect data. For this purpose, the cross sectional data was obtained with the help of structured questionnaire from 225 sampled dairy farmers resided in Central Punjab (Okara, Sahiwal and Pakpattan) of Pakistan. The binary logistic regression model was used to analyses the

data and estimates the impact of various risks on quantity of milk production. Dairy farmers were perceived that temperature; poor breed, pests and disease were the major production risks followed by rainfall, shortage of skilled labor, animal reproduction problems and farm capital. The findings of the binary logistic regression model revealed that various risks such as temperature, pests and diseases, milk marketing problems, increase in input prices, wages of labor, inadequate extension services negatively influenced and reduced the quantity of milk while among other determinants; education, age of the farmers, joint family structure and number of animals had positive and significant impact on quantity of milk production. More than 60% farmers use the regular vaccination to cope up with production risks. The 2nd major coping strategy was observed that farmers use off-farm income activities to reduce the financial and production risks. The study recommended that there should be a legal mechanism for price formation based on the demand and supply of dairy in open marketing system. The government should provide adequate livestock extension, veterinary services and incentives to all farmers for adoption of new technology.
Keywords: Risk, Dairy Management, Central Punjab, Coping strategy

Energy Poverty and Determinates of Household Energy Source Choices in Punjab Pakistan

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Abstract

The significance of energy for life, happiness, and progress can be seen in the continuous rise in mean energy consumption. Energy plays a critical role in household activities such as cooking, heating, and lighting, as well as in the industrial and transportation sectors. The study used primary data collected from 200 sampled respondents of district Faisalabad and Chiniot. The sampled respondents were selected using convenient random sampling and 100 respondents were selected from each district. The multidimensional energy poverty index was developed by scholars at the Oxford Poverty and Human Development Initiative (OPHI). The energy deprivation status of a household is constructed using five aspects: cooking, lighting, mobility, services, and a separate kitchen. The results suggest that household size, monthly income, and education influence energy poverty in Punjab, Pakistan. Larger households, lower-income households, and households with lower levels of education are more likely to experience energy poverty. The findings also indicate that age, gender, livestock ownership, number of rooms, and agricultural land ownership do not significantly influence energy poverty in the study area. The findings show that the energy poverty,

on average of each household is equal to 0.49 percent. This means that more than half of the households in Punjab are considered energy-poor based on the selected indicators. The Tobit model demonstrates a robust fit to the data, as indicated by the statistically significant likelihood ratio at 1% level. The coefficients for most of the variables are statistically significant at the 1% level and have the expected signs. To ensure that low-income communities have access to contemporary energy services like electricity and clean cooking fuels, the government should invest in and enhance the energy infrastructure in these areas. The best way to combat energy poverty is through collaborative efforts involving government, NGOs and the private sector.

Keywords: Energy, Poverty, Tobit model, Multidimensional Energy Poverty Index

Factor influencing farmers crop insurance choices in Pakistan: Evidence from Punjab Pakistan

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Abstract

Pakistan is the world's most susceptible country to different risk such as extreme climatic events, pest and disease risk, price fluctuation and financial risk. For many years the country has been exposed and has experienced losses of crops due to the lack of crop insurance. In the recent year government of Pakistan has implemented crop insurance scheme in the country. In my best knowledge there is limited material on the adoption of crop insurance in Pakistan. Hence, keeping in view present research is an attempt to fill this gap, this study aims to examine the factors influencing the adoption of crop insurance as a risk management strategy by maize farmers. Data collection was conducted through a well-structured questionnaire involving 400 hybrid maize farmers across four districts in Punjab, Pakistan. A logit regression model was applied to examine the relationship among dependent and independent variables. Risk attitude and risk perception of floods for each farm household were calculated and used as independent variables. Regression analysis let drop that distance from farm to main market, off- farm income and Sahiwal (district) while age, maize farming experience, access to extension agent, Okara (district) are the determinants which significantly influence the farmer's decision to purchase crop insurance. The current research findings are anticipated to inform the government institute, insurance companies

and policymakers to implement the crop insurance. The government ought to adopt subsidies and establish a crop insurance program, while increasing knowledge of crop insurance to support small farmers.

Keywords: Crop Insurance, Hybrid maize, Adoption, Punjab

Determinants of Compliance Behavior of Farmers towards Agricultural Taxation in Punjab

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Abstract

Tax compliance is a major concern, especially in developing nations where governments seek ways to increase tax-collecting efficiency to finance their budgets. Agriculture tax is collected from an inadequate base, and its revenues have been insufficient because the compliance behavior of farmers affects agricultural income tax. This study aims to identify factors of tax compliance that affect agriculture taxation in Punjab, Pakistan, by using binary logistic regression. The cluster sampling was used to collect data from 557 farmers. The study's findings show that education, tax knowledge, satisfied tax authorities, and low levels of crime and conflict positively affect tax compliance. On the other hand, government waste taxes and poor agriculture services have statistically negative effects on tax compliance. Moreover, tax authorities should take steps to improve tax compliance rates.

Keywords: Compliance behavior, agriculture taxation, logit model, tax authorities

Estimating Agricultural Income Tax Revenue in Pakistan: Challenges and Opportunities for Institutional Improvement

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Abstract

Taxes are the primary means of generating revenue worldwide. Thus, income taxes could be a long-term and essential source of income for the government. Pakistan lags far behind other countries when taxing individual income, especially income from agriculture. This study evaluates tax collection under various scenarios and analyses the institutional hurdles to collecting agricultural income tax through focus group discussion. Thus, the study results demonstrate that the estimation of tax collection done in this study as agricultural income tax without differentiating lessors' income may generate tax revenues of 65 billion rupees. With differentiated lessors, income may generate revenue of 68 billion. Therefore, other reasons, such as inadequate administrative structure, contribute to the insufficient collection of agricultural taxes. This can be improved through Cooperation among various government institutions for sharing information, which can enhance the capacity of the tax collection authorities

Keywords: Income tax, tax collection, institutional hurdles, administrative structure

Key Factors Influencing Adoption of Adaptation Practices in Rice-Wheat Cropping Zone of Punjab, Pakistan

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Abstract

Climate change" has become a critical topic among experts, government agencies, civil society, and international donors like the World Bank, UNDP, ADB, ADPC and the Green Climate Fund. These funding bodies are in constant collaboration with academia, agriculture department, and government institutions to raise awareness and build resilience among farmers and other stakeholders. Although, climate change is widely discussed, many farmers who are key players in the agricultural sector remain unaware of the direct threat it poses to their crops. For example, extreme weather events, such as the heat wave of 2024 had severe impacts on crops in Punjab, including rice, sesame, and cotton. While the productivity of Wheat has been witnessed declined in rice-wheat cropping zone due to rise in temperature and change in precipitation pattern in the months of February and March. Adaptation has been identified as an effective approach to mitigate the adverse effects of climate change. Adaptation inclusively includes adoption of specific adaptation practices by farmers. The current study aims to identify factors influencing farmers' decisions to adopt adaptation practices for wheat crop rice-wheat cropping system of Punjab, Pakistan. Data was gathered through a Household Questionnaire Survey (HQS) to provide quantitative insights into factors affecting adaptability, perceptions of climate change variability

over recent years. The survey involved interviews with 300 farmers across five districts in Punjab's rice-wheat zone: Gujranwala, Hafizabad, Nankana, Sheikhupura, and Sialkot. Data analysis involved multivariate regression analysis and multivariate correlation analysis techniques. The analysis identified six significant factors with the highest correlation coefficients (r greater than 0.30) with the dependent variable – Adaptation Index influencing farmers' adaptation decisions: farmer-to-farmer extension, Education of farmer, availability of agricultural labor, ownership of tractor, migration of labor force and ownership of tube wells. Multivariate correlation analysis further highlighted additional factors contributing to adaptation. This study also offers recommendations for the Punjab Agriculture Department, encouraging them to support farmers in forming of clusters. Such clustering can help optimize resource use. Furthermore, the Agriculture Department's extension wing may train field staff including Field Assistants, Agriculture Officers in raising awareness about climate change, promoting effective adaptation practices, and strengthening factors that enhance farmer adaptability and profitability.

Keywords: UNDP, Reactive Adaptation, Cobb-Douglas, HQS, Cropping System

Effect of oil prices and exchange rate on Wheat production in SAARC Countries

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Abstract

The objective of the study is to examine the impact of oil prices and exchange rates on the production of wheat in SAARC countries like Pakistan, Bangladesh, India, Afghanistan, and Sri Lanka-using panel data spanning from 1985 to 2022. The study addresses the significant challenge posed by the fluctuations in these economic variables that impact wheat production across the region. Analyzing exchange rates and oil prices' effects on wheat production is crucial for understanding their implications. To check the stationarity of the variables, the study utilized the unit root tests. The choice between OLS and random or fixed effect model is determined by using Lagrange multiplier tests, establishing that the random and fixed effect model is appropriate for further analysis. The Hausman specification test confirm the selection of the fixed effect model. Fixed effect model is used for the analysis of the data. Oil prices, exchange rates and fertilizer use have significant impact on wheat production in SAARC countries. These results provide valuable insights for policymakers in formulating effective policies aimed at promoting economic development in these nations. By understanding the dynamics of these economic factors,

policymakers can better address the challenges and opportunities in agricultural production within the SAARC countries.

Keywords: SAARC countries, oil prices, exchange rates, fertilizer use, wheat production

Factors effecting Rural Women Labour Supply in Agriculture Sector: A Case Study of District Rajan Pur

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Abstract

This research is about the factors effecting the rural women labor supply in agriculture sector in District Rajanpur Pakistan. From 44 Union councils 06 are chosen for study area. A questionnaire was developed to cover up all aspects of household information fro the rural women living in the rural areas of district Rajanpur. The study is found on the field survey accomplished in the district Rajanpur. We have employed Ordinary least square (OLS) regression and Log-Log linear models in order to find the empirically discover the effect of, women age, family type women health status husband income and asset (land ownership) an have significant impact on rural women labour force participation in the agriculture sector. The study finds that the women's health status is strong and positive factor of women labor force participation. However, age of the women, family type (joint, extended) purdha are insignificantly and have negative on the rural women's participation. Among demographic factors, age and household structure and size affect the FLFP rate positively. On the basis of descriptive and econometric results, it can be concluded that culture and mobility strongly affect women's role in rural areas..

Keywords: Rural women, Agriculture sector, Rajanpur

Preparing to celebrate its 100th anniversary, The Turkish sugar industry's past, present and future

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Abstract

The Turkish sugar sector, established in 1926 with the founding of its first factories, has remained a cornerstone of both agriculture and industry. Over time, the area devoted to sugar beet cultivation has expanded, and the number of sugar factories has increased to 33. The contract farming model for sugar beets has become particularly appealing to farmers, offering guaranteed prices and mitigating market risks. In recent years, farmers have shifted from crops like sunflowers and corn to sugar beets, boosting production to an estimated 3.2 million metric tons. Historically state owned, the industry has seen significant privatization after the 2000s, with TÜRKŞEKER, the largest state enterprise, now accounting for over a third of national production. Today, 15 companies, including private firms and cooperatives belongs to PANKOBİRLİK, operate in the sector, with a combined production capacity of around 3.7 million tons annually. Domestic sugar consumption continues to grow due to population increases, urbanization, and changing dietary habits. The food, beverage, and confectionery sectors account for 80% of sugar use, while households consume the remaining 20%. Per capita consumption is about 35 kilograms annually. The sector remains heavily regulated, with production quotas and price controls. As the sector approaches its 100th anniversary, its future will be shaped by critical challenges such as reducing post-harvest losses, improving water management in response to climate change, and promoting sustainable agricultural practices. Moreover, innovations in e-commerce, financial technology, and renewable energy are expected to enhance efficiency and market access, shaping the trajectory of Turkiye's sugar and sugar beet sectors. In this paper, the 100th year of the sugar sector, which plays an important role in Turkiye's agricultural production and food industry, will be discussed in terms of production, trade, agricultural development, rural transformation and food security. The importance of the transformation in sugar policies in terms of a country's agricultural history and the lessons learned in 100 years of experience will be discussed.

Keywords: Sugar, TÜRKŞEKER, Contract Farming, Privatization, Consumption Trends

Paradigm transformation in rural development policies in Turkiye; From modernization to digitalization

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Abstract

The transformation of rural development policies in Turkiye presents a compelling case of evolutionary change from traditional modernization approaches to digital integration. This study examines the historical trajectory and paradigm shifts in Turkiye's rural development policies, focusing on the transition from conventional modernization strategies to contemporary digital solutions. The research methodology employs a mixed-method approach, combining historical document analysis and policy evaluation across different periods. The study periodizes the transformation into three distinct phases: revitalization and the modernization period (1923-1980), the structural adjustment period (1980-2000), and the digital transformation period (2000-present). Findings indicate that Türkiye's rural development policies have undergone significant changes in response to global trends and local needs. The initial modernization approach, characterized by state-led industrialization and agricultural mechanization, aimed to transform traditional rural structures through technological advancement and infrastructure development. The structural adjustment period marked a shift towards market-oriented policies, emphasizing rural entrepreneurship and private sector involvement. The contemporary phase reveals an increasing focus on digital transformation, exemplified by initiatives such as the Digital Agriculture Market, smart village applications, and e-agriculture platforms. This digital transition has introduced new dimensions to rural development, including precision agriculture, digital literacy programs, and ICT-based rural services. The digital divide between urban and rural areas remains a significant concern. In Turkiye, where there are still problems in accessing important resources in rural areas compared to urban areas, it is a fact that these transformations in rural areas, although promising, will take more time. Considering the negative aspects as well as the positive aspects of digitalization, while the new process is expected to increase production efficiency in rural areas in Turkiye, how successful the demographic structure in rural areas will be in adapting to this process is another question mark. This study is important in terms of revealing the changes in the transformation of rural development policies in Turkiye.

Keywords: Rural Development, Digital Transformation, Rural Digitalization Agricultural Policy, Development Paradigm, Turkiye,

Empowering Women through Value Chain Development in District Multan

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Abstract

This study investigates the effects of value chain development on women's empowerment and income within the district of Multan. Women in the study highlighted the lack of economic opportunities particularly outside the home and expressed a strong desire for freedom to work alongside a need for childcare and access to contraception. The research combines surveys, interviews, observations, and participatory focus group activities to provide qualitative and quantitative evidence of the perceived impacts on women processors, retailers, farmers, and other stakeholders along the value chain. The findings reveal that societal norms and structural barriers including limited mobility, restricted access to training, markets, credit and labor-saving technologies continue to hinder women's full participation in value chains. The study also highlights the significant role women play in agricultural labor, comprising a large proportion of the workforce. Education and training emerged as significant contributors to empowerment with positive correlations observed for both men and women. Value chain analysis and development are introduced as effective tools for addressing gender inequities. We can empower women by adopting case-specific upgrading strategies based on robust analysis of causal factors. The government and decision-makers should implement measures that can enhance women's potential by giving them access to and control over important productive resources needed for value chain development.

Keywords: Women empowerment, Value chain development, Rural Women, Robust Analysis

Evaluation of hermetic technology for seed storage of conventional and zinc biofortified wheat

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Abstract

Wheat is a staple food in Pakistan, with the average daily intake of wheat flour is around 124 kilograms per capita per year. Most of the wheat varieties are poor in bioavailable zinc (Zn). As a result, biofortified varieties of wheat are potential food carriers for increasing Zn. With the development of zinc biofortified wheat **(**ZnBW**)** varieties, there is a dire need to study their storage

shelf life because more than 10 percent quantitative and qualitative losses occur in stored wheat. The hermetic storage may help to reduce seed quality and nutritional losses, which occur due to spoilage, insect pests, and environmental factors. The research work was executed by involving the farmers at two locations. Varieties of ZnBW including Akbar-2019 and Nawab-2021 and conventional varieties including Dilkash-2020, and Arooj-2022 were stored by different storage techniques including imported hermetic bags, local hermetic bags, polypropylene bags and metal silos for 9-months. Experiment was conducted by using completely randomized design with factorial arrangement keeping types of wheat varieties and storage techniques as study factors and experiment was replicated thrice. After initial quality analysis including moisture content, seed germination percentage, electrical conductivity of seed leachates and seed composition, seed of wheat varieties were stored using selected storage techniques at four different locations. Seed sampling was carried out after every three month's intervals to determine seed moisture contents, germination, seed vigor and biochemical compositions like crude protein, ash and fiber were determined. The availability of nutrients (especially zinc and iron) was also determined. Seed moisture remain same in all two types of hermetic bags (local hermetic and imported hermetic bags) while increased in polypropylene bags from 12 to 15.4% in 9 months of its storage period as compared to initial moisture content that ranges from 9 to 10 %. Seed germination % decreases from 98% to 48.3% in polypropylene bags while remain same in both imported hermetic and local hermetic bags with very minor decline. Electric conductivity (seed vigor) was same in imported hermetic and local hermetic bags while increased in polypropylene bags from 15.7 ($\mu S\ cm^{-1}g^{-1}$) to 73.3 ($\mu S\ cm^{-1}g^{-1}$). Moreover, it is inversely related with seed vigor i.e.; increase in electric conductivity lower will be the seed vigor. The nutritional parameters like thousand kernel weight, crude protein, crude fat, crude fiber, minerals (zinc & iron), gluten contents (wet & dry), rheology of flour (flour additives and constituents affect dough behavior during breadmaking) was remain same in imported hermetic and local hermetic bags although variations happen but are non-significant results but in case of polypropylene and metal silos possess significant result by declining TKW from 44.5 g to 36.5 g. Moreover, performance of imported hermetic and local hermetic bags was recorded best for seed storage. The recoded data was statistically analyzed with the help of Statistical software Statistix 10 and treatment means were compared by using Tucky's HSD at 5% probability level.

