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ABSTRACTS BOOK OF

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Table of Content

1. Conference Fields	3
2. Organizing Body	4
3. Table of Content	6
4. Phytochemical Analysis And Invitro Antimicrobial Screening Of Polyherbal Formulation Used To Treat Diarrhea In District Karak	10
5. Antimicrobial Evaluation And Phytochemical Screening Of Polyherbal Formulation Used To Treat Sinusitis Caused By <i>Streptococcus Pneumoniae</i> And <i>Haemophilus Influenzae</i>	10
6. Green synthesis, characterization and antibacterial evaluation of piperine loaded copper nanoparticles derived from <i>Piper longum</i>	11
7. Assessing The Role Of <i>Serratia Marcescens</i> Hmr-2 Against Bisphenol A (Bpa) Toxicity In <i>Spinacia Oleracea</i> L.	12
8. Phytochemical Screening And Antibacterial Evaluation Of Crude Extract And Its Derived Fractions Obtained From <i>Orobancha Amethystea</i> Against Human Pathogenic Microbes	12
9. Physicochemical And Biofunctional Analysis Of Quercetin Complexation With Pectin For Probing Their Thermal Stability And Antioxidant Potential	13
10. Evaluation Of Antibacterial Activity Of <i>Moringa Oleifera</i> (Leaf Extract) Against <i>Escherichia Coli</i> Isolated From <i>Ctenopharyngodon Idella</i>	14
11. Lagenaria Siceraria Peel Mediated Green Synthesis Of Trimetallic Cuo-Nio-Zno Nanoparticles, Cytotoxicity And Genotoxicity Profiling	14
12. Political Corruption and Governance: Anti-Corruption Measures and Policy Gaps in Pakistan	15
13. Psychosocial Predictors of Post-Migration Stress among Afghan Refugee Youth: Testing the Buffering Effect of Community Integration	16
14. Do Financial Inclusion and Energy Efficiency Determine Environmental Quality in Pakistan	16
15. Greening or Grinding: Unpacking the Environmental Impact of Globalization in Eurasia	17
16. The Impact of social media on Mental Health across Generations in Layyah	17
17. Representation of Gender Identity Crisis in Pakistani Society: A Critical Discourse Analysis of Durrani's My Feudal Lord	18
18. Psychological Trauma and Identity Fragmentation in Franz Kafka's The Metamorphosis	18
19. Globalization, ICT, and Economic Growth Dynamics: An ARDL Approach to Cointegration and Causality	19
20. Harnessing Microbial Solutions for Climate Change Mitigation and Resilience in Pakistan	20
21. Advancing Inclusive English Language Pedagogy: A Qualitative Case Study of Differentiated Instruction and Understanding by Design in Pakistani Higher Education	20
22. Evolution of Education Policies in Pakistan (1947–2024): A Critical Analysis of Policy Continuity, Reform, and Implementation Gaps	21

23. Does FDI inflow insecure workers in developing countries? Evidence from a two-step system GMM estimation	22
24. Bridging the Gender Gap: An Assessment of Equality in Health and Education in Pakistan (2010-2025)	22
25. Sustainable Work in a Degrowth Economy: Rethinking the SDGon Decent Work and Economic Growth	23
26. Seventy-Seven Years of Health Policy Development in Pakistan: Trends, Transitions, and Lessons for the Future	23
27. The Interplay of Governance and FDI in Driving Economic Growth: Evidence from Emerging Asian Economies	24
28. The Role of Financial Development and Innovation Capacity in Achieving Long-Term Sustainable Growth	24
29. Political Economy of Climate Change Policy: Gaps in Governmental and Market Responses in South Punjab	25
30. The Impact of Green HRM and Digital Leadership on Organizational Resilience: The Mediating Role of Innovation Capability and the Moderating Role of Institutional Support	25
31. The Impact of Artificial Intelligence on Academic Performance among University Students in District Layyah	26
32. From Block chain to Better Money Skills: Examining Gamification and Digital Confidence in Financial Literacy Enhancement	26
33. AI and Bias: Identifying Unexplored Challenges in Algorithmic Fairness	27
34. The Role of the Bureaucracy of Pakistan in Policy Implementation: Gaps in Public Sector Effectiveness	28
35. Bridging Nutrition Literacy and Behavioral Change: A Socio-Cultural Perspective on Sustainable Diets in Pakistan	28
36. E-Government and Digital Public Services: Technological Advancements and Gaps in Public Administration of Pakistan	29
37. Public Sector Innovation: Gaps in Policy and Practice for Sustainable Governance in Pakistan	30
38. Negotiation modernity: An anthropological perspective on cultural transformation in urban Pakistan	30
39. The Role of Financial Technology (FinTech) in Emerging Markets of Pakistan: A Systematic Review	31
40. Development of Worker-Friendly Equipment to Reduce Musculoskeletal Disorders among Brick Kiln Workers	32
41. Mental Resilience and Motivation Patterns among Competitive Athletes in Pakistan: A Mixed-Methods Approach	32
42. Obstacles and Attitudes for Behavioral therapy in Pakistan; An Analysis of Factors and Social Boundaries	33
43. The Misogyny of Dorian Gray: A Feminist Stylistics Analysis of Female Representation In Oscar Wilde's Writing	34
44. Gendered Discourse and Political Power: A Stylistic Examination of Pakistani politicians Speeches	34
45. Power and Ideology in Pakistani Morning Shows: A Critical Discourse Analysis	35
46. Beyond the Fertilizer Bag: An Integrated Strategy for Nitrogen, Climate, and Food Security	35
47. Socio-Psychological Determinants of Farmers' Continuance Intention toward Conservation Agriculture: A PLS-SEM Approach	36