Keywords: ash, crude protein, electrical conductivity, farmers, germination, moisture contents, nutrients, seed leachates, seed vigor.

Cold hermetic storage technique enhances storage life of soybean seed and ensure food security

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Abstract

The quality of soybean seed is compromised during storage due to various factors particularly seed moisture content, storage temperature and relative humidity. This study tested the effectiveness of different storage techniques such as cold storage, hermetic storage and desiccant drying beads alone or their suitable combination to enhance longevity of soybean seed. Soybean seed was stored at 8% MC for 6 months using various storage techniques including seed storage in cloth bags, storage in hermetic box, storage in hermetic box with zeolite drying beads, cold storage in cloth bags and cold storage in hermetic box. Data of seed moisture, germination, vigor and other quality parameters was recorded before and after storage. The experiment was conducted by using CRD design with three replications and total 15 experimental units. Results revealed that higher seed germination percentage, germination index, oil and protein contents, total soluble sugars and lower EC, Malondialdehyde (MDA) contents and reducing sugar contents were observed in seed stored in hermetic box under cold storage conditions. In conclusion, storage in hermetic box at cold conditions is ideal for high quality storage of soybean seed. At ambient temperature, seed storage in hermetic box with drying beads is equally efficient to preserve the quality of soybean seed and helps to ensure food security.

Keywords: Germination; Hermetic storage; Longevity, Reducing sugars; Seed moisture; Vigour

Evaluating the impact of desiccant solar bubble drying and sun drying techniques on quality of chilli, maize and rice seed

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Abstract

Maize, rice, and chilli are among the most important crops in Pakistan's agriculture. To achieve the high production potential of these crops, the availability of quality seeds is the key factor. Seed quality is influenced by various factors such as seed moisture, temperature, and relative humidity of the storage environment. The seed drying method is also an important factor that can affect the seed quality. In the absence of a more efficient and economical drying solution, the process of sun drying poses significant challenges, including labor-intensive efforts and the risk of poor quality and contamination from dust particles. The primary objective of this study was to refine the existing traditional sun drying method and conduct a comparative analysis of drying loss and economic feasibility with other drying techniques. The experiment was performed under RCBD factorial arrangement with two factors i.e. seed of three crops (chilli, rice, and autumn maize) and drying methods (sun drying and drying with desiccant solar bubble dryer). The results showed significant differences among the treatments for the studied traits. The maximum drying time for chili (50 hours), rice (48 hours), and maize (51 hours) were recorded under sun drying, while the solar bubble drier requires less time for drying. The maximum seed moisture content in chili (14.9%), rice (22.8), and maize (25.3) was recorded under sun drying. The maximum EC (131.89 $\mu Scm^{-1}g^{-1}$) was recorded from the sun-dried chili seed. Drying seed in solar bubble showed better germination of chili (76.00%), rice (93.33%), and maize (91.67%) compared to sun-dried seed which showed germination percentages of 49.33, 58.67, and 63.33 of chili, maize and rice, respectively. Solar bubble dried seed showed a maximum germination index for chili (11.33), rice (28.48), and maize (12.80), compared to the sun-dried seed of chili (6.26), rice (12.63), and maize (7.04). Sun-dried seed required a mean germination time of 10.85 days, 9.56 days and 5.71 days, respectively for chili, rice, and maize, respectively. Contrary to that the solar bubble dried seed required less mean germination time for chili (10.40 days), rice (8.91 days), and maize (5.56 days). The solar bubble dryer can be adapted by the farming community to enhance seed quality. The benefits of solar bubble dryers are most efficient and effective, so it is highly recommended to use the solar bubble dryer to farmers having limited resources/drying abilities.

Keywords: Desiccant; Drying; Germination; Malondialdehyde; Moisture; Relative Humidity

Inclusive Agriculture for Regional Food Security in Consumption Pattern and Undernourishment

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Abstract
Food security has become a top concern for nations with varying levels of economic development, and the agriculture industry is working to ensure it. Determining the relationship between the undernutrition index and particular traits that characterize the agriculture sector within designated clusters of developing nations is the aim of this abstract. According to the analyses, the biggest issue in developing countries with a large agricultural share is ensuring food security. As a result, agriculture has a negative impact on GDP because of the negative effects of unfavorable conditions on agricultural production and inadequate infrastructure. Food security is significantly influenced by regional variations in food consumption patterns. Not only is food security an important aspect of national security, but it is also a fundamental tenet of human rights. According to the 2018 Pakistan National Nutritional Survey, food insecurity affected Pakistani households. Food insecurity was most prevalent in the provinces of Sindh and Baluchistan, where 47% and 50% of households were impacted, respectively. Moderate degrees of food insecurity were experienced by 29% and 32% of households in Khyber Pakhtunkhwa and Punjab, respectively. After reaching record highs in 2023, the Global Report on Food Crises 2024 Mid-Year Update illustrates concerning patterns in severe food insecurity and malnutrition. There will be 1.9 million people in 2024, up from 705,000 in 2023, according to the Integrated Food Security Phase Classification (IPC) Phase 5 catastrophe projection. Reduce food waste, improve infrastructure (enough people and machines, storage, and transportation), ensure fair trading practices, give adequate attention to diversification, reduce the yield gap so that production can be made more efficient, combat climate change, and address indirect causes like wars and the demand for biofuels to overcome regional food security in consumption patterns and undernourishment.

Keywords: food security, food consumption pattern, food insecurity, undernutrition, region.

Assessing Environmental and Food Security Implications of Municipal Solid Waste Compost Application in Croplands: Potentially Toxic Element Mobility and Risk Factors

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Abstract

The use of municipal solid waste compost (MSWC) in croplands offers soil fertility benefits, yet the presence of potentially toxic elements (PTEs), such as cadmium (Cd) and lead (Pb), may pose environmental and food security risks. This study evaluates the mobility and environmental risk associated with different chemical species of Cd and Pb in MSWC through a 60-day incubation experiment. MSWC was applied at varying rates (0, 5, 10, 15, and 20 t ha^{-1}) to assess PTE fractionation, environmental risks, and impacts on soil health. Five PTE fractions—exchangeable, carbonate-bound, Fe/Mn-bound, organic, and residual—were analyzed using sequential extraction, and the risk assessment code (RAC) was employed to determine environmental risks of Cd and Pb. Results indicated that MSWC applied at 20 t ha^{-1} contributed the highest concentrations of Cd and Pb across fractions, with the residual fraction predominating for both elements. The RAC analysis highlighted a higher risk potential for Cd at the 20 t ha^{-1} application rate, while Pb posed a medium risk. Additionally, significant increases in soil microbial biomass carbon (C), nitrogen (N), and dehydrogenase activity (DHA) were observed, particularly at the highest MSWC rate, suggesting enhanced soil microbial activity. While the organic matter in MSWC may benefit soil health, elevated PTE levels could threaten environmental and food safety. This study underscores the need for careful MSWC management in agricultural practices to maximize benefits while mitigating potential food security and environmental risks.

Keywords: Solid waste, Compost, Risk, Soil health,

Impact of Urbanization on Sustainable Aquifer Management for Food Security

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Abstract

Water is essential for sustaining life, and ensuring clean water and sanitation outlined in Sustainable Development Goal (SDG) 6 remains a major global challenge. Aquifers dependent

regions, effective management of aquifer protection, desalination, economic growth, agricultural irrigation, and food security can be achieved by identifying and developing sustainable sources of groundwater pumping. Using groundwater for irrigation can help safeguard food security and increase the pressure on local freshwater aquifers. The agriculture sector also extracted groundwater to fulfil requirement of crop. Due to increase the cropping intensity, the irrigation network is not able to fulfil the requirement of crop. The rainfall is not sufficient except groundwater pumping. On the other hand, there is water supply system for urban region. The domestic water demand, industrial demand increasing with the increasing of populations. Theses sectors demand fulfilled through groundwater pumping, which cause to decline the groundwater levels of urban aquifer. Overall, the groundwater extraction is increased from all sectors. The majority of groundwater extraction in Lahore is consumed by the domestic sector, accounting for 56%. The agriculture sector uses 21% of the total groundwater extracted, while the remaining groundwater is allocated to the industrial, commercial, and institutional sectors. To address the food security challenges, the sustainable aquifer management is necessary.

Keywords: Aquifer Management, food security, climate change impact, water resources

Biocontrol Strategies for Ensuring Food Security: Mitigating Aflatoxin Contamination with Non-Toxigenic Aspergillus species and Endophytic Bacteria

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Abstract

Aflatoxins, highly toxic and carcinogenic secondary metabolites produced predominantly by *Aspergillus flavus* and *Aspergillus parasiticus*, pose significant threats to food security and public health. Contamination of staple crops such as maize impacts approximately $1.6 billion worth of global food crops annually. Biological control strategies, including the use of non-toxigenic *Aspergillus* strains and plant-associated endophytic bacteria, have emerged as eco-friendly alternatives to mitigate aflatoxin contamination. Recent studies highlight the efficacy of endophytic bacteria isolated from maize genotypes in inhibiting aflatoxin-producing *Aspergillus* species. Among these, *Alcaligenes* spp. demonstrated significant antifungal activity, achieving up to 67.5% inhibition of *A. flavus* growth, with genetic analyses confirming its close phylogenetic relationship to strains reported in India. Concurrently, surveys across agricultural regions in Multan, Pakistan, revealed varying incidence rates of aflatoxin contamination and identified

toxigenic *A. flavus* and non-toxigenic *A. niger* isolates. Molecular characterization of the non-toxigenic Multan isolate (SS-4) showed high similarity to *A. niger* strains from Brazil, clustering phylogenetically with Latin American isolates. These findings emphasize the potential of integrating non-toxigenic *Aspergillus* species with bacterial endophytes as a sustainable biocontrol approach. Such interventions not only enhance plant health and food safety but also reduce dependence on chemical fungicides, offering a pathway toward improved crop yields and agricultural resilience.

Keywords: *Aspergillus flavus, Aspergillus niger*, Aflatoxins, endophytic bacteria

Sustainable Food Development in Climate Change

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Abstract

Climate change is an emerging challenge to food chains that are now being observed more closely in food systems. Food distribution problems and decreased yields in agriculture are the impacts of extreme weather events, increased temperatures and changing precipitation patterns. Food security, climate change and sustainable development should be addressed as a holistic approach for sustainable food development. There is a need for food systems policies that focused market failures, improve and enforce policies and institutions, invest in technologies and practices in climate mitigation and adaptation. On the farm level, adaptation must take into consideration shifting climatic regimes, water availability and quality, frequent occurrences of droughts and floods, raised disease and pest susceptibilities. Several powerful initiatives indicate that useful innovations can increase yield and improve adaptability and resilience. New crop varieties can be more resilient to climate change shocks and increase yields. Digital technology in the production process can increase the area of accessible knowledge and services and enables producers to tailor practices to environmental, geographical and market conditions. Some others that will support mitigation include irrigation technologies (drip irrigation and solar power pumps), improved cold chain technologies, no-till farming, agroforestry, genome-editing technologies like CRISPR and landscape management. Environmental sustainability of food systems is considered one of the climate smart agriculture's key aspects that widely depends on minimizing the carbon footprint of the various phases of food value chains. These technical innovations will never get to the envisioned maximum optimal level without the appropriate policy enablers and governance frameworks that would support the shift towards climate and other desirable changes for all food

systems actors. This also requires policies for the proper coordination of stakeholders and to promote equal systemic change for everyone.

Keywords: Food security, digital technologies, irrigation technologies, environmental sustainability and food system policies.

Enhancing Productivity through Cotton-Soybean Intercropping: A Case Study from Southern Punjab, Pakistan

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Abstract

Intercropping systems are increasingly recognized as a sustainable solution for enhancing food security and resource optimization, particularly in emerging economies. This study evaluates the productivity and compatibility of cotton *(Gossypium hirsutum)* and soybean *(Glycine max)* under intercropping conditions at Multan, Bahawalpur and Khanewal, Punjab, Pakistan. Two cotton genotypes (MNH-1020 and MNH-886) and two soybean genotypes (NARC-21 and NARC-22) were evaluated in a split-plot design under RCBD with three replications. Key agronomic traits, including seed cotton yield per plant (SCYPP) and pods per plant (BoPP), were analyzed to assess crop performance and identify optimal genotype pairings. The results revealed significant correlations between seed cotton yield per plant and pods per plant, with MNH-1020 and NARC-21 emerging as the most suitable genotype combination for intercropping. The findings demonstrate the potential of cotton-soybean intercropping to enhance land use efficiency and yield stability, offering a viable strategy for addressing food security challenges in resource-limited settings. This study underscores the need for promoting diversified cropping systems to improve agricultural productivity in emerging economies.

Keywords: Intercropping, cotton-soybean system, food security, sustainable agriculture, genotype compatibility

Theme II:

Climate Smart Food Systems and Prospect for Growth

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Climate-Smart Food Systems: A Nexus of Economic Growth, Environmental Sustainability, and Social Equity

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Abstract

Climate change poses an existential threat to global food security, necessitating a paradigm shift towards sustainable and resilient agricultural practices. Climate-smart food systems (CSFS) offer a promising approach to address these challenges by integrating economic growth, environmental sustainability, and social equity. CSFS encompass a multifaceted array of agricultural practices, policies, and technologies that promote sustainable resource utilization, mitigate greenhouse gas emissions, and enhance food security. Key components include agroforestry, precision agriculture, climate-resilient crop varieties, and sustainable land management practices. By optimizing resource use, reducing waste, and enhancing agricultural productivity, CSFS contributes to increased food production while minimizing environmental impacts. From an economic perspective, CSFS offers several benefits, including increased farmer incomes, improved livelihoods, and enhanced food security. By enhancing agricultural productivity and reducing production costs, CSFS can contribute to economic growth, particularly in developing countries. Furthermore, CSFS can help to mitigate the adverse impacts of climate change on agricultural production, thereby reducing food insecurity and ensuring a more stable food supply. From an environmental perspective, CSFS play a crucial role in mitigating climate change and protecting biodiversity. By reducing greenhouse gas emissions, improving soil health, and conserving water resources, CSFS can help to mitigate the adverse impacts of climate change on ecosystems and human well-being. Additionally, CSFS can contribute to biodiversity conservation by promoting agrobiodiversity and supporting ecosystem services. CSFS offer a promising approach to addressing the challenges of climate change and food insecurity. By integrating economic growth, environmental sustainability, and social equity, CSFS can contribute to a more resilient, sustainable, and equitable global food system.

Keywords: Climate Change, Food Security, Climate-Smart Food Systems (CSFS), Sustainability, Resilience, Agricultural Practices

Intention Action Gap in the Adoption of Climate Smart Agriculture Among Small Scale Farmers in Disaster Prone Areas

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Abstract

Pakistan is fifth most climatic change affected country with irregularity in precipitation, temperature increases, and changes in climatic patterns. Hunger is one of the core reason for increase crop production, but unfortunately, increase in production has led to climate change through unsustainable practices in agriculture. Climate Smart Agriculture (CSA) is a comprehensive concept that provides approaches to food security and responding climate change issues but it is not practiced by small holder farmers widely. District Muzaffargarh is at high risk of climate change impacts for which CSA challenges persist. Cross-sectional descriptive study of 200 small-scale farmers in four disaster-prone Union Councils conducted to assess the intention-intention gap of small scale farmers regarding CSA adoption. Some of the targeted interventions on water-smart as well as nutrient-smart were only partially implemented with the economic self-interest and peer opinions being the key influencing factors. Adoption of CSA practices was encouraged by in-kind support, but was also hindered by high costs, especially for water-smart and energy smart practices. As expected all the respondents indicated they were willing to continue CSA but with an in-kind support. The analysis of attitudes and practices showed that gender and number of family members affected practices on the farm, with broth male farmers using carbon-smart and nutrient-smart methods. There is need to design and implement community-driven initiatives that offer economic incentives, climate-sensitive training, and in-kind support to mobilize and motivate sustainable adoption of Climate-Smart Agriculture, enhancing resilience against climate change and ensuring food and nutrition security.

Keywords: Climate Smart Agriculture, Intention-Action Gap, Adoption, Food Security

Understanding the Relationship Between Climate Change, Cotton Production, and its Marketing: Evidence from Pakistan's Cotton Industry

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Abstract

Pakistan is one the developing countries that have been struck hard by climate variability although it contributes very small in greenhouse gas emissions. Pakistan’s vulnerability is high because of it’s dependence on agriculture which is highly climate sensitive. To cope with potential impacts of climate change the policy and institutional setup has been formulated. This research aims to study the impacts of climate change on agriculture sector with special reference to cotton crop and the

relations of that impact with marketing industry of Cotton in Pakistan. The study will be conducted in the Punjab province of Pakistan which play a vital role in understanding to climate change adaptation and mitigation which will eventually leads to environmental sustainability. The study nature will be based on mixed methods approach where the data will be collected from expert peoples in cotton industry as well as from the cotton farmers in the study area with the help of structured questionnaire and interview schedule. The quantitative data will be analyzed with the help of Statistical Package of Social Sciences (SPSS) in the form of frequency distribution as well as application of regression analysis to know about the relations of impacts of clime change on marketing of cotton industry while the qualitative data will be analyzed in the form of thematic analysis and in last the conclusion and recommendations will be drawn on the basis of data obtained from the field.