48. Waste Reduction Strategies for Sustainable Urban Development In The Punjab, Pakistan	36
49. Impact of Religious Motivation On Rate of Recidivism in Rural Areas of District Okara	37
50. Investigating the Optoelectronic Properties and Third-Order Nonlinear Optical Susceptibility of Cross-Shaped Molecules: From Molecular Insights to Material Applications	38
51. Electro-Optical and Charge Transport Properties of Chalcone Derivatives: A Dual Approach from Molecular to Material-Level Simulations	38
52. First-Principles Study of Structural, Electronic and Magnetic Properties of Fe-Doped MgS	39
53. Stakeholder Influence under AKIS for Sustainable Agricultural Development in Pakistan	40
54. Emerging Technology and Sustainable Innovation's in Food and Allied Sciences for Ensuring Future Food Security	40
55. Deep-Feature X-SN: A Contrastive Learning Framework for Cross-Dataset Generalization in Deep-fake Detection	41
56. An Interpretable, Multimodal Deep Learning Framework for Early Alzheimer Disease	42
57. Detection: Synergizing MRI, Quantitative EEG, and Clinical Biomarkers	42
58. Mitigating Unauthorized Access in Data Security Using IDs and IPs	42
59. Soliton Dynamics and Stability in a Higher-Order Dispersive Cubic–Quintic Nonlinear Schrödinger Equation	43
60. Fractal Geometry and Nonlinear Dynamics of Agricultural Models with Allee Effect	44
61. Computational insights into phthalimide-core non-fullerene acceptors for next-generation organic solar cells	44
62. Identifying Pathways for Scaling Alternate Wetting and Drying (AWD) as a Climate-Smart Technology in Punjab	45
63. Automated Detection of Cyberbullying-Driven Hate Speech on Social Networks Using a Stacked Ensemble Learning Approach	46
64. Resistance Potential of Different Potato Cultivars Against Early Blight Caused By Alternaria Solani And Its Management	46
65. Biology and Management of Blackleg Of Potato In Punjab And Its Management	47
66. Training Needs Assessment for Strengthening Women-oriented Rural Entrepreneurships in District Sargodha	48
67. Harmful Effects of Pesticides on Human Health and Environment: Case Study of Punjab, Pakistan	48
68. Modeling of surface plasmon polaritons in indium antimonide embedded between plasma layers	49
69. Transverse magnetic mode in black phosphorus sandwiched between uniaxial chiral layers	50
70. Dyakonov surface wave supported at plasma dielectric interface	50
71. Light plasmon coupling at anisotropic chiral-graphene interface	51
72. Aqualitative study of the issues in adopting entrepreneurial skills in the livestock business among women farmers in the central punjab, pakistan	51
73. A Kap Survey of The Wheat-Losses During And After Harvesting Process In Southern Punjab, Pakistan	52
74. Electrochemical corrosion behavior of chitosan-hydroxyapatite coated dental implant	53
75. Effect of temperature on mechanical and bioactive properties of glass ceramic	54

76. Review of Effects of Ag, Cu, or Fe Addition on Microstructure and Properties of Biodegradable Zn–Mg Alloy	54
77. Biological investigation of metal (Ag, Cu, Fe) and Ceramic Composites	55
78. Machine learning assisted prediction of the mechanical properties of Graphene/Aluminum nanocomposite based on molecular dynamics simulation	55
79. Genetic Investigation Of Potential Intraspecific Hybrids Of Canola For Seed Yield Using Diallel Analysis	56
80. Effects Of <i>Sesbania Aculeata</i> As Green Manure On Fertility Of Different Soil Types And Wheat Growth Parameters	56
81. Isolation Of Fermented Food-Derived <i>Lactobacillus</i> Spp. With Potent Activity against Multidrug-Resistant Human Pathogens And Detection Of Their Inhibitory Mechanisms	57
82. Tritrophic Interactions Revealed Predator Mediated Constraints on the Sustainable management of <i>Parthenium hysterophorus</i> by <i>Zygogramma bicolorata</i>	58
83. Molecular Characterization And Phylogenetic Analysis Of <i>Echinococcus Granulosus</i> Isolates From Small Ruminants Based On The Antigen B Subunit 2 Gene	59
84. <i>Serratia Marcescens</i> (Hrm-2) Mediated Physiological And Metabolic Responses In Maize Seedling Under Bisphenol A (Bpa) Toxicity	60
85. The impact of economic diversification on economic resilience in SAARC region	60
86. Biochemical Characterization and Antibacterial Efficacy of <i>Atriplex halimus</i> (Salt bush) Against <i>Aeromonas hydrophila</i> Isolated from <i>Labeo rohita</i>	61
87. Structural Characterizations and Homomorphic Properties of Soft Left Almost Semirings	62
88. Ecofriendly Synthesis of Silver Nanoparticles Using <i>Withania coagulans</i> Dunal Ethanolic Extract: Comprehensive Characterization and Assessment of Biomedical Potential	62
89. Human Carbonic Anhydrases Activity Of The Phytochemicals Isolated From <i>Haplophyllum Erythraeum</i>	63
90. Detection of Androgen Receptor Gene Polymorphisms rs1204038 and rs1337076 in Infertile Pakistani Males Using Tetra-ARMS PCR	64
91. <i>Prunus Persica</i> Seed -Mediated Fabrication Of Silver-Doped Zinc Oxide Nanoparticles; Characterization And Acaricidal Potential Against Hylomma Ticks	65
92. Association of the BMP15 rs3810682 and rs17003221 Variant with Female Infertility in the Pakistani Population	65
93. Structural Characterizations and Homomorphic Properties of Soft Left Almost Semirings	66
94. Prevalence And Associated Risk Factors Analysis Of <i>Fasciola Gigantica</i> In Cattle Of Kohat Khyber Pakhtunkhwa	67

Phytochemical Analysis And Invitro Antimicrobial Screening Of Polyherbal Formulation Used To Treat Diarrhea In District Karak

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Diarrhea is still a major global health concern, especially in areas with low resources and poor access to sanitary facilities and medical care. In Pakistan, where diarrheal illnesses contribute to substantial morbidity and mortality, traditional herbal remedies offer a potential alternative for managing this condition. This study focuses on a polyherbal formulation comprising *Psidium guajava*, *Punica granatum*, *Coriandrum sativum*, and *Mentha arvensis* known for their traditional use in treating digestive ailments. Through scientific validation, this research aims to bridge the gap between traditional knowledge and modern evidence-based medicine. The selected plants formula was procured from local markets and subjected to methanolic extraction. Antidiarrheal assays were conducted against multidrug-resistant clinical isolates *Escherichia coli*, *Salmonella enterica* and *Shigella boydii* using agar well diffusion methods. Additionally, GC-Mass analysis was performed to identify the bioactive components of the polyherbal formulation. Results demonstrated significant antidiarrheal activity of the polyherbal extract against the tested pathogens. GC-Mass analysis revealed the presence of various bioactive compounds, indicating the formulation potential therapeutic efficacy.

Keyword: Polyherbal formulation, *Psidium guajava*, *Punica granatum*, *Coriandrum sativum*, *Mentha arvensis*, Antidiarrheal activities, phytochemical analysis.

Antimicrobial Evaluation And Phytochemical Screening Of Polyherbal Formulation Used To Treat Sinusitis Caused By *Streptococcus Pneumoniae* And *Haemophilus Influenzae*

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Sinusitis is the most frequently occurring respiratory tract infection and is primarily a bacterial infection with *Streptococcus pneumoniae* and *Haemophilus influenzae* being the most frequently isolated pathogens. Since there is growing resistance to the antibiotic drugs and side effects of the synthetic drugs, researchers have turned to medicinal plants to find alternative therapeutic agents. The present study aimed to assess the antimicrobial activity and phytochemical profile of a poly herbal formulation of *Zingiber officinale* (Ginger), *Curcuma longa* (Turmeric), *Allium sativum* (Garlic) and *Cyperus rotundus* (Nutgrass) against the bacterial pathogens associated with sinusitis. The polyherbal formulation was prepared in methanol by maceration method and was tested for its antimicrobial activity against *S. pneumoniae* and *H. influenzae* by agar well diffusion method at different concentrations (25, 50, 75 and 100µg/mL). The major bioactive

compounds present in the formulation were identified by the qualitative phytochemical screening and GC-MS analysis. The results showed that there was a dose dependent antibacterial activity against both bacterial strains. The greatest inhibition zones were seen at 100 µg/mL and were 18.8 mm for *S. pneumoniae* and 18.4 mm for *H. influenzae*, Ciprofloxacin being the most active drug in positive control. The result of qualitative phytochemical screening revealed the presence of alkaloids, flavonoids, tannins and saponins in all the selected plants. GC-MS analysis showed that there are many bioactive compounds such as turmerones, phenolic ketones, sesquiterpenes, fatty acids and esters. Major compounds identified were Tumerone (13.84%), 1-(4-Hydroxy-3-methoxyphenyl) dec-4-en-3-one (13.56%), ar-Turmerone (8.48%), and Cyclopentanol (7.62%). The results indicate that the polyherbal formulation has substantial antibacterial activity as a result of synergistic effect of various phytochemicals. This study scientifically confirms the traditional uses of these medicinal plants and provides a new indication for their use as natural alternative medicine in the treatment of bacterial sinusitis.

Keywords: Polyherbal formulation, Sinusitis, *Streptococcus pneumoniae*, *Haemophilus influenzae*, Antibacterial activity, GC-MS, Phytochemicals, Medicinal plants.

Green synthesis, characterization and antibacterial evaluation of piperine loaded copper nanoparticles derived from Piper longum

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Nanotechnology has emerged as a promising field for the development of novel antimicrobial agents through the synthesis of bioactive nanoparticles. Piperine, the major bioactive alkaloid of *Piper longum*, possesses remarkable antioxidant, anti-inflammatory, antimicrobial, and bioavailability-enhancing properties, making it an ideal candidate for nanoparticle synthesis. The present study aims to isolate and purify piperine from *Piper longum* and employ it as a reducing and capping agent for the green synthesis of piperine-loaded copper nanoparticles (CuNPs). Piperine will be extracted using Soxhlet and ultrasound-assisted extraction methods, followed by purification through recrystallization and/or column chromatography. The purity of the isolated piperine will be confirmed by thin-layer chromatography (TLC) and melting point determination. The synthesized CuNPs will be characterized using UV–Visible spectroscopy, Fourier Transform Infrared Spectroscopy (FT-IR), and X-ray Diffraction (XRD) to evaluate their optical, structural, and crystalline properties. Furthermore, the antibacterial efficacy of the piperine-loaded CuNPs will be assessed against selected Gram-positive and Gram-negative bacterial strains. It is anticipated that the synergistic combination of piperine and copper nanoparticles will exhibit enhanced antibacterial activity compared with conventional formulations. This study is expected to establish a simple, eco-friendly, and cost-effective approach for the development of biologically active copper nanocomposites with promising applications in antimicrobial therapy and other biomedical fields.

Keywords: Green synthesis, copper nanoparticles, piperine loaded copper nanoparticles, *Piper longum* extract, Antibacterial activity.

Assessing The Role Of *Serratia Marcescens* Hmr-2 Against Bisphenol A (Bpa) Toxicity In *Spinacia Oleracea* L.