Keywords: climate variability, climate change adaptation, environmental sustainability, cotton industry

Assessing Climate-Smart Agricultural Practices and Growth Prospects in South Asia: A Focus on Pakistan, India, and China

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Abstract

This study examines the growth of climate-resilient agriculture from 2010 to 2022, focusing on Pakistan, India, and China. The analysis utilizes data from the World Development Indicators (WDI), International Monetary Fund (IMF), and World Bank to assess various factors influencing climate-smart food systems and their prospects for growth. The dependent variable, Growth in Climate-Resilient Agriculture, is evaluated through dimensions such as climate-resilient crop yield, the area of land under climate-smart practices, and the resilience of livestock to climate change. These measures are critical in understanding how agricultural systems can withstand the adverse effects of climate change. Independent variables include Climate-Smart Agricultural Practices, which cover the use of drought-resistant seeds, water-saving irrigation techniques, and sustainable soil management. The study also explores Climate Change Policy Implementation, focusing on national adaptation policies for agriculture, international climate agreements participation, and green technology adoption. Agricultural Investment in Research and Development is assessed through R&D expenditure on climate-smart agriculture, the number of climate-smart innovations, and collaboration with international research bodies. Additionally, Renewable Energy Usage in

Agriculture, encompassing solar-powered irrigation, biogas adoption, and wind energy utilization for farms, is analyzed. Finally, Risk Mitigation Measures, such as crop insurance penetration, disaster preparedness plans, and early warning systems for climate events, are examined. Findings reveal that Pakistan, India, and China have made significant strides in adopting climate-smart agricultural practices, but challenges remain in fully integrating renewable energy and risk mitigation measures. Investment in research and development has shown a positive correlation with growth in climate-resilient agriculture, particularly through international collaborations. The study highlights the importance of effective climate change policies and innovative technologies in enhancing agricultural resilience in the face of increasing climate variability.

Keywords: Climate-resilient agriculture, Climate-smart practices, Renewable energy in agriculture, Risk mitigation, Pakistan, India, China, WDI, IMF, World Bank.

Assessing the Environmental Efficiency of Cotton Production in Punjab, Pakistan

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Abstract

In agriculture-dependent countries like Pakistan, maximizing productivity while minimizing environmental pollution in agricultural production is a top priority. The cotton industry in Pakistan has long faced challenges related to inefficiency and low output, which negatively impact both the nation's economy and its agricultural sector. Contributing factors include poor seed quality, ineffective pest and disease management, outdated technology, insufficient research and development, land degradation, inadequate infrastructure, limited farmer education, and market barriers. This study uses stochastic frontier analysis (SFA) and the Efficiency Measurement System (EMS) to evaluate the technical and environmental efficiency of cotton farms in Punjab and to identify the factors influencing efficiency. The findings reveal that the average environmental efficiency score was 47.92%, while the technical efficiency score was 0.97. Moreover, inefficiency was significantly and positively affected by factors such as age, extension contact, and total agricultural land. Based on these results, it is recommended that the government implement policies that strengthen the agricultural extension system to educate farmers and facilitate the adoption of modern technologies.

Keywords: Environmental Efficiency, Cotton Farm, Technical Efficiency, SFA, EMS, Pakistan

Role of Integrated Nutrient Management (INM) for Sustainable Agriculture in Pakistan

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Abstract

The objective of the study is to highlight the importance of INM in sustainable agriculture. The excessive use of chemical fertilizers in agriculture, which negatively impact on environment particularly on soil fertility. The challenge is to reduce the over-consumption of synthetic fertilizers without compromising crops yield. In recent times, Integrated Nutrition Management (INM) have gained a significant role in the development of soil health. To overcome these concerns with INM can be a sustainable approach for agriculture. It includes use of chemical fertilizers, compost, green manures, animal manures, biofertilizers, agricultural leftovers, recyclable waste, legume inter-cropping, and other locally accessible nutrient supplies on integer level to enhance the soil fertility, health, and productivity. This review explores the importance of INM as an eco-friendly approach for sustainable and regenerative agriculture. It reflects on the principles, components, and cost-effective resources of INM. Moreover, in Pakistan's agricultural context, it concerns with the factors, such as soil health and cropping patterns with respect to climate change, crop diversity, and socio-economic conditions. In this review, data were collected from published research papers and book chapters on ResearchGate, Springer, Elsevier, and Google Scholar. Several studies have revealed that INM enriches the soil with micro and macronutrients, which can dramatically increase crop yields compared to the over- or under-application of fertilizers. The INM improves soil texture and fertility by applying compost, organic manures, and other organic materials. It has significantly enhanced the soil stability, improved soil moisture-retention capacity, and raised soil organic carbon levels. It also increased crop yield which lead to INM is an eco-friendly and economically viable for sustainable agriculture. The INM effectively fulfills the plant nutrient requirements, by enhancing soil health and fertility. It's a cost-effective, and sustainable approach which provide financial advantages for formers, increase soil organic matters, improve biodiversity and biosafety. For the future considerations, all the stakeholders (farmers, corporate sectors and researchers etc.) should focus on Integrated Nutrient Management technologies.

Keywords: Integrated Nutrient Management (INM), sustainability, Soil Fertility and climate change

Adoption of climate smart agricultural practices in Punjab Pakistan

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Abstract

Pakistan is a vulnerable country in terms of both climate change and food security. The agriculture sector, especially in a developing country like Pakistan, is affected by the adversities of the climate change. With respect to food security, climate change can potentially affect the crop production and access to affordable food. This research examined adoption of Climate Smart Agriculture (CSA) through five key practices, i) Balanced use of chemical, ii) Integrated Pest Management, iii) Formal irrigation techniques, iv) Knowledge of Climate Smart varieties, and v) Change in crop calendar. The adoption of these CSA practices is assessed for farmers of wheat (a major crop in the food basket of Pakistan). The determinants of adoption were estimated using Probit model. With the help of Data Envelopment Analysis (DEA) farm efficiency (technical) is calculated employing the survey of 384 farmers from Punjab. The results of the study suggest that only 17.4 percent of the farmers are adopters of CSA practices. The determinants like farmer education, income, productivity, and land ownership etc. have positive impact on adoption. Whereas age, land-use and distance from nearby city center have negative association with adoption. Based on the results and outcomes of the study, CSA practices are critical and hold key to improve food security in the country. Adoption of CSA practices can help in attenuating the vulnerabilities of farmers to climate change.

Keywords: Climate Smart Agriculture (CSA); Adoption of CSA practices, Food security; Agriculture; Probit model; Efficiency analysis.

Climate Change and Food Crises: Strategies for Building Resilient Food Systems

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Abstract

Food security is a multifaceted issue that encompasses the availability, accessibility, and utilization of nutritious food to meet the dietary needs of individuals. Despite the global agricultural system's capacity to produce sufficient food, malnutrition and hunger remain critical challenges, particularly in South Asian. South Asia is one of the most densely populated regions in the world. With 5% of the global agricultural land, South Asian farmers have to feed over 20% of the global population.

In South Asia, around 412.9 million people are severely food-insecure, making up 21 percent of the total population, while food security is low in 40.6 of the total population. This review paper explores the definitions and significance of food security, emphasizing the human right to accessible and adequate nutrition. It traces the historical evolution of food security, highlighting key frameworks and policies that have shaped its contemporary understanding. Additionally, it delves into the alarming statistics surrounding global food insecurity, particularly in regions like South Asia and Pakistan, where poverty and climate change exacerbate vulnerabilities. The interrelationship between climate change and food security is critically analyzed, demonstrating how shifting weather patterns threaten agricultural productivity and food accessibility. The paper concludes by addressing the urgent need for sustainable agricultural practices and comprehensive policies to combat food insecurity and enhance resilience against climatic challenges, thereby ensuring food security for future generations.

Keywords: Food Security, Climate Change, Sustainable Agriculture, Malnutrition, South Asia, Agricultural Productivity, Poverty.

Ground-Level Ozone and Climate Change: Monitoring Strategies for Ensuring Sustainable Food Security in Pakistan

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Abstract

Ground level ozone (O3) is the atmospheric pollutant most likely to threaten global food supply. It is extremely dangerous for arable crops and is widely distributed in important agricultural regions. In contrast to stratospheric ozone, which shields life by absorbing damaging UV radiation, ground-level ozone is a major contributor to pollution and is extremely dangerous for agriculture, ecosystems, and human health. In the context of climate change, rising temperatures quicken the chemical processes that result in the generation of the ozone, aggravating problems with air quality and setting off a vicious cycle that intensifies global warming. Since crops like wheat, rice, and maize are extremely susceptible to high ozone levels and produce lower yields, the relationship between ozone and climate change poses a serious threat to agricultural production and food security. Today's O3 concentrations are frequently lowering crop yields in South Asia's agriculturally significant areas by 5 to 35%. Food security is directly threatened by the increasing

occurrence of ground-level ozone in Pakistan, since agriculture is the main driver of the country's economy. The effects are especially bad for staple crops like rice and wheat, where estimates of crop loss in areas with high ozone levels range up to 15%. Understanding how ozone affects agriculture and the climate requires regular monitoring of ozone levels. For systematic ozone tracking, Pakistan can make use of resources such as satellite-based remote sensing, ground-based air quality monitors, and modeling techniques like the Tropospheric Ozone Assessment Report (TOAR). This study analyzes the mitigating measures required to preserve food security under changing climatic conditions, shows the correlation between ozone and climate change, and suggests practical monitoring methodologies for ground-level ozone in Pakistan.

Keywords: Ground-Level Ozone, Climate Change, Food Security, Pakistan, Ozone Monitoring, Agriculture

Quantifying the Economic Impacts of Climate Change on Crop Yields and Farming Systems in Punjab, Pak

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Abstract

The development policies must have synergy effect with climate change for the better adaptive capacity of nation. This study is specifically designed to find climatic vulnerability of cotton wheat cropping system in current time and devise adaptation packages for the farmers to better adapt to climate change. The main objective of this research was to design adaptation options for farmers in current and future time periods to better equip the farm families against climate change. The study utilized primary and secondary data from 165 farmers in five South Punjab districts, focusing on socioeconomic factors and crop production. The Tradeoff Analysis Model for Multi- dimensional Impact Assessment was utilized to find the current and future vulnerability and adaptation benefits for cotton wheat cropping system. For future climatic vulnerabilities different adaptations were compiled in which biophysical, socioeconomic and policy parameters were assessed. Yield reductions due to climate change would increase the poverty rate and reduce net farm returns and per capita income of farming community. Current adaptations regarding climatic hazards are increase in cropping intensity, fertigation, efficient irrigation system, import of gene variety, crop insurance, and enterprise diversification. Crop insurance and agricultural credit must be insured for farmers to better adapt to the climatic extremes. Agricultural policies must be integrated and devised to combat the climatic variations and sustainable resource use with consultation of researchers,

farmers, processors and other stakeholders for better implementation. Important adaptation parameters for future adaptations were genetic improvements, draught resistant and heat tolerant varieties, deep tillage, soil and water conservation practices, construction of water storage, efficient irrigation systems, crop diversification, agricultural insurance and farm mechanization (mechanical picker for cotton). For future agricultural system new genetic varieties, improved fertilizers and efficient method of plantation were assessed and substantial improvement were realized for cotton crop but in case of wheat there are less benefits as losses are also low in case of wheat.

Keywords: Climate Change, Vulnerability, Resilience, Sustainable Development, Mid Century, Agricultural Production System

Adapting to Climate Change and Building Resilience among Vegetable Growers

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Abstract

Climate change-related challenges have lowered the production of vegetables in Pakistan. There is a significant yield gap between potential and actual yield in vegetable production. Implementation of adaptation measures for higher production is insufficient to bridge these yield gaps. Therefore, the factors influencing climate change adaptation are worth measuring. In this study, 118 farmers engaged in sustainable vegetable production were evaluated. The finding showed that employing a combination of adaptation strategies that involved conventional techniques (altering sowing date, minimum tillage, mulching, drainage construction, organic manuring, pest control using neem oil), and modern technology (crop diversification, rainwater harvesting, using digital platforms for information, integrated pest management) had a positive impact on implementing climate change adaptation measures. Similarly, Lack of trained workers and budgetary constraints hindered adaptation to climate change. Accessibility to accurate knowledge about climate change and possible adaptation measures promotes adaptation. Enhanced timely information sharing and the accessibility of tools to meet adaptation requirements for environmentally friendly and economically viable vegetable production could assist growers in addressing climate change challenges. Addressing the factors that impact the implementation of adaptations may help alleviate the constraints and build resilience among vegetable growers.

Keywords: Climate change adaptation, Vegetable production, Adaptation strategies, Sustainable agriculture, Access to information.

Transforming Agriculture for a Climate-Resilient Future: Opportunities in Climate-Smart Food Systems

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Abstract

Climate-smart food systems represent a forward-thinking approach to addressing the dual challenges of feeding a growing global population and mitigating the impacts of climate change. By focusing on sustainable agricultural practices, climate-resilient crops, and reducing greenhouse gas emissions, these systems aim to enhance productivity while preserving environmental integrity. Innovations such as precision farming, water-efficient irrigation, and soil health management play a critical role in this transformation. Additionally, shifting towards plant-based diets and reducing food waste are key components in minimizing the environmental footprint of food production. The prospects for growth in this sector are significant, with increasing investments in technology, research, and policy support. By fostering collaboration across sectors and engaging communities, climate-smart food systems offer a promising pathway to ensure food security, protect ecosystems, and build resilience against climate-related risks.

Keywords: Climate resilient, Climate food system, Sustainable agriculture, Transformation

Advancing Climate-Smart Food Systems: Pathways for Sustainable Growth and Resilience

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Abstract

A climate-smart food system integrates agricultural practices, supply chains, and consumption patterns to enhance food security while mitigating the impacts of climate change. This approach emphasizes sustainable production, resilience to climate shocks, and the reduction of greenhouse gas emissions. Key strategies include promoting climate-resilient crops, efficient water use, and low-emission farming technologies. Additionally, reducing food waste and encouraging plant-based diets can significantly lower the environmental footprint of food systems. As global demand for food rises, the potential for growth in climate-smart agriculture is immense, driven by innovation, technology, and policy support. Investments in research and development, along with collaborative efforts between governments, the private sector, and communities, are crucial to scaling up these solutions. The integration of climate-smart practices could not only improve food security but also contribute to the broader goals of environmental sustainability and economic growth, offering a pathway to a more resilient and equitable global food system.
Keywords: Climate smart food system, sustainable growth, resilience, Low emission.

Barriers and Opportunities for Climate-Smart Agriculture Adoption in Developing Countries

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Abstract

The increasing impacts of climate change, along with pressing food security concerns and rising greenhouse gas emissions, are driving the need for sustainable agricultural transformations in developing countries. Climate-Smart Agriculture (SCA) has emerged as a pivotal approach, endorsed by international bodies, aimed at enhancing resilience, reducing emissions and ensuring food security. However, the rate of adoption of CSA among the farmers in developing countries, especially in Pakistan continues to be constrained. This study explores the various barriers and opportunities impacting the adoption of Climate-Smart Agriculture (CSA) by systematically reviewing over 40 CSA practices and 30 influencing factors. The main factors influencing adoption are grouped into categorize related to personal, farm-specific, financial, environmental and informational aspects. The findings indicate that higher levels of education, farming experience and larger farm size have a positive effect on the adoption of Climate-Smart Agriculture. In contrast, financial limitations, restricted access to credit, and reliance on off-farm income serve major

obstacles to this adoption. The research emphasizes the intricate nature of adopting Climate-Smart Agriculture, pointing out the necessity for tailored support systems to address financial and informational obstacles, by talking these issues, developing countries can more effectively utilize CSA practices to promote sustainable food systems in the face of climate change.

Keywords: Climate-Smart agriculture (CSA), financial constraints, systematic review, credit access, educational attainment.

Hydro-Economic Modelling of Water Resources Challenges under Climate Change

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Abstract

Hydro-economic models (HEMs) serve as valuable tools for evaluating water-resource management and guiding water policy. Over the past decade, HEMs have made substantial progress in assessing the impacts of water resources at the different levels, particularly in the context of climate change (CC). It examines how recent hydro-economic models (HEMs) address the uncertainty and risk factors associated with global climate change, providing a discussion on these latest advancements. The Water Evaluation and Planning model analyse the water resources with relate to economy. WEAP evolute the water economics from international, national, provincial, canal command area, and water course level. The demand economy at the water course levels is agriculture and domestics. Due to climate change, the crop water requirement is increasing, which increase the overall cost. On the other hand, the yield is severely effected. The farmer's economic severely disturbed due to climate change. WEAP can be use as tool for water policy assessment of Pakistan at different scales. The design catchment area generated for water course levels to estimate the key take ways of water economics. In conclusion, key challenges in hydro-economic modelling include accurately representing the water and food security, effectively capturing the micro-macro linkages and socio-economic and Numerical model components, and addressing uncertainties and risks associated with climate change within the analysis.