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Bisphenol A is a widely distributed environmental pollutant released from the extensive use of plastics and industrial products. Its accumulation in agricultural environments poses serious threats to plant growth, crop productivity, and food safety by inducing oxidative stress, generating reactive oxygen species (ROS), disrupting photosynthesis, impairing nutrient uptake, and altering cellular metabolism. *Spinacia oleracea* L., an important leafy vegetable belonging to the family *Amaranthaceae*, is highly valued for its nutritional and economic importance but is susceptible to BPA-induced phytotoxicity. Therefore, developing sustainable strategies to mitigate BPA toxicity is essential for maintaining crop productivity and environmental health. Plant growth-promoting bacteria (PGPB) have emerged as an eco-friendly approach to enhance plant growth and improve tolerance against environmental contaminants. *Serratia marcescens* strain HMR-2 is a BPA-tolerant bacterium possessing plant growth-promoting characteristics such as phytohormone production and phosphate solubilization. However, its effectiveness in reducing BPA-induced toxicity in spinach has not yet been comprehensively investigated. Therefore, the present study aims to assess the role of *Serratia marcescens* HMR-2 in alleviating BPA-induced toxicity in *Spinacia oleracea* under hydroponic conditions. The experiment will evaluate growth parameters including root length, shoot length, fresh and dry biomass, and number of leaves, together with physiological and biochemical traits such as chlorophyll contents, proline accumulation, hydrogen peroxide (H_2O_2), and antioxidant enzyme activities (SOD, POD, and CAT). It is expected that bacterial inoculation will improve plant growth, enhance photosynthetic efficiency, strengthen the antioxidant defense system, reduce oxidative damage, and increase BPA tolerance in spinach plants. Overall, this study will provide valuable insights into the use of *Serratia marcescens* HMR-2 as a sustainable bio-inoculant for mitigating BPA toxicity and promoting environmentally friendly agricultural production in contaminated environments.

Keywords: Bisphenol A (BPA), *Spinacia oleracea*, *Serratia marcescens* HMR-2, plant growth-promoting bacteria, oxidative stress, hydroponics, phytoremediation.

Phytochemical Screening And Antibacterial Evaluation Of Crude Extract And Its Derived Fractions Obtained From *Orobanchae Amethystea* Against Human Pathogenic Microbes

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The increasing prevalence of antimicrobial resistance has intensified the search for effective antibacterial agents from medicinal plants. *Orobancha amethystea* is a medicinal plant that may contain bioactive phytochemicals with therapeutic potential. Crude methanolic extract of *Orobancha amethystea* was prepared and fractionated into n-hexane, chloroform, ethyl acetate, and aqueous fractions. Preliminary phytochemical screening was performed using standard qualitative methods. Antibacterial activity against selected human pathogenic bacteria was evaluated by the agar well diffusion method, while minimum inhibitory concentration (MIC) was determined using the broth microdilution technique. Phytochemical analysis confirmed the presence of alkaloids, flavonoids, phenolics, tannins, terpenoids, and saponins. The crude methanolic extract and ethyl acetate fraction exhibited the highest antibacterial activity, whereas the n-hexane fraction showed comparatively lower activity. MIC results further confirmed the superior antibacterial potential of the methanolic extract. The study demonstrates that *Orobancha amethystea* possesses valuable phytochemicals with significant antibacterial activity against human pathogenic bacteria. These findings suggest that the plant could serve as a promising natural source for the development of novel antimicrobial agents.

Keywords: phytochemical screening, antibacterial activity, crude extract, solvent fractions, human pathogenic bacteria.

Physicochemical And Biofunctional Analysis Of Quercetin Complexation With Pectin For Probing Their Thermal Stability And Antioxidant Potential

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Quercetin is a naturally occurring flavonoid widely recognized for its antioxidant, anti-inflammatory, and health-promoting properties. However, its practical applications in pharmaceutical and food systems are limited due to poor water solubility, low bioavailability, and instability under various processing conditions. Pectin, a naturally occurring polysaccharide, possesses excellent biocompatibility, biodegradability, and film-forming properties, making it a promising carrier for bioactive compounds. The present study aims to investigate the physicochemical and biofunctional characteristics of quercetin after complexation with pectin, with particular emphasis on thermal stability and antioxidant potential. The quercetin–pectin complex will be prepared under optimized experimental conditions and characterized using appropriate analytical techniques to confirm successful complex formation and evaluate possible molecular interactions. Physicochemical properties, including solubility, thermal behavior, and structural stability, will be assessed using suitable instrumental analyses. The antioxidant activity of the complex will be compared with that of free quercetin using standard in vitro antioxidant assays to determine whether complexation enhances or preserves its biofunctional properties. The findings of this study are expected to provide valuable insights into the interaction between quercetin and pectin and demonstrate the potential of pectin as a natural carrier for improving the stability and functional performance of quercetin. This research may contribute to the development of stable, efficient, and naturally derived antioxidant delivery systems for pharmaceutical, nutraceutical, and functional food applications.

Evaluation Of Antibacterial Activity Of *Moringa Oleifera* (Leaf Extract) Against *Escherichia Coli* Isolated From *Ctenopharyngodon Idella*

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The rapid expansion of aquaculture has significantly increased the occurrence of bacterial diseases threatening fish production and food security. *Escherichia coli* is an opportunistic pathogen frequently associated with disease outbreaks in *Ctenopharyngodon idella* (grass carp), while the excessive use of antibiotics has accelerated antimicrobial resistance and environmental contamination. This study evaluated the antibacterial activity of *Moringa oleifera* leaf extracts prepared using methanol, ethanol and acetone against *E. coli* isolated from *C. idella* and characterized their phytochemical constituents through GC–MS analysis. Fresh *M. oleifera* leaves were shade-dried, powdered and extracted by cold maceration using different organic solvents. *E. coli* isolates were recovered from fish tissues identified through morphological and biochemical characterization and subjected to antibacterial susceptibility testing using the agar well diffusion method. Antibacterial activity was assessed at three concentrations (25, 50, and 75 mg/mL), while the minimum inhibitory concentration (MIC) was determined using the broth microdilution method following CLSI guidelines. All solvent extracts exhibited concentration dependent antibacterial activity with statistically significant inhibition compared to the control ($p < 0.001$). The methanolic extract demonstrated superior antibacterial efficacy producing mean inhibition zones of 28.0, 32.0 and 35.0 mm at 25, 50, and 75 mg/mL, respectively. The ethanolic extract showed inhibition zones of 25.3, 30.0 and 33.3 mm, whereas the acetonic extract produced mean inhibition zones of 23.3, 28.0, and 30.0 mm at the corresponding concentrations. These findings indicate that methanol extracted a greater proportion of antibacterial phytochemicals than ethanol and acetone resulting in enhanced inhibitory activity against *E. coli*. The study demonstrates that *M. oleifera* leaf extracts possess significant antibacterial potential and may serve as an eco-friendly alternative to conventional antibiotics for controlling bacterial infections in aquaculture thereby supporting sustainable fish health management and reducing dependence on synthetic antimicrobial agents.

Keywords: *Moringa oleifera*, *Escherichia coli*, *Ctenopharyngodon idella*, Antibacterial Activity, Aquaculture.

Lagenaria Siceraria Peel Mediated Green Synthesis Of Trimetallic CuO-NiO-ZnO Nanoparticles, Cytotoxicity And Genotoxicity Profiling

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Nanotechnology has emerged as a promising field with wide applications in agriculture, environmental science, and medicine. The present study aims to synthesize and characterize trimetallic CuO-NiO-ZnO nanoparticles using an eco-friendly green

synthesis approach mediated by *Lagenaria siceraria* (bottle gourd) peel extract. The plant extract will act as a reducing and stabilizing agent in the formation of nanoparticles from metal precursors under controlled conditions. The synthesized nanocomposites will be characterized using UV-Visible spectroscopy to confirm surface plasmon resonance, FT-IR spectroscopy for functional group analysis, scanning electron microscopy (SEM) for morphological evaluation, and X-ray diffraction (XRD) for crystallinity assessment. The biological applications of the synthesized nanoparticles will be evaluated through cytotoxicity testing using *Artemia salina* (brine shrimp) larvae and phytotoxicity assessment on wheat (*Triticum aestivum*) seed germination and seedling growth. Different concentrations of nanoparticles will be tested to determine dose-dependent effects, including mortality rate, ED50 values, and germination parameters. This study is expected to provide insights into the green synthesis of trimetallic nanocomposites and their potential impacts on aquatic organisms and crop plants, contributing to safer and sustainable application nanotechnology.

Political Corruption and Governance: Anti-Corruption Measures and Policy Gaps in Pakistan

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This research examines the persistent challenge of political corruption in Pakistan and evaluates the effectiveness of existing anti-corruption measures within the country's governance system. The study aims to identify key policy gaps that weaken institutional accountability and hinder transparency. It also seeks to understand how governance structures, public sector reforms, and institutional coordination shape the overall integrity framework in Pakistan. The research uses a qualitative methodology, drawing on policy documents, official reports, and academic literature. A systematic review approach is employed to evaluate the performance of key anti-corruption institutions, including the National Accountability Bureau (NAB), provincial anti-corruption departments, and internal administrative mechanisms. The analysis focuses on governance dynamics, including political interference, bureaucratic discretion, weak oversight, and limited citizen participation. The findings indicate that, despite Pakistan having several anti-corruption laws and institutions, their impact remains limited due to inconsistent implementation, overlapping mandates, politicization, and gaps in monitoring and evaluation. The study also reveals that public awareness campaigns and digital governance reforms are gradually improving transparency, but structural challenges continue to undermine long-term progress. The research concludes that Pakistan needs a more coordinated and autonomous accountability system, stronger whistleblower protections, and enhanced parliamentary oversight. Strengthening institutional capacity and ensuring political neutrality emerge as essential steps toward building an effective national integrity system. The study highlights that sustainable anti-corruption reforms require not only legislative improvements but also a clear commitment to good governance, ethical leadership, and citizen engagement.

Keywords: Political Corruption, Governance, Anti-Corruption Measures, Accountability Mechanisms, Policy Gaps

Psychosocial Predictors of Post-Migration Stress among Afghan Refugee Youth: Testing the Buffering Effect of Community Integration

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For over four decades, Afghan refugees in Pakistan have experienced displacement, socio-political marginalization, and cultural erosion. This protracted crisis has resulted in well-documented mental health challenges. However, the specific psychosocial experiences of young refugees during emerging adulthood remain critically understudied. This study examined the complex interplay between cultural bereavement, perceived discrimination, and post-migration stress among young Afghan refugees in Pakistan. Additionally, the study investigated how perceived discrimination mediates the relationship between cultural bereavement and post-migration stress, and the moderating role of community integration in this pathway. Purposive sampling was used to collect data from 141 English-speaking Afghan refugees (men = 60, women = 81; age range = 18–25 years) residing in Islamabad, Lahore, Karachi, Peshawar, and Quetta. The Cross-Cultural Loss Scale (Wang et al., 2015), the Everyday Discrimination Scale (Williams et al., 1997), the Community Integration Scale (McColl et al., 2001), and the Refugee Post-Migration Stress Scale–Revised (Malm et al., 2023) were used to measure study variables. Data were analyzed using SPSS Version 26, and the moderated mediation model was tested using the PROCESS macro. Findings revealed that cultural bereavement predicted post-migration stress both directly and indirectly through perceived discrimination. Furthermore, community integration moderated this pathway, such that higher levels of integration buffered the negative effects of cultural bereavement and perceived discrimination on stress. These results underscore the need for culturally grounded interventions that build on social support networks and community resilience. Such efforts should be integrated into local service-providing systems, including educational and mental health programs, to ensure sustainable support for refugee youth.

Keywords: cultural bereavement, perceived discrimination, post-migration stress, community integration, Afghan refugees, Pakistan

Do Financial Inclusion and Energy Efficiency Determine Environmental Quality in Pakistan

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This study will investigate the impact of financial inclusion, and energy efficiency on environmental quality along with other factors in Pakistan from 1990 to 2024, using the

Auto-Regressive Distributed Lag (ARDL) method. It is expected that the impact of both energy efficiency and financial inclusion will be positive on environmental quality. Whereas both the trade openness and GDP growth rate are hypothesized to cause higher levels of pollution thereby causing environmental degradation. On the Basis of the findings, the policymakers will be recommended to design such strategies that can promote financial inclusion, and energy efficiency vis-à-vis economic growth and trade policies should be aligned with objective of environmental sustainability and maintenance of cleaner environment in Pakistan.