Keywords: Water Economy, Food Security, Water course, Water policy

Impact of Solar, Wind, and Bioenergy in Mitigating Climate Change with a Focus on Pakistan

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Abstract
The global reliance on fossil fuels has led to alarming increases in carbon dioxide emissions, accelerating the threat of climate change, particularly in vulnerable regions like Pakistan. As one of the countries most affected by climate-induced disasters, Pakistan faces extreme weather events, shifting agricultural patterns, and rising energy demands, highlighting the urgent need for sustainable solutions. Renewable energy sources, especially solar, wind, and bioenergy, offer a viable pathway towards reducing emissions and building a resilient energy infrastructure. In Pakistan, solar and wind energy are emerging as practical alternatives, supported by technological advancements and government initiatives. Bioenergy, derived from Pakistan's rich agricultural waste, holds untapped potential not only for energy generation but also for improving rural livelihoods. However, challenges such as energy storage, grid infrastructure, and intermittent supply persist, requiring strategic policy interventions. Pakistan has made significant strides in adopting renewable energy, with a notable focus on solar and wind projects in regions like Sindh and Punjab, which possess immense potential for harnessing clean energy. Currently, there are 36 private wind projects operating in Pakistan, producing approximately 1,845 MW of electricity. Similarly, solarization of tubewells, as well as houses is underway. The Government of Pakistan's renewable energy policy aims to generate 60% of the country's energy from renewable resources by 2030. Thoughtful management through innovation, local solutions, and international cooperation is essential to ensure the effective transition towards a sustainable, low-carbon future.

Keywords: Renewable Energy, Carbon Emissions, Solar Energy, Wind Energy, Bioenergy, Pakistan, Sustainability, Technological Advancements, Climate Change Mitigation, Low-Carbon Transition, Policy Innovation

Assessing the Impacts of Climate Change on the Distribution of *Juniperus excelsa* in Ziarat, Balochistan: A Predictive Study Using Ecological Niche Modeling

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Abstract

In recent years, the impact of global climate change on various terrestrial habitats, including the Ziarat region, has become increasingly evident, influencing their biological composition, temporal patterns, and spatial distribution. This study focused on assessing the effects of climate change on the geographic distribution of *Juniperus excels*a within the area and identifying priority habitats for protection against these changes until 2075. Employing the MaxEnt species distribution model, we analyzed two climate data series, GFDL-CM3 and MRI-CGCM3, based on scenarios RCP2.6 and RCP4.5 from the 5th IPCC report. Our results underscored the significance of factors such as elevation, minimum temperature during the coldest month, precipitation levels during the coldest quarter, annual mean temperature, and slope aspect in shaping the distribution of *Juniperus excelsa* within the region. Under the optimistic RCP2.6 scenario, both models projected an expansion of the species' habitat range. However, under the RCP4.5 scenario, the models predicted the potential loss of habitat in certain western and central areas of Ziarat by 2075 due to changes in climate parameters such as the minimum temperature during the coldest month and precipitation during the coldest quarter. The findings suggest that *Juniperus excelsa* in Ziarat may gradually migrate to higher elevations as a response to climate change. Field studies conducted to assess the results indicated that the outputs of the GFDL-CM3 model closely align with observed realities in the region. This study underscores the importance of proactive measures to safeguard the habitats of *Juniperus excelsa* in Ziarat against the adverse effects of climate change.

Keywords: Ecological Niche Modeling, Impact, Geographic distribution.

Theme III:

Value Chains, Marketing, and Entrepreneurship in Agribusiness

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Exploring the Role of Value Chains, Marketing, and Entrepreneurship in Agribusiness Development: A Comparative Study of Pakistan, India, and China (2010-2022)

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Abstract

This study delves into the dynamics of value chains, marketing, and entrepreneurship in promoting agribusiness development across Pakistan, India, and China from 2010 to 2022. The dependent variable, Agribusiness Development, is assessed through key dimensions such as revenue growth in agribusiness, the number of agribusiness startups, and market penetration in agribusiness products. The study focuses on five independent variables: Market Access, Entrepreneurship Index, Value Addition in Agriculture, Supply Chain Efficiency, and Access to Technology, each analyzed through distinct dimensions. Market Access is explored via distance to markets, export volumes of agricultural products, and digital marketing adoption. The Entrepreneurship Index is evaluated based on the number of new agribusinesses, the availability of venture capital for agricultural startups, and the survival rate of these startups. Value Addition in Agriculture is assessed through post-harvest processing levels, packaging and branding, and the export of value-added agricultural products. Supply Chain Efficiency is analyzed in terms of logistics infrastructure, cold storage capacity, and transportation costs. Lastly, Access to Technology is measured by the adoption of e-commerce, the use of agricultural machinery, and the prevalence of mobile payment systems in the agribusiness sector. Data was collected from reliable global sources, including the World Development Indicators (WDI), the International Monetary Fund (IMF), and the World Bank, to provide a comprehensive understanding of agribusiness trends in the three countries. The findings of this study reveal significant regional disparities in agribusiness development. China outperforms Pakistan and India in terms of Access to Technology and Supply Chain Efficiency, leveraging advanced logistics and digital platforms to boost its agribusiness sector. Pakistan shows considerable improvements in Market Access due to its increasing adoption of digital marketing tools and growing export volumes. India, on the other hand, leads in Value Addition in Agriculture, particularly in post-harvest processing and the branding of agricultural products, driven by government support and investment in agricultural startups. Overall, the study concludes that enhancing Market Access, fostering entrepreneurship, improving supply chain efficiency, and increasing technology adoption are key factors for agribusiness development in the region. These elements, if further optimized, can lead to stronger revenue growth, the proliferation of agribusiness startups, and deeper market penetration of agribusiness products, ultimately contributing to regional food security and economic resilience.

Keywords: Agribusiness Development, Value Chains, Market Access, Entrepreneurship Index, Value Addition, Supply Chain Efficiency, Access to Technology.

Determinants of Farmers' Adoption of Social Media Platforms Towards Mango Marketing: Insights from South Punjab, Pakistan

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Abstract
The adoption of new technologies and social media platforms has significantly transformed the marketing landscape, with the persistent rural-urban gap in technology usage prompting an investigation of farmers' decisions to adopt social media for marketing of mangoes. This study, using the extended Unified Theory of Acceptance and Use of Technology (UTAUT) framework, explores the factors influencing farmers' intentions to use social media for marketing purposes. Primary data was collected from 190 mango farmers in two districts of South Punjab, namely Multan and Muzaffargarh, through face-to-face interviews. The data was analyzed using Structural Equation Modeling (SEM) via SPSS and AMOS software. The findings indicate that access to information is crucial for making informed decisions, benefiting both technology providers and farmers alike.

Keywords: Farmers' behavior, Agricultural Marketing, Mango, Social media platforms, UTAUT.

Assessing Post-Harvest Losses and Causes: Implications for Competitiveness and Stakeholder Performance in Pakistan's Red Chili Value Chains

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Abstract
Reducing post-harvest losses is crucial for enhancing competitiveness, rural livelihoods, and food security in Pakistan's red chili value chain. These losses significantly impact the quantity and quality of chilies, diminishing market competitiveness and stakeholder performance. This study

addresses this gap by assessing post-harvest losses and identifying fundamental causes affecting competitiveness and performance in the value chain at various stages. 185 value chain actors, including growers, intermediaries, traders, processors, and exporters, were interviewed using structured questionnaires. The purposive sampling technique was used to collect data from the value chain actors on post-harvest management practices and post-harvest losses. The data collected included methods used at different stages, such as harvesting, drying, sorting, packing, transport, and storage, along with the percentage of losses and reasons for damage at each stage. The findings show post-harvest losses ranging from 15% to 30%, mainly due to labor-intensive methods, poor post-harvest practices, limited market access, and inadequate infrastructure. The most significant issue is food safety, particularly aflatoxins, which degrade quality and pose health risks. Smallholder farmers are especially vulnerable due to limited resources, financial constraints, and challenges meeting food safety standards, discouraging adopting improved practices. Based on the responses of the interviewed value chain actors, the study recommends improving market access and infrastructure to reduce losses, promoting technologies like mechanical drying, and educating value chain actors on aflatoxin control and proper post-harvest methods. Policies offering financial incentives for better practices are needed to increase the supply of high-quality chili. The study provides practical solutions to improve competitiveness and performance across the red chili value chain.

Keywords: Postharvest losses, Competitiveness, Implications, Stakeholders performance.

A Case Study of Karachi City: The Interplay Between Post-Harvest Diseases, Food Security, and the Banana Value Chain

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Abstract

Banana is a major fruit produced in Sindh, and Karachi, the capital of Sindh and Pakistan's most populous city, is a major banana consumption center. Its post-harvest losses are a significant concern since they result in considerable fruit loss and threaten food security. A survey of 200 respondents, including 150 retailers and 50 wholesalers/ripening store owners, was conducted in major markets in Karachi City. The respondents were randomly selected, and information on post-harvest handling and marketing practices was collected through structured questionnaires. The SPSS software version 28 was used for data analysis. The results showed that the value chain had

32 percent overall post-harvest losses. Out of 32 percent, Retail accounted for 62.6 percent of total losses, while wholesalers/ripening stores accounted for 37.4 percent. Mechanical damage, inappropriate transportation, insufficient post-harvest handling, packaging, and storage were the leading causes of banana loss at the wholesale level. At the retail level, fruit rotting, improper ripening, mechanical damage, and environmental effects were the leading causes of losses. In addition, critical post-harvest diseases like anthracnose, cigar end rot, and crown rot were identified to substantially impact the quality and marketability of bananas in the markets of Karachi. The relationship between post-harvest diseases, food security, and the value chain is clear since losses of up to 32 percent reduce the supply of high-quality bananas and threaten the food security of consumers who prefer this fruit. A significant lack of awareness among responders about appropriate fruit-handling methods worsens the situation. This study suggested that improving knowledge and training on the significance of appropriate post-harvest handling procedures and sufficient packing across the value chain is crucial for reducing post-harvest losses and enhancing food security in the banana value chain in Karachi city.

Understanding the complexities of pomegranate value chain system in South Punjab, Pakistan

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Abstract

This study explores the dynamics of the pomegranate value chain system in South Punjab, Pakistan, by examining the roles and challenges faced by various actors, including farmers, pre-harvest contractors, wholesalers, retailers, and consumers. Pomegranate cultivation has emerged as a promising solution for managing soil salinity, allowing the crop to thrive in saline lands and offer a sustainable income source for local farmers. The research assesses how best practices—such as pre- and post-harvest interventions—implemented through research approaches have improved product quality and supported market expansion. Consumers prioritize cleanliness, freshness, color, packaging, and variety, while middlemen often focus on more immediate commercial gains. This disparity highlights the need for improved communication across the value chain to align production with market demands. Retailer insights also provide a clearer

understanding of how pricing, accessibility, and product quality influence consumer behavior and satisfaction. The study further identifies key challenges, such as poor information flow, weak market linkages, limited awareness of standardized practices, and gaps in pest management techniques, all of which contribute to post-harvest losses and reduced product value. By emphasizing the importance of sustainability and efficiency, the research advocates for improved connections between value chain actors, better knowledge dissemination, and enhanced market infrastructure. Overall, the findings suggest that aligning value chain activities with consumer preferences can significantly boost pomegranate quality, reduce losses, and increase profitability for all stakeholders involved.

Keywords: consumer satisfaction, Quality perception, Market linkages, Sustainable practices, Post-harvest losses, Profitability.

Value Chain Governance Impacts Sustainable Agriculture: The Case of Potato Growers in Pakistan

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Abstract

Value chains in the agricultural sector that must get food products from remote farms to customers are much more complicated than in many other economic sectors. A major challenge is that the farming industry is more closely related to society, the economy, and the environment. The agricultural value chains are more complex than those of non-food industries due to the nature of the products and needed GAP. To navigate these challenges, agri-food customers (processors and supermarkets, etc.) established Value Chain Governance (VCG) structures, such as formal contracts, to meet their requirements. This study examined that the growers operating under a formal VCG structure in the potato industry of Pakistan, are efficiently using farm inputs by implementing GAP procedures and eliminating farm-level waste and pollution to protect the environment. According to this study, growers who employ formal VCG are more likely to promote sustainable agriculture than those who use the traditional marketing system. The study proposed that growers encourage formal contracts with their buyers to revamp farm-level agricultural practices and increase profitability.

Keywords: Traditional marketing system, GAP, environmental compliances,

Innovative Value Chain Practices in Fresh Produce Distribution: A Case Study of S. Katzman Produce

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Abstract

This study investigates the value chain mechanisms employed by S. Katzman Produce, a major player in New York's fresh produce market, to enhance efficiency and differentiation in a highly competitive sector. Using qualitative interviews with key stakeholders at S. Katzman, the research examines the company's value chain operations, including procurement, cold chain logistics, inventory management, and customer engagement. A particular focus is placed on how S. Katzman navigates supply chain complexities, manages perishable goods, and maintains competitiveness through innovation and strategic partnerships. The results indicate that S. Katzman's integration of advanced cold chain technology, combined with real-time supply chain data analytics, has significantly improved the shelf-life of perishable products, minimized waste and optimizing inventory turnover. The company's strategic partnerships with global suppliers, enhanced by sophisticated forecasting methods, enable it to mitigate risks associated with market volatility and seasonal fluctuations. Furthermore, S. Katzman's ability to dynamically adjust procurement and distribution processes based on live market data has led to a 20% improvement in operational efficiency and a 15% reduction in supply chain costs. These innovative practices not only ensure high product quality but also strengthen relationships across the value chain, from growers to retail clients. The study concludes that the adoption of advanced logistical systems, real-time market intelligence, and strategic supply chain partnerships are critical for enhancing the resilience and efficiency of fresh produce distribution systems. These findings offer valuable insights for emerging economies, where improving value chain activities can play a pivotal role in ensuring food security, reducing post-harvest losses, and fostering sustainable market growth.

Key Words: Fresh Produce Value Chain, Cold Chain Logistics, Supply Chain Innovation, Food Security

Pakistani consumers online purchase intentions: Theoretical consideration and Application

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Abstract

Pakistan has seen a considerable increase in e-commerce adoption, with an increasing proportion of consumers using online platforms. The shift in consumer behavior has prompted experts to explore factors affecting Pakistani customers' online buying intentions, which is vital for firms aiming to develop strategies and leverage digital opportunities. Current study explores the decision-making process when individuals already have an interest and desire to engage with a product or brand. The study's target population consists of Pakistani social media users, with data collected through a self-administered survey of 315 participants. The fundamental premise in the research is the notion of the Theory of Planned Behavior, employing descriptive and hypothesis-testing quantitative analysis. A multi-analytic approach, combining structural equation modeling and network analysis, is used to identify and evaluate key determinants and their relative importance. It examines the relationships between purchase intentions, attitudes, subjective norms, perceived behavioral control, perceived risk, compatibility, and ease of use. This research investigates the impact of past online shopping experiences on consumers' online purchase intentions and assesses post-purchase satisfaction and dissonance. The findings provide insights into how online purchasing aligns with current consumer behaviors and how individuals express interest in online shopping.

Keywords: Theory of Planned Behavior, Perceived Risk, Compatibility, Ease of Use

Value Chain Analysis and Marketing Opportunities of Dates in District Panjgur Balochistan

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Abstract

Date is the important cash crop for Pakistan's agriculture sector. Therefore, the cultivation of date palm is a major source of revenue for the rural Makran Division residents. Due to poor marketing structure and post-harvest losses the quality and prices are compromised. The study aims is factors

affecting the production of date in study area. To identify the existing value chain practices and the economic value (losses) distributed in the value chain, and also suggest policy intervention to enhance the development of the sector. Through convenience sampling, data were collected from 61 date farmers, 8 processer, 11 wholesalers, 11 retailers, and 30 consumers in Panjgur, Balochistan. For this purpose, the SPFF was employed to find factors affecting the production of dates. The results show Soil Fertility, irrigation, fertilizer, and pollination statistically significant positives affect the production of dates and also 85 % date farmer are efficient. Further, the profitability shows of farmers range from Rs. 22,343 to Rs. 169,123 per acre, while processors, wholesalers, and retailers, profit margins range from Rs .2, 573 to Rs. 5,505, Rs. 182 to Rs. 527, and Rs. 570 per Munds, respectively. Date palm production has potential for farmers income is the study area. The future research should focus on the development of marketing strategies and post-harvest management practices.

Keywords: Date Production, Value Chain Analysis, Marketing Opportunities, Sustainable development and Balochistan

Identifying Supply Chain Model for Apricot and Cherry Farms in Gilgit-Baltistan

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Abstract

This study investigates the supply chain model for apricot and cherry farms in Gilgit Baltistan, focusing on the role of technology, processing, packaging, and distribution in enhancing supply chain efficiency. Data was collected through qualitative interviews and quantitative surveys with key stakeholders, including producers, processors, and distributors. The findings indicate that advanced packaging methods and cold storage technologies significantly reduce spoilage and extend the shelf life of apricot and cherry products, while optimized distribution strategies improve market access. However, limited access to these technologies and inadequate infrastructure, particularly in remote areas, remain major challenges. Addressing these issues can improve the market position of apricot and cherry growers, meet consumer demands for quality and affordability, and contribute to the sustainable growth of agriculture in the region. The study concludes that targeted investments in processing and packaging technologies, along with improvements in distribution networks, are essential for increasing the competitiveness and sustainability of the apricot and cherry supply chains in the region.

Keywords: Supply Chain Efficiency; Technology Integration, Processing Innovations, Packaging Solutions, Cold Storage Technologies, Distribution Optimization, competitiveness.

Statistical Modelling of Agribusiness Growth in Emerging Economies

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Abstract

Agribusiness is one of the major stimuli for developing countries' economies, given the high value added both to the GDP and jobs, especially in rural areas. Value chains, marketing strategies, and entrepreneurial innovations are the critical determinants of the agribusiness sectors of such an economy. Thus, it becomes easier to model statistically the changes and behaviour that development assumes in current modernization under principles of market accessibility, supply integration, and entrepreneurship in agribusiness. The objective of the paper is to apply statistical models in order to demarcate the growth patterns of agribusiness in emergent economies. Regression analysis, time-series forecasting, and econometric modelling will be used for the analysis of growth in agribusiness. In this respect, the main indicators will involve production output, infrastructure, access to markets, and entrepreneurial activities. This information will be retrieved from national agricultural reports and business surveys, along with international trade databases. However, barely any has been conducted within the context of an emerging economy. The statistical model indicated that integration of value chains and market access is positively related to agribusiness growth; the $r = 0.65$ and $r = 0.71$, respectively. It has also been ascertained thereby that entrepreneurial activities account for 28% of growth variance and therefore are crucial in the introduction of innovation into the development of the agribusiness sector of any economy. The model sums up that 72% of the variation in the growth of agribusiness is related to efficient value chains and accessible markets as a driver of economic growth. A major drawback of the current research is a general lack of good-quality data, particularly from rural areas dominated by informal markets. Still, other directions for further research will be toward the improvement of methods of data collection techniques and machine learning approaches for the purpose of making more accurate predictions. Deeper analysis of policy measures concerning access to markets and the integration of value chains shall be vital in outlining how this growth of agribusiness may be sustained within the economies of developing countries.

Keywords: Agribusiness, Emerging Economies, Statistical Modelling, Value Chains, Marketing, Entrepreneurship

Digital Marketing Strategies of Agriculture Products in Pakistan

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Abstract

The agriculture sector is the most important sector of the economy that can help in alleviating poverty and supporting human development in Pakistan. Most of the population of Pakistan directly or indirectly depends upon agriculture sector. Agriculture plays a vital role in the Gross Development Products (GDP) and in the foreign source of income. The purpose of this research is to study the factors (education, digital instruments skills, internet skills, internet access, E-agri markets and government support,) which are influencing the scope of electronic business in agriculture sector of Punjab, Pakistan. This research is associated with a Pulses value chain project funded by ACIAR. This research was conducted in the region of district Bhakkar and Chakwal of province Punjab which is a rich agricultural land with pulses (Mungbean, mash bean, lentil, and chickpea) cereal etc. The targeted population was the District Bhakkar and Chakwal farmers. The data was collected through questionnaires and interviews. The sample size was 150 and the population is divided into two districts. 70 farmers from Bhakkar and other 80 farmers from Chakwal. Stratified random sampling method was used. Data was analyzed through SPSS. This study presents results by using binary logistic regression model for analysis of farmers willingness to adopt digital marketing. Surprisingly the data analysis had shown significant effect of factors on the E-agriculture business except government support. This study concluded that the respondents in the represented study mainly farmers were willing to adopt the digital marketing of pulses. The most important is government support or training centers can change the trend of traditional agriculture business to electronic agriculture business. These results are beneficial to develop appropriate policy measures by the Government as well as guide the farmers and traders to implement effective marketing strategies to meet the farmers' needs in the e-commerce era.

Keywords: Digital marketing, Pulse farmers, online marketing, Internet skills, E-commerc

Social Capital and Entrepreneurial Intentions among Women Farmers in Punjab, Pakistan

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Abstract:

Entrepreneurship is an important driver of economic development, innovation, economic competition, and social mobility in societies, particularly in rural areas. Women business owners are regarded as successful business owners due to their intense drive, and capacities for efficient economic growth. However, women are tied up with strong social and cultural norms in society which may hinder them from achieving their aim to be entrepreneurs. Social capital theory underpins the essential elements of social capital prevalent among rural women, such as trust, social networks, norms, and cooperation. This study investigated women's intention to engage in entrepreneurial activities by analyzing their entrepreneurial intention in the light of social capital theory. A mixed methodological approach was adopted to collect data from pulse production regions. For this purpose, data was collected through a purposive sampling technique from 120 rural women of Punjab province. Qualitative techniques guided the key factors affecting rural women in generating new businesses, which were further explored using the order probit model to assess the direct effect of social capital on women's entrepreneurial intentions at the community's wider level. The results showed that participation in the local community (PLC) and feelings of trust and safety (FTS) significantly increased the intention of rural women. Furthermore, content analysis was employed to analyze the barriers and opportunities for entrepreneurship among women in the rural community was also identified through semi-structure interviews, which shows that Participation in the local community (PLC), perceived self-efficacy and perceived desirability (PDE) are the opportunities for rural women who have intended toward business. The findings suggested that entrepreneurship programs in rural communities can be successful and more effective if the development agencies focus on neighbourhood connection and friend and family support.

Keywords: Entrepreneurial Intention, Rural women, Social Capital, Local economic development.

Analysis of domestic goods transport and logistics dynamics within the agricultural supply chain in Pakistan

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Abstract

For adequate farm management and an efficient value chain approach, properly managed transportation is the key element. Transport plays a very important role in every industry including

agriculture. In Pakistan fruit and vegetables are being transported to the city centers, i.e., Fruit and Vegetable Markets every day from the remote/rural area and sometimes from the other provinces, where it is sold out through the process of open auction. Hence, transportation also plays an important role in the competitive prices of fruit and vegetable commodities. A slight delay of the commodities in the market distorts the supply/arrival in the market and causes price fluctuations. Therefore, it is imperative to explore the relationships/role of transporters with the other stakeholders of the value chain. Another aspect of the study was to highlight the issues of post-harvest losses because it is reported in the literature that almost 25-30 percent of post-harvest losses occurred in fruit and vegetables. Therefore, it is again needed to explore the quality of transportation facilities. For the reasons recorded above the said study was carried out using – at first, a desk review and secondary sources about the overview of the sector. Secondly, to delve into the highlighted issue a field survey was carried out in the seven major Markets of Punjab. A sample of at least three and maximum transport companies was interviewed. The results of the Logistic Performance Index (LPI) showed that Pakistan is only above Afghanistan in the region stating the poor condition and it is ranked 122 out of 160 countries in the International LPI results. The results of the field survey showed that in the agriculture supply chain, only 1% of reefers were used during transportation most of the transport facilities are traditional trucks. It was found that the transportation sector is governed by the commission agents having an indication of manipulation of the supplies in the market for price determination. The results of the study showed interesting facts to be noted by the policymakers that can support the development of the industry in Punjab and enhance the overall productivity and profitability of the agricultural sector in Pakistan.

Keywords: Agricultural supply chain; transportation; logistics; post-harvest losses; value chain development

Nexus between Strategic Entrepreneurship and Herd Size Expansion: A Study on Efficient Entrepreneurial Approaches in the Livestock Sector of Pakistan

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Abstract

This study aims to examine the role of strategic entrepreneurship in dairy business in the Southern region of Punjab, Pakistan. Utilizing primary farm-level data (n=273) of dairy farmers, we employ

ordered probit models. Our findings indicate that some farms and farmers related variables (agricultural extension services, age, availability of milking machine, exclusive adoption of expansion and diversification entrepreneurial strategy, involvement of spouse in dairy farms activities, use of silage feed, and use of meat production techniques), influence the farm size. From a policy perspective of these variables, the imperative policy option appears to be creating an efficient entrepreneurial environment (exclusive adoption of expansion and diversification entrepreneurial strategy by the dairy farmer), coupled with the adoption of modern farming technologies (milking machine and silage feed). Additionally, access to agricultural extension services to dairy farmers is likely to support the development of dairy sector in developing countries.

Keywords: agricultural extension services; classification of dairy farmers; diversification entrepreneurial strategy; expansion entrepreneurial strategy; modern farming technologies

Investigating Young Consumers Attitudes towards Food Waste Reduction: Key Insights and Lessons Learned

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Abstract

Food is always being a necessity of life as it's not a matter of greed or taste. Food waste is defined as the portion of digestible food that is not consumed and contains material for human consumption that is subsequently lost, polluted, degraded, or discarded. It has been noticed there is an enormous amount of food available, which has led to an increase in food waste behavior by all individuals but in recent years technological advancement has been incurred. This research aims to understand young consumer perception about the food waste and to analyze dynamics which affects the young consumer attitude towards food waste. We will propose an integrated theoretical framework that considers social, behavioral, psychological, and economic factors. As a basis for this framework, could be used structural equation modelling (SEM) and logistic regression approaches for estimating how socio-psychological drivers influence young consumers' attitude towards minimizing food losses. The primary data will be collected from three districts of South Punjab as Multan, Bahawalpur and Khanewal using stratified random sampling technique with equal

allocation. The targeted people are students of universities of given districts. This study aims to identify local priorities and knowledge bases, facilitating the development of appropriate and viable solutions that enhance the subjective well-being of consumers. By understanding the specific context and needs of the community, the research seeks to ensure that pragmatic interventions are both relevant and effective.

Keywords: Young consumers, food waste reduction, subjective well-being, pragmatic interventions

Agroecology and Sustainable Farming for Food Security

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Abstract

Agroecology is a comprehensive framework that integrates a transformative approach to agricultural sustainability and resilience. Considering multiple global crises including COVID-19 pandemic, climate change and geopolitical tensions, agroecology emerges as a promising pathway to enhance food security, especially for small-holders who face heightened vulnerabilities. The studies examined here reveal agroecology's multifaceted benefits, from improving biodiversity and soil health to supporting community well-being and economic viability. Notably, agroecology's principles, grounded in diversity, nutrient cycling and ecosystem services are shown to reinforce the resilience of agricultural systems across different scales. Agroecology's success as a mainstream model will require an integrated, multiscale approach that aligns scientific, technological, and policy innovations with economic incentives for farmers. By leveraging new technologies like digital tools and improved crop varieties, agroecology can adopt to the evolving demands of global food systems. It also supports the key sustainability goals, viz; zero hunger and climate action, through diversified practices including poly cropping, agroforestry, and resource efficient methods that reduce pollution and water use. The research emphasizes underscore agroecology's potential not only to sustain food production in the face of growing populations but also to foster a regenerative, climate-resilient agricultural future.

Keywords: Agroecology, sustainable development goals (SDGs), poly cropping, economic viability and sustainable agriculture.

Evaluation of Marketing Management Strategies in Sustainable Meat Production through SWOT Analysis

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Abstract

In recent years, several reports have been published highlighting the negative environmental impacts of meat production, particularly its significant contribution to greenhouse gas emissions and climate change. In addition to the high-water consumption required in the production process, the waste generated by cattle and other farm animals is also considered a major environmental concern. These issues are seen as key obstacles in achieving the sustainability of meat production.The aim of this study is to evaluate marketing management strategies for ensuring the sustainability of meat production, which plays a crucial role in meeting the protein needs of the population in the context of food access, balanced, and adequate nutrition. The evaluation is conducted using SWOT analysis. To this end, in-depth interviews were conducted with producers in the Kırşehir province of Turkey, and fieldwork was carried out with 38 participants. The collected data were digitized and analyzed, leading to the identification of key findings and the creation of a SWOT matrix that highlights the strengths, weaknesses, opportunities, and threats associated with the sustainable production of meat.The findings suggest that breeding high-quality, genetically strong livestock breeds is essential for the sustainability of meat production. Furthermore, the establishment and widespread adoption of modern farms designed with smart systems, as well as improving the tracking of herds and enhancing waste management, are identified as critical strategies for sustainability. The study also indicates the need to promote the production of roughage in the region. Moreover, it emphasizes the urgency for policymakers to take immediate action to address water scarcity and mitigate the adverse effects of climate change, particularly in relation to drought and access to water resources.Another significant issue identified in the study is the ongoing decline in the number of female livestock, which is perceived as a major threat to future meat production due to the potential difficulty in sourcing breeding stock. This situation raises concerns that the country may shift towards an import-dependent meat production policy. Additionally, this trend has been observed to push farmers towards exploring alternative agricultural activities.In conclusion, the findings of this study underline the significant responsibilities of policymakers, civil society organizations, and academics in the field.

Implementing effective marketing strategies for sustainable meat production is crucial not only for reducing environmental impacts but also for ensuring the economic sustainability of the sector.

Keywords: Sustainability, Marketing Strategies, SWOT Analysis, Livestock Farming

Digital Marketing Strategies of Agriculture Products in Pakistan

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Abstract

The agriculture sector is the most important sector of the economy that can help in alleviating poverty and supporting human development in Pakistan. Most of the population of Pakistan directly or indirectly depends upon agriculture sector. Agriculture plays a vital role in the Gross Development Products (GDP) and in the foreign source of income. The purpose of this research is to study the factors (education, digital instruments skills, internet skills, internet access, E-agri markets and government support,) which are influencing the scope of electronic business in agriculture sector of Punjab, Pakistan. This research is associated with a Pulses value chain project funded by ACIAR. This research was conducted in the region of district Bhakkar and Chakwal of province Punjab which is a rich agricultural land with pulses (Mungbean, mash bean, lentil, and chickpea) cereal etc. The targeted population was the District Bhakkar and Chakwal farmers. The data was collected through questionnaires and interviews. The sample size was 150 and the population is divided into two districts. 70 farmers from Bhakkar and other 80 farmers from Chakwal. Stratified random sampling method was used. Data was analyzed through SPSS. This study presents results by using binary logistic regression model for analysis of farmers willingness to adopt digital marketing. Surprisingly the data analysis had shown significant effect of factors on the E-agriculture business except government support. This study concluded that the respondents in the represented study mainly farmers were willing to adopt the digital marketing of pulses. The most important is government support or training centres can change the trend of traditional agriculture business to electronic agriculture business. These results are beneficial to develop appropriate policy measures by the Government as well as guide the farmers and traders to implement effective marketing strategies to meet the farmers' needs in the e-commerce era.

Keywords: Digital marketing, Pulse farmers, online marketing, Internet skills, E-commerce

Theme IV:

Outreach, Agricultural Extension and Continuing Education

2nd International Conference
Food Security and Value Chain Systems:
Challenges and Opportunities in Emerging Economies
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Factors Influencing Agricultural Knowledge Dissemination: A Comparative Study of Pakistan, India, and China (2010-2022)

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Abstract

This study examines the factors influencing Agricultural Knowledge Dissemination across Pakistan, India, and China from 2010 to 2022, utilizing data from the World Development Indicators (WDI), the International Monetary Fund (IMF), and the World Bank. The dependent variable, Agricultural Knowledge Dissemination, is evaluated through three dimensions: the number of farmers trained, the adoption rates of new techniques, and farmer awareness of market trends. The independent variables include Agricultural Extension Services, which are measured by the number of extension workers, the frequency of farm visits by experts, and access to agricultural helplines. The second variable, Educational Programs for Farmers, focuses on the availability of vocational training programs, farmer literacy rates, and participation in continuous education workshops. Technology Transfer in Agriculture is assessed using ICT tools in farmer training, mobile app usage for agricultural advice, and government technology transfer programs. Another critical variable, Government Agricultural Policies, examines subsidies for education programs, policies for extension worker recruitment, and public-private partnerships in agricultural education. Finally, Access to Agricultural Information considers the internet penetration in rural areas, availability of farmer-friendly publications, and the use of radio/TV programs for farmer education. The findings of the study reveal that Educational Programs for Farmers and Technology Transfer in Agriculture have a significant positive impact on the adoption rates of new techniques, especially in China, where ICT tools play a critical role. Agricultural Extension Services are more effective in Pakistan and India, where frequent farm visits increase farmer awareness. The study highlights the need for strengthening public-private partnerships and improving internet penetration in rural areas to enhance agricultural knowledge dissemination across these countries.

Keywords: Agricultural Knowledge Dissemination, Agricultural Extension Services, Educational Programs, Technology Transfer, Government Policies, Access to Information

Empowering Voices, Shattering Boundaries: Feminist Perspectives on Shafaq's 10 Minutes and 38 Seconds in this Strange World

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Abstract

Postmodern feminism is basically a theoretical perspective to destabilize the patriarchal norms entrenched in the society that have led to gender inequality by rejecting essentialism, philosophy and universal truths in favour of embracing the differences that exist amongst women. This theoretical perspective celebrates the notion of inclusion of multiplicity and demonstrates that not all the women are same. The purpose of the current research is to conduct a thorough and concise analysis of the various patriarchal and social barriers that are challenged by *Shafak* in *10 Minutes 38 Seconds in this Strange World* through the theoretical perspective of postmodern feminism. For fulfilling the purpose of this research, the researcher has opted for the qualitative research approach and descriptive textual analysis based research design is adopted for analysis of the data. The study basically focused on the various societal, patriarchal and religious barriers that are challenged by *Shafak* in her selected novel. For methodological framework the researcher has drawn from the works of *Jane L. Parpart (1993), Linda J. Nicholson & Nancy Fraser (1990)* and *Bell Hooks (2000)*. The analysis of the selected novel revealed that *Shafak* has elaborately presented the plights of Eurasian patriarchal societies where women are allowed little recognition as individuals. They are defined in relation to their male members (to whom they belong). Moreover, the patriarchal males manipulate culture, society and religion for maintaining their hegemony over women. The conclusion of the study logically supplicates that Shafak challenges and shatters all such patriarchal, religious, political, ideological and societal barriers which subjugate the Eurasian women and her female characters neither remain invisible nor silenced.