Keywords: Financial inclusion, Trade openness, Energy efficiency, Environmental quality, Economic growth

Greening or Grinding: Unpacking the Environmental Impact of Globalization in Eurasia

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This study investigates the impact of globalization (GL), ecological footprint (EFP), natural resources (NR), and total reserves (TR) on environmental crisis (EC), examining 84 Eurasian nations from 1991 to 2021 through a comprehensive index integrating CO₂ and GHG emissions metrics and leveraging dependency theory. Employing a robust methodological approach combining parametric and non-parametric methods, the analysis reveals that GL and NR negatively correlates with EC, while EFP and TR positively correlates with EC. The effects of globalization dimensions encompassing economic globalization, political globalization, and social globalization on EC vary across developed and developing economies. Introducing an innovative environmental crisis index, the research uncovers complex relationships between globalization and environmental sustainability, offering guidance for policymakers to reduce EC through resource-independent, low-carbon pathways. While the findings are limited to Eurasian nations, future studies could extend this analysis for broader applicability. The study provides practical insights for fostering sustainable economies and mitigating EC, supporting global initiatives to decrease CO₂ and GHG emissions and promoting healthier environments and sustainable living conditions worldwide.

Keywords: Environmental Crisis, Ecological Footprint, Natural resources, Total Reserves, Globalization, Dependency Theory.

The Impact of social media on Mental Health across Generations in Layyah

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This research investigates how social media influences mental health across different generations—Gen Z, Millennials, and Older Adults—within the context of Layyah. The

study aims to analyze how patterns of social media use contribute to variations in self-esteem, anxiety and social connection among these age groups. Using a comparative, cross-sectional, and quantitative research design, data will be gathered through structured questionnaires to evaluate psychological outcomes associated with online engagement. The findings are expected to highlight generational differences in digital behavior and their impact on emotional well-being, offering valuable insights for educators, mental health practitioners, and policymakers. This study emphasizes the growing need to understand the psychological effects of social media in shaping interpersonal relationships and overall mental health across generations.

Keywords: Social media, Mental health, Generational difference, Sociology, Layyah

Representation of Gender Identity Crisis in Pakistani Society: A Critical Discourse Analysis of Durrani's My Feudal Lord

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Women have always suffered from patriarchal power abuse, identity crisis, marginalization, oppression and segregation. The researchers probe the suppression and subjugation of women in Pakistani society with reference to Tehmina Durran's autobiography *My Feudal Lord* (1995). In this research, the researcher's objective is to identify the gender identity crisis and the sort of oppressions that are faced by the women in Pakistani society. For this purpose, the researcher has chosen five extracts from the selected narrative through purposive sampling technique. The nature of this research is qualitative in which the selected extracts have been analyzed through Fairclough's three-dimensional model of critical discourse analysis (1995). This study's findings reveal that women in Pakistan are oppressed, marginalized, subjugated and their identity is challenged. By taking gender discrimination and women oppression into consideration, this research brings to the fore the fact that Pakistani women are marginalized and considered as sex objects and marriage is emphasized as the only social identity in the life of a woman.

Keywords: Identity Crisis, Marriage, Marginalization, Critical Discourse Analysis, Gender Discrimination, Oppression

Psychological Trauma and Identity Fragmentation in Franz Kafka's The Metamorphosis

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Franz Kafka's *The Metamorphosis* offers a striking examination of psychological trauma and the fragmentation of identity in the face of familial, social, and economic pressures.

Gregor Samsa's sudden transformation into an insect embodies the physical and symbolic collapse of self, reflecting the stern weight of family expectations, financial burdens, and societal judgment. Existing scholarship highlights Gregor's alienation, yet this study extends the conversation by foregrounding how trauma emerges not only from external forces but also from internalized guilt, suppressed desires, and the instability of selfhood. Using close textual analysis informed by psychoanalytic and postmodern narrative theory, this paper traces shifts in Gregor's agency, self-perception, and emotional coherence. The analysis further examines the family's changing responses and the social reactions that reinforce Gregor's dehumanization. The novella's metafictional elements disrupt narrative authority and expose the constructed, unstable nature of reality and identity. The study finds that psychological trauma in *The Metamorphosis* is relational, existential, and socially mediated. By revealing how economic strain, familial neglect, and symbolic displacement converge to dissolve the human subject, Kafka anticipates postmodern concerns with fractured selves and unstable subjectivity. This research contributes to deeper understanding of trauma, identity, and the human condition in modern literature.

Keywords: Psychological Trauma, Identity Fragmentation, Dehumanization, Alienation, Metafiction, Postmodernism

Globalization, ICT, and Economic Growth Dynamics: An ARDL Approach to Cointegration and Causality

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This study provides a comprehensive examination of the relationship between economic growth, information technology and its key components with particular emphasis on the development of Pakistan's stock market. The findings indicate a positive association between a well-functioning stock market and economic growth in both the short and long run. Financial theory suggests that globalization and information technology play a significant role in fostering economic development. The study further explores the impact of globalization and economic progress on income inequality in Pakistan. Annual time-series data from 1980 to 2024 were utilized and the Autoregressive Distributed Lag (ARDL) model was applied as the main econometric technique. Data were sourced from the State Bank of Pakistan and International Financial Statistics. The results reveal that globalization and advancements in information technology exert a substantial influence on income distribution, while economic growth contributes to greater income equality. From a policy perspective, trade openness, foreign remittances and foreign direct investment can help reduce inequality. Key variables incorporated in the analysis include savings, inflation, exchange rate, gross domestic product and investment. Overall, the study suggests that to accelerate economic growth, Pakistan must develop and effectively implement targeted policies that promote investment in information and communication technologies (ICT).