Keywords: Post-modernism, Feminism, Descriptive Textual Analysis, Post-feminism, patriarchy, Othernes, Liberation, Equality.

Role of Agricultural Extension for the Sustainable Development of Livestock Sector in the Punjab, Pakistan

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Abstract

Livestock sector is of paramount importance on accounts of its positive impact on poverty alleviation and economic growth in the Punjab, Pakistan. It contributes significantly in the GDP. Most of the livestock farmers are not harnessing its potential economic gains due to number of challenges including lack of development of new breeds of animals, unbalanced nutrition and diet, lack of proper animal health care and use of conventional methods of rearing of livestock animals. Agricultural extension agents need to focus on the fodder crop varieties especially suitable for fodder scarcity during the dry season. Conventional top-down agricultural extension services are unable to help boost the fodder crop production; therefore, participatory learning techniques should be applied in the Farmers' Training Programmes (FTPs) of the agricultural extension department. Agricultural extension and livestock extension departments can also train the farmers as a joint venture regarding animal health care as well as extending the latest fodder crop production technologies. The agricultural exhibition is the best source of knowledge both for farmers and agricultural extension agents. It may enhance the capacity of the livestock farmers for selecting the better breeding stocks suitable for further propagation. Participatory techniques on vaccination and other medical services for livestock animals by livestock professionals should also be incorporated in Farmers' Training Programmes arranged by the agricultural extension department so as the livestock farmers can protect their animals against various epidemics and common diseases. The training of livestock farmers on value addition of livestock products is imperative for the sustainable development of this sector.

Keywords: Livestock, Extension, Sustainable development.

A Critical Analysis of Smart Farming and its Challenges in the Developing Countries

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Abstract

Modern technologies are being used to incorporate the challenging threats like rapid changes in climate, fast growing hunger and food insecurity in developed countries. Presently, societies are facing more crucial, threatening and challenging situations than ever before and which can not be solved without the innovative solution like the use of different kinds of technologies. In this perspective smart farming is a recent concept in modern farming. Smart farming is a modern agricultural practice which uses the latest technology and data analysis to get potential yield,

reduces waste risks and promotes sustainable agricultural practices. The collected data with the help of sensors, GPS, drones' satellites imaging, micro control and other modern technology help to make decision on planting, harvesting, irrigating, water management, applications of fertilizers and pesticides and crop monitoring and management. Smart farming assists the farmers to analyze the present state of crops, livestock and poultry farming and, in this way, it enhances the farming productivity and simplifies the farmers' work. Moreover, it is an eco-friendly solution which is also involved in the feedback for the management of agricultural systems and sustainable rural development. Although smart farming is a step towards precision agriculture, and it could be the best solution by using artificial intelligence for the sustainable agricultural development, but it is not adopted commonly in developing countries due to number of challenges. These challenges involve limited access to technology and internet availability in rural areas, lack of training regarding the use of advanced technology, high cost of smart farming infrastructure, small landholding, inadequate extension services, shortage of energy, limited credit, language barriers and climate change and etc. Public-private partnership and collaborations can invest on digital infrastructure and encourage the farmers through supportive policies and framework.

Keywords: Smart farming; challenges; sustainable development; precision agriculture; artificial intelligence

Core Competencies Based Continuing Professional Development of Agricultural Extension Agents: Implications for Smallholder Farmers' Food Security in Pakistan

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Abstract

Public sector Agricultural Extension and Advisory Service (AEAS) has been instrumental to food security of small landholder farmers in the entire world and Pakistan is no exception. The working of public AEAS has consistently been perceived as partially effective. One of the factors that can be attributed to this partial effectiveness of AEAS is the low competence level of Frontline Agricultural Extension Agents (FAEAs). Empirical evidence have established that in- service trainings are pre-packaged and are being imparted without need assessment of FAEAs. These in-service trainings mostly focus on technical skills (technical competencies) but not on process/soft

skills (professional competencies). Moreover, the curricula of pre-service training at under-graduate and post-graduate level of FAEAs (with exception of FAEAs having specialization in Agricultural Extension discipline) focus least on process/soft skills. Core competencies (combination of both the technical and professional competencies) are basic sets of skills, knowledge, abilities, and behaviors that FAEAs require to perform their job tasks well. Continuing Professional Development (CPD) is a strategic tool used for core competencies-based learning of FAEAs for their personal, professional, and career enhancement through formal, workplace-embedded, and self-directed informal CPD practices while executing their professional roles in order to address demand-driven agricultural extension needs of their clienteles throughout their working span after joining the profession. Hence, core competencies based Continuing Professional Development of FAEAs is indispensable.

Keywords: Competencies, Continuing Professional Development, Extension

Exploring the Importance of Continuing Education in Agricultural Extension in the Punjab, Pakistan

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Abstract

The importance of continuing education cannot be denied in agricultural extension as it plays pivotal role in assisting farmers to understand the complexities of modern agriculture. It is also empowering the agricultural extension agents to approach and bridge the agricultural researcher and farmers. Presently, the agriculture sector is facing several challenges including major low crop yield, small piece of land, shortage of water, lack of education, climate change and traditional cropping methods resulting in low income. Continuing education can enhance the knowledge and skills of farmers, extension agents and rural communities to compete with the modern agricultural challenges. Trained and updated farmers have better decision-making power, and they can cope with modern agricultural challenges. Farmers can be trained and equipped with practical based research which is truly their assistance in enhancing their crop yield with the available resources. The farmers can be provided productive agricultural information and educate regarding sustainable agriculture and entrepreneurship through continuing education. Moreover, it has the potential to

improve the crop yield and quality, increase the adoption of climate resilient agricultural practices, better management regarding food security and water, improve the livelihood and income of the rural community. Continuing education can be provided through face to face, online classes, result and method demonstration, participatory learning techniques, workshops, training programs, print and digital media and mobile based extension services. Although there are some major challenges to continuing education including limited resources, accessibility issues, quality and relevance of continuing educational programs, language and cultural barriers but the opportunities like digitalization, public private partnership, collaborative research and innovation and supportive policies are the hope. Farmers organizations, extension agencies, non-governmental organizations (NGOs) and the private sector should provide need-oriented continuing educational programs to farming communities.

Keywords: Continuing Education; Agricultural Extension, Challenges; Opportunities; Climate

Wheat Growers' Competencies and Agriculture Extension Service provided regarding Climate Smart Food System: Empirical Evidence from Selected Areas of District Chakwal

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Abstract

The issue of feeding an expanding global population and climate changes has led to the development of climate-smart food system (CSFS). Wheat is an important crop in the system (CSFS), and it is a staple food in Pakistan, and an important component of the daily diet and economy. The district of Chakwal is a significant contributor to Pakistan's wheat production, but the ability of its wheat growers to adopt climate-smart agriculture practices was questionable and agriculture extension service provided by public sector, aligns the specific need or not, this was also a question mark. The aim of this research was to assess the competencies of wheat growers focusing on their knowledge, skills, attitude and practices related to climate-smart food system and to assess the effectiveness of agriculture extension service provided in district Chakwal. Quantitative research methods were used, including collection and analysis of data from the respondents in the target district. Multi-stage sampling technique was used to select respondents (wheat growers) for the survey. Data was analyzed using the Statistical Package for Social Sciences (SPSS). The findings revealed that the respondents exhibited positive attitude towards CSFS, with a mean score of 3.68. The knowledge level of wheat growers was moderate, with a mean score of 2.80. In terms of practical skills, the respondents demonstrated medium level competency, with a mean score of 3.08. The agriculture extension service had a significant impact in enhancing wheat

grower's competencies regarding climate-smart food system (CSFS), as indicated by a mean score of 3.72. Although gaps such as economic incentives, lack of research on CSFS, and limited resources (with mean score of 5.0, 4.74, and 3.49 respectively) were identified. Opportunities for enhancing CSFS adoption were perceived through technological support and government partnerships with mean score of 4.5 and 4.0 respectively. The potential for employment opportunities and market diversification were noted. The findings underscored the importance of targeted interventions to address knowledge gaps, enhance skills, and overcome barriers to the adoption of CSFS in the study area. So that the issues of food insecurity and climate change can be addressed.

Keywords: Competencies, wheat growers, climate smart agriculture, climate smart food system, climate change, food security, agriculture extension service.

An Analysis of Knowledge, Skills and Attitude of Rice Growers regarding Pesticide and Weedicides Use for Sustainable Agricultural Development in District Sheikhupura, Punjab, Pakistan

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Abstract

Rice is one of the economically viable crops in Pakistan. The Punjab province produces 70% of the total rice in the country due to the conducive environment for rice cultivation. The obtained production is less than the potential yield pertaining to various plights like the outbreak of insects, pests and diseases and the farmers' inadequate knowledge, attitude and skills to cater to insects, pests and weeds driving into sustainable rice production. Pertaining to poor knowledge of rice growers, sustainable production is often delved into excessive use of pesticides, increasing the cost of production and endangering the ecosystem. Therefore, this study was designed to analyze rice growers' knowledge, skills and attitude regarding pesticides and weedicides use for sustainable agricultural development in district Shiekhupura, Punjab, Pakistan. The research population comprised 44453 rice growers and 381 respondents were selected at random by using the online website www.surveysystem.com at a confidence level of 95% and confidence interval of 5. The study district, shiekhupura consists of five tehsils thus proportionate sampling technique

was used to select respondents from each tehsil. This study adopted cross-sectional research design. A pre-tested and validated interview schedule was used to collect data from the selected respondents. The statistical package for Social Sciences (SPSS) was used to analyze the collected data. Both descriptive and inferential statistical techniques were used for data analysis. The descriptive technique, frequencies, percentages, means and standard deviation were generated to describe the variables. Inferential statistics, binary logistic regression analysis and Pearson correlation, were applied to determine the relationship between dependent and independent variables. Results indicate that 58.5% of respondents were aged between 36 to 50 years. One-fourth (25.2%) of the respondents were considerably old (>50 years), regarding education, 63.7% respondents were literate while 18.6% were above matriculation, 60.1 and 28.3% were living in a joint and nuclear family, respectively. Forty percent were large farmers (>25 acres) and 38.8% had 12.5-25 acres of land. More than half (54.1%) of respondents had an annual income of less than Rs. 5 Lac and 28.3% had a yearly income of Rs.10 Lac. The knowledge of rice growers regarding prices of pesticides and weedicides with a mean value of 2.30 was rated as important but inclined towards very important. A vast majority (82.2%) of the respondents had knowledge of avoiding from smoking during the handling of pesticides and weedicides. Majority (64.6%) of the respondents had knowledge about the storage of pesticides and weedicides in their original containers. The respondents had training needs from agricultural equipment dealers which were ranked at 1st having weighted score of 1148 and mean value $\bar{x}$=3.01 showing the training needs as medium, tending towards high. Training needs of rice farmers regarding pesticides and weedicides application for cleaning equipment and containers were ranked at 1st, having weighted score of 1253 and the mean value ($\bar{x}$=3.29) showing the training needs of respondents as medium, leading towards high. The rice growers' news personal protective equipment (PPE) such as goggles' (73.2%), face masks (66.1%), trouser suit/long suit (66.7%) and long shoes (65.4%). The attitude of rice growers regarding empty containers or packs for reusing for the domestic purposes was ranked at 1$^{sgrower'ss}$g weighted score of 1038 and mean value ($\bar{x}$=2.72) indicating the rice growers has disagreed, tending towards an undecided level. Meanwhile, the regression coefficients and value of R^2 indicated 29% (β=0.293) of the total variation in the knowledge, skills (28.7%, β=0.287) and attitude (32%, β=0.32) of the rice growers regarding pesticides and weedicides use for sustainable agricultural development. It was concluded that the rice growers were small landholders, primarily owners, lacking basic training for optimum usage of pesticides and weedicides and unaware of proper handling of pesticides. The rice farmers had a traditional attitude towards the usage of pesticides and weedicides in rice crop, affecting agricultural sustainability and its development. Therefore, it is recommended that the basic skills and innovative technologies regarding pesticides and weedicides usage be provided to rice farming

communities at the time of their need. A strong relationship should be developed between rice growers and the government to disintegrate the traditional behaviour of using chemicals. Agricultural extension personnel should be provided with the need-based training by developing training program and make the rice farmers technically strong.

Keywords: Knowledge, Skill, Attitude, Sustainable agriculture development.

Continuing Education of Agricultural Extension Educators through Virtual Communities of Practice: A Situated-Learning Strategy

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Abstract

Continuing Education (CE) is indispensable for professional development of field-level Agricultural Extension Educators (AEEs) throughout their working span as pre-service education is simply inadequate to commensurate with ever-changing socio-economic and technological landscape. The demand-driven agricultural extension needs of farmers can only be catered to if AEEs are continuously updating themselves with process skills and technical subject matter expertise through CE. Because of overwhelming official engagements, shortage of staff and financial constraints, AEEs find it hard to leave their workplace to participate in formal in-service training courses. Digital revolution has engendered an innovative solution i.e. Virtual Communities of Practice (VCoP) that has emerged as a viable option being participatory, self-directed, informal, flexible, collaborative, practice-based and situated-learning strategy for CE of AEEs. This intervention is also time efficient, cost effective and immediate context or need based. Professionals use VCoP for social networking to share the domain of their common interests through peer-to-peer learning. Agricultural Extension Educators, reflecting on their practices, feel engaged, connected and empowered through VCoP. Virtual Communities of Practice substantially contributes to knowledge creation and problem-solving by sharing their expertise, experience and insights with fellow extension professionals working on self-initiated projects. Agricultural Extension Educators attain inter-professional competencies while interacting with professionals of other disciplines. Virtual Communities of Practice play a significant role in CE of AEEs thus enhancing their capacities to deliver demand-driven agricultural extension and advisory services efficiently and effectively to their clients, mainly farmers.

Addressing the role of Self-Management strategies to enhance daily life Skills

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Abstract
Self-management enables people to effectively control their behaviors, emotions and time is becoming more and more acknowledged as a crucial element of both professional and personal success. This study aims to explore how self-management techniques are applied and how well they work to enhance critical everyday life skills including goal setting, time management, organization, and emotional control. The study was conducted in Govt. Girls High School Dhanola. Participants of the study were 10th grade students. Surveys and observational notes are used to gather data which is then analyzed using both qualitative and quantitative techniques to evaluate how participants' everyday skill applications have changed over time. The findings of the study showed that the best self-management practices for different life skills help in the creation of a structured, flexible self-management model that both educators and students can utilize to promote lifelong learning and personal development. Moreover, self-management techniques like time management, goal setting, prioritization, and self-monitoring greatly enhance everyday life abilities. Teachers reported improved problem-solving and time-management skills while students reported feeling more independent and confident. In order to maximize benefits and promote the development of lifelong skills additional reforms and enhancements to the intervention strategies are suggested in light of these findings.

Keywords: Self-management, lifelong learning, personal development, confidence

Developing Career Decision-making Options through SMART Goal Setting

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Abstract
An outreach activity is an interaction and engagement of sharing knowledge and expertise on a particular topic with the general or specific audience. This study presents outreach research executed by the researcher through action research. This activity was organized Government Girls High School 210 GB, Faisalabad in October to address the High school students who are at the terminal phase of their school education phase. It is intended to enhance the awareness of this

specific population regarding SMART decision-making in their career options selection. This research will enable the high school students to set realistic goals while considering their resources and constraints. It will be helpful for them to establish milestones that can positively influence their life and career. This outreach activity will not only focus on goal setting but also explore strategies and options for their future decision-making by two-way communication. Through this activity researchers will provide an opportunity for the participants to share their career choices. It will also highlight the significant role of career counseling awareness sessions in making informed choices about their professional path. Considering the cultural sensitivity and evidence-based practices this study can facilitate this gender and population to apply effective decision-making strategies.

Keywords: Career decision making, SMART goals

Analysis of the Contribution, Competence Levels, and Challenges in Agricultural Practices Faced by Rural Women in Moosa Khatian, Taluka Hyderabad, Sindh

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Abstract

The study was conducted in Moosa Khatian, Taluka Hyderabad. Its purpose was to examine the economic contribution, competence levels, and challenges faced by rural women in the area. The sample size consisted of 120 women farmers, randomly selected from a list obtained from the Revenue Department. A survey method was employed, and a questionnaire was developed and implemented to gather the necessary responses. The results revealed that 65% of the women farmers were married, and 70% had formal education. More than 50% of the women farmers had experience in farming practices. The competence levels of the women farmers regarding agricultural activities such as picking, harvesting, weeding, sowing seeds, storage, and dyeing were found to be somewhat satisfactory. In contrast, their competence levels in poultry management—including raising poultry, collecting eggs, cleaning sheds, and managing diseases—were deemed satisfactory. For household management activities such as embroidery, stitching, basket making, handicrafts, wood collection, and house chores, competence levels ranged from satisfactory to good. In livestock management activities like food preparation for domestic animals, milking, whey production, and ghee making, the women farmers demonstrated good skills. However, the

women farmers faced various constraints at the farm level, including a lack of communication with experts, insufficient knowledge, poor coordination, technical challenges, and difficulties in decision-making related to farming activities. Several recommendations were made, including training programs for women farmers in collaboration with women extension workers and NGOs. It is essential to provide women farmers with equal opportunities to participate in various field activities, as they play a crucial role in the farming community.