Keywords: Investment, Savings, Inflation, exchange rate, Autoregressive Distributed Lag, Price Index

Harnessing Microbial Solutions for Climate Change Mitigation and Resilience in Pakistan

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Pakistan is one of the most climate-vulnerable countries in the world with rising temperatures, floods, droughts, glacial melt, and sea level rise endangering infrastructure, agriculture, and health. Microbial solutions present an understudied but promising path toward climate resilience, even as national programs like the National Climate Change Policy and the National Food Security Policy encourage adaptation and mitigation measures like clean energy transitions and reforestation. Carbon sequestration, climate-resilient agriculture, biofertilization, bio pesticide development, abiotic stress tolerance, bioremediation, wastewater treatment, and bio-saline farming are all facilitated by beneficial microbes. These strategies can improve soil health, agricultural yield, and environmental sustainability, as shown by pilot programs run by organizations like the Pakistan Agricultural Research Council. However, a lack of finance, lax enforcement of policies, poor infrastructure, and low stakeholder knowledge all impede the wider implementation of microbial technology. Scaling microbial-based climate solutions requires addressing these obstacles through coordinated investment, capacity building, and policy integration. This paper outlines the advancements, difficulties, and potential paths for using microorganisms in Pakistan mitigation and adaptation plans for climate change.

Keywords: Climate change, Microbial solutions, Carbon sequestration, Biofertilizers, Bioremediation

Advancing Inclusive English Language Pedagogy: A Qualitative Case Study of Differentiated Instruction and Understanding by Design in Pakistani Higher Education

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This qualitative case study is an instrumental study focused on how inclusion-based English language pedagogy can be developed through incorporation of Differentiated Instruction (DI) and Understanding by Design (UbD) among the undergraduate English language learners in Pakistani higher education. The research was carried out in Bahauddin Zakariya University (BZU) in Multan in a sample of 50 (40 students and 10 teachers). Semi-structured interviews were used to collect data and analyzed by means

of thematic analysis. The findings indicate that the integration of DI and UbD had a great benefit to students as it allowed the organization of instruction content, process and products to meet the preparedness, interests and the learning profile of the learners. Such a dynamic strategy resulted in a more active student participation, their confidence and enhanced knowledge of English language, and was seen as more accommodating and efficient when compared to the old-treasured teaching in one size. Nonetheless, there were issues encountered during implementation including huge classes, lack of teacher training and rigidity in institutional curricula. Regardless of these challenges, the participants believed that the DI-uBd strategy has a high potential in the long run, particularly when institutional changes are supportive, professional help is provided continuously, and technology is incorporated. Comprehensively, the research results in the conclusion that environmentally sound practices of DI-uBd may create more equitable, student-centered, and context-relevant teaching of English language in Pakistan.

Keywords: Differentiated Instruction (DI), Understanding by Design (UbD), Inclusive Pedagogy, English Language Teaching (ELT), Higher Education; Academic Diversity, Pakistan

Evolution of Education Policies in Pakistan (1947–2024): A Critical Analysis of Policy Continuity, Reform, and Implementation Gaps

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The vitality of education as a cornerstone for national development cannot be denied, as it serves as an indispensable tool for societal transformation, political stability and economic growth. Since 1947, its inception, the strategic role of education in nation-building has been continuously recognized. Though, the education policy agenda has been advanced in different phases, each reflected the socio-political primacies, and economic realisms of that particular time. This study will examine the historical route of education policies in Pakistan from year 1947 to 2024, to analyze their relevant objectives, execution challenges, and upshots. The study will trace the major policy reforms starting with Education Conference in 1947, along with National Education Policies viz., 1959, 1972, 1979, 1992, 1998, 2009, and 2017, and up to the fresh developments under the “Single National Curriculum (SNC)” initiative and the Vision 2025. A historical-descriptive and qualitative approach will be adopted. To evaluate the consistency between policy goals and their execution data will be collected from government reports, policy documents, and existing literature the findings will reveal the factors that have been hindering sustainable progress in education system in the country. The coherent long-term policy recommendations will be given to the government for inclusive and quality education by adhering Sustainable Development Goal 4 (SDG-4) and depoliticizing the implementation mechanisms, and greater investment in human capital.

Keywords: Education Policy, SDG-4, Single National Curriculum

Does FDI inflow insecure workers in developing countries? Evidence from a two-step system GMM estimation

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This study investigates the effects of Greenfield Foreign Direct Investment (GFDI) inflows on labor market volatility in 100 developing countries. Our goal is to examine whether GFDI increases labor market volatility and thereby workers economic insecurity and provide support to the idea behind compensation hypothesis. The hypothesis suggests that economic openness increases government size by increasing the economic insecurity of workers. To that goal, we built a data set (2003-2019) that merges data on the level of employment from Penn World Table, country economic and institutional indicators from World Development Indicators and World governance indicators, and data on GFDI from the United Nations Conference on Trade and Development. By applying the two-step system GMM estimation technique, we find that GFDI contributes to economic insecurity by increasing employment volatility in developing countries thus provide support to the existence of compensation hypothesis. Further, we find that population density and output volatility have a positive effect on employment volatility while government expenditure and political stability have a negative effect.

Keywords: Greenfield FDI, Labor market volatility, Employment, Government Expenditures,

Population density.