Awareness of Health Issues and Adoption of Pre-Cautionary measures related to Women Cotton Pickers in Taluka Hyderabad, Sindh

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Abstract

The study was conducted in Taluka Hyderabad, primarily aimed at assessing the awareness of health issues and the adoption of precautionary measures among women cotton pickers in the region. A purposive sampling method was employed, resulting in a sample size of 100 women cotton pickers. Data were collected through a structured, pre-tested questionnaire. The findings revealed that 48% of the women pickers belonged to the age group of 36 to 50 years. On average, over 60% of the women had received formal education. Remarkably, 99% of the cotton pickers resided within 0.5 kilometers of a hospital. Many described cottons picking as a profession that provided vital economic support to their families. Despite their awareness of the pesticides used on cotton crops, all of the women reported experiencing illnesses during the cotton-picking season. The results indicated that 51% of the women had given birth to sickly children. A significant majority (88%) were unaware of the health risks associated with cotton picking and reported suffering from abdominal and stomach pain, which they attributed to their work. Eye irritation was also commonly noted during the picking season, as perceived by the women. Conversely, the respondents consistently practiced hygiene measures such as washing their hands, laundering their clothes, and ensuring proper hand hygiene before eating or handling food after picking cotton. However, various barriers were identified, including a lack of knowledge about health issues related to cotton picking, the costs associated with implementing precautionary measures, and the economic challenges faced by many of the women. Additionally, the timely availability of necessary precautionary measures and medical personnel was also cited as a significant barrier.

Strengthening Agricultural Extension Education in Pakistan: Challenges and Opportunities for Sustainable Development

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Abstract

Agricultural extension education is vital for promoting sustainable agricultural practices, enhancing farm productivity, and improving the socio-economic conditions of rural communities in Pakistan. The extension system serves as a bridge between research institutions and farmers, helping to transfer knowledge on new technologies, crop management techniques, and resource optimization. However, the effectiveness of agricultural extension services in Pakistan faces several challenges. These include limited institutional capacity, outdated extension methodologies, inadequate infrastructure, and a lack of access to modern tools and technology for both extension workers and farmers. Smallholder farmers, who form the majority of Pakistan's farming population, are particularly affected by these constraints, leading to low adoption rates of improved agricultural practices. One of the most critical challenges is the limited outreach of extension services. Due to resource constraints, many rural areas remain underserved, limiting farmers' access to information and modern farming methods. Additionally, there is often a disconnect between extension workers and farmers, further reducing the effectiveness of these services. The integration of Information and Communication Technology (ICT) offers a significant opportunity to overcome these barriers. Mobile platforms, online advisory services, and e-learning initiatives can help provide real-time information on weather, pest control, and market prices, enabling farmers to make informed decisions. ICT can also facilitate distance learning, bringing training programs directly to remote rural communities. Moreover, capacity building for extension workers is essential. Providing continuous professional development, enhancing their technical knowledge, and equipping them with modern tools can improve their ability to deliver relevant and impactful services to farmers. Collaboration between government agencies, research institutions, and private sector organizations can also play a crucial role in expanding the reach of extension services. Public-private partnerships (PPPs) and farmer-led initiatives can contribute to a more participatory and responsive extension system. Policy reforms are another key aspect in strengthening agricultural extension education. By allocating sufficient resources, establishing clear regulatory frameworks, and ensuring effective coordination among stakeholders, the government can create an enabling environment for the modernization of extension services.

In conclusion, strengthening agricultural extension education in Pakistan is essential for achieving sustainable development in the agricultural sector. By addressing current challenges and embracing opportunities such as ICT integration, capacity building, and policy reforms, Pakistan can develop a more efficient, inclusive, and resilient extension system. This will empower farmers with the knowledge and tools necessary for improving agricultural productivity, ensuring food security, and fostering rural development.

Keywords: Agricultural extension, sustainable development, ICT in agriculture, capacity building, rural development, policy reforms, smallholder farmers, Pakistan, agricultural education.

Role of Extension in Technology Transfer

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Abstract

One of the most important functions of extension is to facilitate the transfer of technological know-how from academic institutions to their end users, including farmers, entrepreneurs, and businesses. By using customized communication tactics, extension services help spread, adopt, and modify technologies to meet individual customer demands. Translating technical knowledge into practical applications, offering hands-on training, and raising awareness of new technology are key duties. By involving stakeholders and using participatory methodologies, extension agents may make sure that technologies are suitable for the local environment and socioeconomic circumstances. As an added bonus, they set up systems of feedback that let scientists improve technology in response to problems and experiences reported by actual users. Extension promotes capacity development and the dissemination of innovations in the agricultural, healthcare, educational, and industrial sectors, hence increasing sustainability, productivity, and community well-being. Now more than ever, technology transfer is accessible and effective because to the widespread use of digital tools and information systems, which have expanded the scope and effectiveness of extension programs.

Keywords: Technology Transfer, Innovation, Extension.

Theme V:

Next-Gen Agriculture with AI

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Enhancing Fish Monitoring in Pakistan through Blockchain Technology

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Abstract

At present, blockchain has become a great innovation which provides real benefits to manage the fish flow chain. Make sure food safety is very important for every common person and the economy of every country. Historic methods for tracking the fish flow chain face numerous challenges such as slow processes and records through manual files and a lack of transparency. Accordingly, this research represents a framework that employs blockchain to build a genuine method for tracking fish food systems. Therefore, this research shows how blockchain innovation can enhance the safety quality and trust of customers in food systems. By integrating blockchain innovation with devices, we can monitor fishes in actual time along the productivity. This improves the quality of data, reduces the time and resources required for fish food tracking, and encourages Customers to interact with focus in their safety of sea food. The increasing global demand of fish products has led to unsupportable, resulting in illegal fishing and environmental harm. This research paper presents an adaptable approach to address these challenges and ensure the sustainability, traceability, and safety of fish flow chains. We propose an Ethereum blockchain using platform Remix ide, web 3 and dashboard to monitor the fish flow chain in truthful manner. This shows the appropriate solution for today's environment. In addition, we examine many challenges such as scalability and data privacy and suggest some approaches to solve these issues.

Keywords: Blockchain, Fish Flow chain, Fish Monitoring, Pakistani Fish

Blockchain-Based Crop Monitoring and Insurance for Climate Resilience

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Abstract

In an era of climate unstable, securing agricultural yields against unfavorable weather conditions is most important for global food security and economic stability. This research explores the potential of blockchain technology to protect the resilience of agricultural systems. Traditional methods of crop monitoring often suffer from inefficiencies and inaccuracies, prompting the need for innovative solutions. By controlling blockchain's unchangeable ledger, this research

proposes a transparent and reliable framework for managing agricultural data. Through the integration of blockchain with smart devices, real-time monitoring capabilities are unlocked, enhancing data precision and optimizing resource allocation. This current approach not only ensures the honesty of farming information but also encourage the adoption of sustainable and weather-resistant agricultural practices. As global demand for agricultural products grows rapidly, addressing concerns such as environmental sustainability and accountability becomes essential. By leveraging blockchain technology, this research presents a manageable solution to promote transparency and accountability in farm management practices. Moreover, the research addresses potential challenges such as scalability and data privacy, offering strategies to reduce these obstacles and ensure the validity of the proposed system.
Keywords: Blockchain, Climate resilience, Crop monitoring, Weather

Leveraging Remote Sensing and Artificial Intelligence for Accurate Cotton Crop Detection and Area Mapping

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Abstract
Agriculture is central to national prosperity, addressing vital challenges like poverty reduction, food security, unemployment, and economic stability. Cotton, as a key cash crop, demands accurate detection and mapping for effective agricultural management and informed decision-making. While traditional field surveys are reliable, they are also labor-intensive and time-consuming, creating a need for more advanced and efficient techniques. Remote sensing, particularly through satellite technology, offers a powerful and efficient alternative. This study utilizes Landsat-8 satellite imagery from Google Earth Engine (GEE) to accurately detect and map cotton cultivation in Rahim Yar Khan, Pakistan. Data spanning from April to November 2023 was collected to capture the cotton crop's key growth stages. We leveraged six multispectral bands to provide high-resolution imagery of land surfaces. Incorporating independent data into the training of advanced machine learning models ensured high accuracy and reliability in crop detection. The models selected include Logistic Regression, Random Forest (RF), k-Nearest Neighbors (kNN), Support Vector Machines (SVM), Decision Trees, Convolutional Neural Networks (CNNs), XGBoost, LightGBM, and Long Short-Term Memory (LSTM) networks. Our optimized CNN model significantly outperformed existing methods, achieving a notable accuracy to predict and map cotton crop. This research signifies important progress in agricultural remote sensing, offering

considerable benefits for crop management, yield forecasting, and the broader field of precision agriculture.

Keywords: Cotton crop detection, remote sensing, Landsat-8, machine learning, precision agriculture, CNN

An Automated Classification of Sugarcane Leaf Diseases Using Deep Learning

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Abstract

Sugarcane is a critical crop for many agricultural economies, yet it remains vulnerable to various diseases that can severely affect yield and quality. Early and accurate identification of sugarcane leaf diseases is essential for effective management and prevention of crop loss. This study proposes an automated system for classifying sugarcane leaf diseases using deep learning techniques, specifically ResNet52 for feature extraction and YOLOv9 for object detection and classification. Our approach aims to leverage the robust feature learning capabilities of ResNet52 combined with the speed and precision of YOLOv9 to create a model that can classify sugarcane leaf diseases with high accuracy. The dataset includes five classes: healthy, mosaic, RedRot, rust, and yellow, each representing key challenges faced by sugarcane farmers. Preliminary results demonstrate that our model outperforms traditional methods in both detection speed and classification accuracy, making it a promising tool for field deployment. This research has the potential to facilitate real-time disease monitoring, enabling farmers to take timely action to protect their crops.

Keywords: Deep Learning, ResNet 52, YOLOv9, Feature Extraction, Precision

AI-based Optimized Crop Selection for Sustainable Agriculture

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Abstract

Agriculture stands at a crossroads where traditional methods meet cutting-edge technology, and Machine Learning (ML) is leading the way. As we face the dual challenges of increasing food production and minimizing environmental impact, AI-based optimization of crop selection emerges as a vital solution. This research delves into how AI can revolutionize agriculture by

enhancing crop selection processes, thus fostering more sustainable farming practices. Traditionally, agricultural decisions have often been based on generalized practices that do not fully account for the intricate details of soil conditions or crop needs. Farmers typically rely on broad guidelines that might not address the unique characteristics of each field. This one-size-fits-all approach can lead to suboptimal outcomes, both in terms of crop yield and environmental impact. By analyzing extensive datasets on soil moisture, temperature, and chemical composition, ML algorithms offer a more granular understanding of what each crop needs to thrive. This technology enables us to tailor crop selection to the specific conditions of each field, ensuring that the chosen crops are best suited to the environment. Such precision allows farmers to treat plants and manage resources on an individual basis, leading to more effective and efficient agricultural practices. One of the most compelling benefits of AI in agriculture is its ability to predict crop yields with remarkable accuracy. By examining historical data alongside current conditions, ML models can provide reliable forecasts that help farmers plan their activities and manage resources more effectively. Additionally, AI can assess the quality of crops at an individual level, allowing for early detection of diseases and weed infestations—challenges that were previously difficult to address with such precision. The integration of AI also aligns with the goals of sustainable agriculture. By optimizing crop selection and resource management, AI helps reduce waste and environmental impact. Farmers can use water, fertilizers, and pesticides more efficiently, minimizing their footprint while maximizing productivity. This approach supports the broader vision of sustainable farming, where the focus is not just on growing more food but on doing so in a way that preserves the environment for future generations. In summary, AI-based optimized crop selection offers a transformative approach to modern agriculture. It empowers farmers with precise tools to enhance crop growth, predict yields, and manage resources sustainably. By embracing this technology, we can move towards a more efficient, effective, and environmentally friendly agricultural system that meets the demands of today while safeguarding the resources of tomorrow.

Keywords: Cutting-Edge Technology, Machine Learning, AI, Precision, Accuracy

AI-Driven Smart Agriculture 4.0 for a Sustainable Future Farming

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Abstract
Today in the world, the population is growing and climate change issues make the agriculture sector's responsibility of feeding the world quite challenging and unique. Modern practices of

farming are not very productive, time consuming, and cannot respond favourably to the changing climate conditions and increasing food requirement. Smart Agriculture 4.0, as a newly developed paradigm, introduce the complicated problems of AI and ML to agriculture and pave a data-driven way to farming. This shift expands upon the previous shifts of prior agricultural revolutions while going deeper than merely incorporating machinery and computers to become a precision ag that also gives stability to the design to account for unpredictable environments. Smart Agriculture 4.0 seeks to create sustainable agricultural value chains that should adapt to climate change vagaries, pest incidence, and limited resources through the adoption of AI and ML technologies. The capabilities of combining large amounts of the generated data from sensors, satellite imaging, and drones with AI and ML give producers an edge in tracking health and quality of the soil, weather conditions, crop yield, and pest infestations. Previous literature on precision agriculture indicated that these technologies can enhance productivity; Smart Agriculture 4.0 builds on this by having integrated predictive models, decision making, self-learning. Such as the case of machine learning, which can forecast and monitor planting calendars together with applications of water and fertilizers. Furthermore, it can look for precursors of crop diseases and advise on the appropriate measures to avoid that, without using excessive chemicals and promoting efficient farming practices. The delivery of data coupled with analysis received, in turn, equips farmers with timely and strategic decisions to enhance productivity outcomes and reduce wastage. To develop the Smart Agriculture 4.0 model, it is suggested to implement an AI, ML, IoT sensor, and cloud-based platform model. This platform will collect data from different sources, analyse it using a machine learning algorithm for decision making and prediction in addition to presenting real time updates to the farmer through a friendly user interface. Moreover, planting, monitoring and harvesting will also be done by self driven drones and robots to reduce on labour force and ensure standards are checked. Because farming practices will be adapted in real time through, this approach should be helpful in making food systems more climate ready and less vulnerable to shocks. Smart Agriculture 4.0 therefore presents a future vision of farming where AI and ML powers a sustainable, responsive and robust agricultural food production system in the future world.
Keywords: Smart Agriculture 4.0, AI, Machine Learning, IoT Sensors, Decision Making

Smart Farming Revolution with Next-Gen AI Tools for Sustainable Agriculture

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Abstract

The agricultural sector is one of the biggest in the world as it is burdened with the task of producing food for a continuously growing global population while struggling with limited resources, climate change and environmental problems. Many of these practices involve close supervision and broad application of inputs, and have been largely found to be incapable of supporting modern farming requirements regarding sustainability. For these reasons, what is required are smart and automated agricultural techniques that can make the best use of the resources, the climates, and the soil, and produce improved produce without harming the environment. The integration of AI, sensors, and drones has recent development that could present the biggest change agent in crop and soil management. Hence, due to the advancement in artificial intelligence in using sensors and drones to collect data on the moisture content of the soil, availability of nutrients for crops, crop health and condition of the environment in large tracts of arable land Precision farming is possible through the help of AI and its sensors which provide soil data to ensure that water, fertilizers, pesticides among others are applied where and when they are required. Multispectral and thermal cameras integrated in drones allow for rapid imaging of large fields and provide detailed information on the health status of plants, pests, and diseases' distribution. The background technology relies on precision agriculture which has over the recent decades been growing gradually, however, the innovations in AI are expanding at a higher rate. This enables the machine learning algorithms to automate the interpretation of the large volume of data that is collected to make predictive suggestions of irrigation intervals, figures for controlling pests, and nutrients. Such knowledge helps farmers prevent undesirable outcomes or minimize the losses posed by the cyclical adverse weather changes or diseases. Specifically, the proposed methodology focuses on developing an intelligent farming solution, where an intelligent farming ecosystem will consist of sensors, drones, and machine learning algorithms connected by a single application. These attached applications will generate user-friendly graphical interfaces such as dashboards and alerts for the farmers, IT solutions even for the small-scale farmers easily accessible. SOCO analysis will indicate that soil and crop conditions will be monitored and analysed; the recommendations to be made will be dynamic depending on changing environmental data. In addition, the drones will have the capability of autonomous navigation; the drones will conduct routine field scans thus providing standard results without human influence. This is expected to positively affect crop quality, resource application and overall food production in a method that is sustainable. Therefore, the goal of the proposed study is to convert conventional farming practices into smart and intelligent farming for paving the way towards constructing more sustainable and robust food models adequate enough to feed the growing population ahead.

Keywords: Artificial Intelligence, Multispectral, Soil Management, Sensors, SOCO Analysis

Blockchain-enhanced IoT Integration for Secure and Transparent Farm Sensor Data Management

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Abstract
With the evolution of communication technologies, the Internet of Things (IoT) is progressing from its early stages to complete maturity, experiencing explosive data transmission and processing growth. Consequently, the management of globally deployed devices has faced heightened and demanding features for real-world performance. Most current IoT device management platforms are centralized, presenting technical drawbacks like susceptibility to cyber-attacks and a single thread of execution. A novel approach is imperative to improve data access while following government dictates on confidentiality. This study introduces a sensor system based on IoT with the integration of blockchain technology to ensure the privacy and security of sensing data. The aim was to provide IoT device owners with a real application that provides a broad and unalterable record and enables the easiest access to devices. It features typical attributes of the IoT sensor framework, such as facilitating data monitoring and controlling interactions among users and devices. An intelligent contract defines rules and conditions for the application's business logic. The proposed approach is validated through the real-world deployment of an IoT prototype using a microcontroller (NodeMCU) and the defined network permissions. A target study employing various performance metrics emphasizes the platform's suitability for resource-constrained IoT architectures and its scalability for diverse IoT scenarios. The study work is tested for cotton fields. Additionally, irrigation automation was applied to optimize water consumption. The findings show that combining blockchain with IoT significantly improves transparency, security, and efficiency in agricultural management, providing a strong and effective solution for contemporary agricultural practices.

Keywords: IoT, blockchain, sensor data, cotton, smart contracts.

AI-Driven Multilingual Crop Advisory Chatbot & Expert Recommendation System

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Abstract

Our AI-Driven Multilingual Crop Advisory Chatbot is designed to transform agricultural support by providing farmers with expert-driven, personalized guidance through an intuitive platform. Currently in its Test Stage, the chatbot delivers real-time advice on critical agricultural topics such as market trends, pest management, irrigation practices, and crop health. Leveraging Natural Language Processing (NLP), sentiment analysis, and advanced machine learning, it effectively bridges language barriers, offering multilingual support in over 100 languages, including Urdu and English. The platform is accessible on PCs, tablets, laptops, mobile devices, and browsers, ensuring broad reach and accessibility. Beyond automated responses, Farmers can register on the platform to post crop-related queries and receive direct recommendations from industry-sponsored agricultural experts, creating a highly tailored and interactive advisory experience. These experts are part of business collaboration with agricultural industries, forming the foundation of our business model. The platform offers live Q&A sessions, community forums, and predictive analytics, empowering farmers to make informed decisions for crop sustainability and yield optimization. This network of registered experts and peer-driven insights fosters a vibrant ecosystem of knowledge sharing and collaboration, encouraging best practices and the adoption of sustainable agricultural methods. By improving farming techniques and resilience, the chatbot directly benefits entire communities reliant on agriculture, enhancing local economies and promoting sustainable growth.

Keywords: Crop advisory, Chatbot.

Deep Neural Network Architecture for the Classification of Rice Variety toward Sustainable Agriculture

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Abstract

When considering the global production values of grain goods, rice comes in third place behind wheat and corn. It is an excellent source of complex carbs and rich in nutrients and minerals. Among the greatest extensively cultivated global crops of grains, rice occurs in a wide range of genetic types. They differ from one another in part because of their characteristics. Typically, these

characteristics are like color, shape and texture. It is acceptable to assign a seed quality classification using the traits that distinguish the varieties of rice. At the industrial level, rice grain identification and classification are crucial for the production and packing of food products. For this reason, machine vision technologies are opening new possibilities for the classification of rice varieties. The studies suggest a reliable approach for rice grain evaluation and classification, utilizing deep learning methodology to increase accuracy performance and time. A complete dataset of 75,000 rice pictures has been created as part of a research project. This data contains a range of rice types, such as Arborio, Jasmine, Basmati, Karacadag, and Ipsala. In this study, the deep learning CNN model has been developed to precisely classify five kinds of rice based on the visual data present in images. The main aim of this research is to generate a computerized classification system capable of distinguishing diverse rice kinds. The system has multiple algorithms and layers that allow it to process and evaluate massive amounts of rice image data. Our CNN based proposed model reaches the highest accuracy rate of 99.64% after executing significant experimentation. The results make a significant contribution to agricultural developments by providing a dependable strategy for precisely distinguishing rice types.
Keywords: Neural network, Sustainable agriculture, Machine vision,

IoT based Smart System for Detection of Chicken Meat Spoilage using Machine Learning

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Abstract
The high protein, vitamin, and mineral content of chicken meat makes it a vital part of the human diet. We can check the freshness and deterioration of chicken flesh using a number of factors. One of the most important markers of the freshness of chicken flesh is its aroma. To determine whether chicken meat has spoiled, a number of conventional techniques have been employed; however, they are time-consuming, costly, and complicated. Furthermore, the conventional techniques do not offer a real-time assessment of the deterioration of chicken flesh. Therefore, monitoring the deterioration of chicken meat necessitates a trustworthy method. This study suggests a smart system based on the Internet of Things (IoT) that uses several gas sensors to identify and distinguish between rotten chicken. Using a sophisticated Arduino board called the NodeMCU/ESP32, the data is gathered using a sensor array and permanently saved on Google Sheets via wireless technology (Wi-Fi), offering a solid dataset for analysis. This study looks on the development of a machine learning-based intelligent Internet of Things system for detecting

spoiled poultry flesh. The MQ6, MQ7, and MQ135 gas sensors are used by the system to track particular gas levels that signify damage. Three machine learning models Naive Bayes, Linear Regression, and Support Vector Machine (SVM) are employed to predict decomposition. With an 89% prediction accuracy, the linear regression model was the most accurate of them. This study demonstrates how the chicken industry may improve food safety and quality control by integrating IoT and machine learning technologies. Future research will focus on improving sensor technology, optimizing machine learning models, and conducting extensive field experiments to capture real-world. accuracy.

Keywords: IoT, Smart System, Machine Learning,

Forecasting Onion Prices using Machine Learning Models in Markets of South Punjab

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Abstract

Price plays a crucial role in financial activities, with unexpected fluctuations often signaling market instability. In today's market, machine learning offers a variety of techniques to forecast commodity prices, helping to manage such instability. This paper explores the application of machine learning methods to forecast onion prices, utilizing data collected from the ministry of agriculture South Punjab, Pakistan. For making predictions we used machine learn algorithms such as Linear Regression, SARIMA, LSTM, SVR and Random Forest Regression. We then evaluated and compared the performance of these techniques to determine which provides the highest accuracy. Our findings indicate that all the techniques used to determine which provides the high accuracy and indicate that all the techniques produced similar results. Using these methods, we aim to forecast onion prices into categories of preferable (low), economical mid, or expressive high.

Keywords: Onion Price Forecasting, Regression Analysis, Predictive Modeling, Machine Learning (ML)

AI and Bioinformatics in Agriculture Innovations for Sustainable Crop Breeding and Genetic Improvement

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Abstract

Recognizing that the global agricultural sector is facing enormous pressure to increase food production sustainably to feed growing populations and in a changing climate and finite natural resources, a holistic and integrated review of the systems underlying land productivity and food availability is urgently required. The existing crop breeding and genetic improvement are time consuming and do not possess the precision for the demands of modern agriculture. Therefore, artificial intelligence (AI) and bioinformatics integration is emerging as a powerful approach to accelerate and refine crop breeding processes, ultimately developing high yielding, climate resilient and nutrient rich crops. The integration of this AI driven prediction with bioinformatics based genetic insights enables the disclosure of valuable genetic traits by facilitating the optimization of breeding strategies, contributing to the breeding of sustainable crop varieties suited for future food security needs. Over the last decade, advances in genomics and bioinformatics have enabled researchers to generate unpreceded data on the genomes of crops allowing for unprecedented understanding of variations in the genetic make up of crops, their resistance to disease and their yield potential. Currently, these datasets have been underused in breeding for the inherent difficulty of data processing and analysis. Now, thanks to AI, machine learning algorithms can crunch through gigabytes of genetic and phenotypic data to identify trends, correlations and patterns which suggest the best targets for breeding. Precision breeding background studies indicate that genomic selection, enabled by AI, can accurately predict desirable traits better than traditional methods, and thereby accelerate breeding cycle and increase precision of outcomes. Additionally, environment influenced factors and their interactions with genetic traits can be assessed by AI models to develop crops with unique adaptation to different climate conditions ranging from drought resistance to nutrient efficiency. An AI driven bioinformatics platform integrating genomic, phenotypic and environmental data to inform breeding programmes is proposed as the focus of the method. Machine learning algorithms in this platform will be used for prediction of high yield traits, disease resistance etc using genomic data. Using deep learning models, the system will help identify genetic markers indicating desirable traits, allowing growers to select parents of crops with the greatest expressions of those traits. Moreover, AI will also be able to simulate numerous environmental conditions and will identify crops which are better suited to specific regional climates. This study seeks to advance a sustainable crop breeding model with reduced reliance on chemical inputs, improved yield stability, and higher nutritional value, using these innovations. Leveraging AI and bioinformatics to change the breeding process helps

agriculture take a more sustainable, resilient, and productive path toward the kinds of foods we'll rely on to meet global food security goals.

Keywords: AI, Bioinformatics, Sustainable crop breeding

Transforming Post-Harvest Practices AI Innovations for Reducing Losses and Enhancing Supply Chain Efficiency

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Abstract

Postharvest losses are a major bottleneck to food security, with much of the fresh produce lost or wasted during movement from the farm to the consumer. Lack of real time data, inefficient post-harvest practices, and supply chain disruptions only aggravate these losses leading to loss in productivity of agriculture and also wastage of resources. The agricultural supply chain can be transformed with artificial intelligence (AI) towards more efficient, traceable and decision management post-harvest. The analysis and processing of massive amounts of data, along with technological advances in sensors and predictive analytics, can substantially reduce post-harvest losses and enhance performance within supply chains right from the farm gate to the consumer thus allowing the development of highly efficient supply chains capable of competing with traditionally global supply chains. Typically, Traditional post-harvest handling relied on manual inspection and general practices, that not only may be inefficient in addressing diverse factors that include of crop type, storage conditions, and mode of transportation. AI driven systems have recently been shown to be able to automate and optimize post-harvest processes, such as quality assessment and inventory management. Image recognition tools now based on AI can identify produce quality and categorize by ripeness, colour and surface damage to enable more accurate sorting and grading. Additionally, machine learning algorithms can predict the best storage and transportation conditions by taking into account temperature, humidity and product shelf-life without spoiling the product while on transit. Also, the integration of AI within supply chains allows for real time tracking and risk assessment in order to proactively manage supply disruption and guarantee perishable goods get to market efficiently. An integrated AI platform, composed of image processing, predictive analytics and IoT enabled sensors to facilitate streamlining of post-harvest processes is the proposed methodology. Through real time data from sensors, this platform will assess produce quality, forecast spoilage risks, and optimize storage environments.

Furthermore, AI-driven logistics optimization models will determine the most efficient way to ship goods, both in terms of routing goods and in minimizing transit time and improving cold chain logistics. AI's data analytics capabilities on the platform will provide supply chain managers with actionable insights on inventory planning, etc. to minimize bottlenecks and waste. This research modernizes post-harvest practices through AI in order to greatly reduce food loss, significantly improve supply chain efficiency, and contribute to a more resilient, sustainable food distribution network that can meet future demand.

Keywords: AI, Innovation, Transformation, Postharvest practices.

Miscellaneous

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Assessing The Socioeconomic Consequences of Increasing Divorce Rate in Faisalabad Division, Pakistan

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Abstract

Divorce is a serious societal issue in any community, as it is an essential component of the fundamental family structure of society. Pakistan is among the countries experiencing an ongoing rise in divorce rates. Divorce can, in some situations, save a man or woman from unending distress, but in the majority of cases, it destroys family objectives, goals, and dreams, leads to unbearable suffering, and pushes their children into uncertainty about the future. Divorce can frequently result in a decrease in overall income of victim and an increase in financial pressure for both individuals involved. Dividing assets and covering legal expenses after divorce can exhaust financial resources, resulting in reduced economic stability for both parties. It has been claimed that a significant number of divorced women encounter greater financial challenges compared to men. This study determines the factors that contribute to the increasing divorce rate and evaluate the socio-economic repercussions of this trend in Faisalabad Division, Pakistan. The present study is conducted in Pakistan, Faisalabad division in the Punjab province is purposively selected using multistage sampling technique. 120 sample respondents were chosen with the help of purposive sampling approach, which resulted in snowball sampling throughout the way. Using a non-random sample technique called purposive sampling, participants are selected based on the researcher's assessment of who would be the most suitable A well-structured, pre-tested questionnaire are used to collect relevant data. This study employed two models to assess the socio economic consequences of divorce bivariate probit regression model is employed while to identify the factors affecting divorce rate the logistic regression model is employed. The finding highlights that individuals experiencing financial difficulties are more likely to be divorced Media addiction also has a positive and marginally significant effect on the divorce rate. This study underscores the complexity of divorce, showing that certain factors like financial stress, women economic independence, husband unemployment and age are significant, other anticipated factors like domestic violence, and cultural beliefs may require further investigation or larger sample sizes to understand their impact fully.

Keywords: Divorce, Family Structure, Financial Difficulties, Media Addiction, Snowball Sampling, Logistic regression, Domestic Violence

Socioeconomic Impact Assessment of Polycystic Ovary Syndrome: A Case Study of Faisalabad District

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Abstract

Polycystic Ovary Syndrome represents one of the extreme common hormonal disorders influence women of reproductive period. PCOS is a complex condition that can affect various systems in the body, leading to symptoms ranging from menstrual irregularities to metabolic issues like insulin resistance and increased risk of type 2 diabetes. Beyond its implications for reproductive health, polycystic ovary syndrome shows a significant socioeconomic burden, both direct healthcare expenses and indirect costs stemming from decreased productivity and compromised quality of life. The aimed of this study was to calculate the health cost associated with PCOS, encompassing both direct and indirect cost, and awareness of life cycle modification. Primary data were collected through well-structured questionnaire from 160 women, spilt evenly with 80 women diagnosed with PCOS and 80 without the condition from Faisalabad District. Statistical data entry and analysis of the result were performed using Microsoft Excel and SPSS. The results showed that women with PCOS face significant direct healthcare costs, such as medical expenses and travel, as well as indirect costs due to lost workdays and reduced productivity. On average, women with PCOS incur a total healthcare cost significantly higher than those without the condition, the total direct health cost was PKR 3241000 and indirect health cost was PKR 1057612. The presence of the symptoms of PCOS among these women was as, the most common symptom were Irregular periods 99 percent, Acne 86 percent, Hair Growth 27 percent, Weight Gain 66 percent, Hair Loss 45 percent, Depression 76 percent. The study highlights that the disproportionate financial strain on women suffering from PCOS, emphasizing the need for affordable healthcare options and increased public awareness in the region. The study reveals that PCOS significantly affects the lives of women, with wide-ranging consequences for their health, economic status, and social well-being. Efforts need to intensify in creating awareness on the general public about PCOS.

Keywords: Polycystic Ovary Syndrome, BMI, Health Cost, Financial Strain, Lifestyle Modification

Treatment of Inflammatory Bowel Disease using natural Flavonoid Curcumin from Turmeric -Containing: Macroscopic and Microscopic Analysis

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Abstract:

Curcumin known as diferuloyl methane is a naturally occurring phytochemical found as a major pigment in turmeric (Curcuma longa, family Zingiberaceae) plant. Lack of local availability for drugs in the colon can be addressed by preparing a self-emulsifying drug delivery system (SEDDS) of curcumin (Cur) which is ultimately used for the treatment of inflammatory bowel disease (IBD). Z-average size (12.36 ± 0.04 nm), zeta potential (−14.7 ± 0.08 mV), and polydispersity index (PDI) (0.155 ± 0.036) of Cur-loaded SEDDS (S-Cur-SEDDS) showed a comparative droplet surface area and charge. The physicochemical stability of Cur in S-Cur-SEDDS was confirmed via FTIR, DSC, TGA, and XRD analyses, while morphological analysis through SEM and atomic force microscopy (AFM) confirmed Cur loading into SEDDS with an increased surface roughness root mean square (RMS) of 11.433 ± 0.91 nm, greater than the blank SEDDS. Acute toxicity studies with an organ weight ratio and % hemolysis of 15.65 ± 1.32%at a high concentration of 600 mM showed that S-Cur-SEDDS are safe at a medium dose (0.2–0.8 g/kg/day). The excellent *in vitro* antioxidant (68.54 ± 1.42%) and anti-inflammatory properties (56.47 ± 1.17%) of S-Cur-SEDDS proved its therapeutic efficacy for IBD. Finally, S-Cur-SEDDS significantly improved acetic acid-induced IBD in albino rats through a reduction in the disease activity index (DAI) and macroscopic ulcer score (MUS) from 4.15 ± 0.21 to 1.62 ± 0.12 at 15 mg/kg/day dose, as confirmed via histopathological assay. Conclusions: Based on the above findings, S-Cur-SEDDS appears to be a stable, less toxic, and more efficacious alternative for Cur delivery with strong competence in treating IBD.

Keywords: Curcumin; self-microemulsifying drug delivery system; colon; acute toxicity; inflammatory bowel disease