Bridging the Gender Gap: An Assessment of Equality in Health and Education in Pakistan (2010-2025)

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The present study will explore the advancement, challenges, and policy answers linked to gender equality in health and education sectors of Pakistan ranging from 2010 to 2025, marked as transformative and decentralization era under the 18th Constitutional Amendment. It is when the National Education Policy (2009), the Health Vision 2025 framework, and the execution of initiatives associated with SDG-3("Good Health and Well-being) and SDG-5(Gender Equality)" has been introduced. The qualitative and analytical approach will be applied to review Pakistan

Social and Living Standards Measurement (PSLM) surveys, national policy documents, WHO and UNESCO reports, and existing literature review to assess the trends in access of women to healthcare and education. The findings will reveal the situation related to

school enrollment, female literacy, life expectancy and maternal health. The study will recommend sustained policy in light of the outcomes

Keywords: Gender Equality, Health Policy, Education Policy, Women Empowerment, SDG-3 and SDG-5

Sustainable Work in a Degrowth Economy: Rethinking the SDG on Decent Work and Economic Growth

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The UN Sustainable Development Goal of “Decent Work and Economic Growth” supposed that consistent economic expansion is associated with higher level of employment and societal uplift. As evidence speaks that constant economic expansion is ecologically harmful and communally stratified. This study will find out novel idea, transformation from “Decent Work and Economic Growth” to “Sustainable Work and Economic DE growth”. The Panel data of selected Asian countries regarding (SDG 8) from year 2000–2023 and Generalized method of moments method will be utilized to attain the results. The results will show how and to what extent economic expansion in Asian countries such as Pakistan, India, Bangladesh, China, Malaysia and Indonesia has increased employment prospects and how it has jeopardized the ecological balance? The policy recommendations about eco-friendly work models will also be presented.

Keywords: Economic growth, Economic de growth, sustainable work, Pakistan.

Seventy-Seven Years of Health Policy Development in Pakistan: Trends, Transitions, and Lessons for the Future

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Pakistan has been focusing on the development of holistic health policies, essential yet challenging objective since its independence in 1947. Keeping in view that recognition of health as an important constituent of nationwide development, economic stability, productivity, and community well-being, the present study will critically inspect the success of health policies in Pakistan from year 1947 to 2025, by investigating the policy outlines, institutional modifications, and execution challenges that shape the healthcare system of the country. Starting with early post-independence steps, the study will cover key policy indicators, including Health Policy of (1990), National Health Policy (1997), National Health Policy (2001), and succeeding outlines regarding Vision 2025, and Universal Health Coverage (UHC) announced after 2015. Adopting a qualitative, historical-descriptive approach, this study will utilize World Health Organization (WHO) reports, policy documents, other government data, and extant literature to evaluate the advancement and limitations of health governance of Pakistan. The policy recommendations in the light of outcomes will also be presented.

Keywords: Health Policy, Universal Health Coverage, Primary Healthcare, SDG-3, Vision 2025

The Interplay of Governance and FDI in Driving Economic Growth: Evidence from Emerging Asian Economies

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This study aims to assess Asian countries governance, foreign direct investment, and economic growth. The Asian economies are labelled as middle or low-income economies as they have constantly been confronted with issues such as poverty, underdeveloped infrastructure, an unbalanced economy, and low personal incomes. This study examines the impact of governance, and foreign direct investment, on economic growth in Asian nations. In order to take results, this study used panel data of selected 40 countries from 2000–2024 attained from World Development Indicators (WDI). The results of panel ARDL model indicated that good governance and FDI both have positive significant impact on economic growth of selected developing countries. Policy recommendations in the light of the results have also been discussed.

Keywords: Governance, Foreign Direct Investment, Panel ARDL, Asian Countries.

The Role of Financial Development and Innovation Capacity in Achieving Long-Term Sustainable Growth

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The present study is concerned with the impact of financial development, innovation on along with other variables such Capital Formation, Energy Use, Labor Force and Trade Openness. The time series data from 1992 to 2022 are taken from World Development Indicators for Pakistan economy. The results taken from ARDL Model show that financial development, innovation and trade openness significantly positively affect sustainable economic growth. Moreover, the study emphasizes the need for comprehensive policies that foster investment, innovation, production efficiency, and effective energy utilization to ensure sustainable economic growth and improved living standards for long-term stability.

Keyword: Sustainable economic growth, Financial Development, Innovation

Political Economy of Climate Change Policy: Gaps in Governmental and Market Responses in South Punjab

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This study examines the political economy of climate change policy in South Punjab, with a focus on the persistent gaps in governmental and market responses. The research aims to understand how institutional weaknesses, limited market incentives, and socio-economic disparities shape the region's climate adaptation and mitigation outcomes. The study also seeks to highlight the governance challenges that restrict effective policy implementation at both provincial and district levels. A systematic qualitative approach is used, combining a review of policy documents, climate vulnerability reports, and existing literature with insights from key stakeholder perspectives reported in previous studies. The analysis applies a political economy lens to assess how power structures, resource allocation mechanisms, and administrative capacities influence climate policy performance in South Punjab. The findings show that climate-related policies remain under-prioritized due to bureaucratic fragmentation, insufficient coordination among departments, and limited fiscal autonomy at the local level. Market responses also appear weak, as private-sector actors face low incentives to invest in climate-resilient technologies or green innovation. Additionally, socio-economic vulnerabilities—such as poverty, water insecurity, and agricultural dependence—intensify the region's exposure to climate risks and undermine community-level adaptation. The study concludes that meaningful climate action in South Punjab requires stronger institutional integration, decentralization of climate finance, and targeted market incentives that encourage private-sector participation. The results suggest that addressing structural governance barriers is crucial for creating a climate-resilient and economically sustainable future for the region.

Keywords: Climate Policy, Political Economy, South Punjab, Governance Gaps, Market Responses

The Impact of Green HRM and Digital Leadership on Organizational Resilience: The Mediating Role of Innovation Capability and the Moderating Role of Institutional Support

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In an era of rapid digital transformation and environmental challenges, higher education institutions must develop resilience to sustain their operations and academic performance. This study examines the influence of Green Human Resource Management (Green HRM) and Digital Leadership on Organizational Resilience (the capacity to survive, adapt, and thrive in a changing and uncertain environment) in educational institutions, with Innovation Capability serving as a mediating variable and Institutional

Support as a moderating factor. Drawing on the Resource- Based View (RBV) and Dynamic Capabilities Theory, this research employs a quantitative survey design. Data will be collected from academic and administrative staff of public and private higher education institutions in Pakistan using a structured questionnaire. The proposed model will be analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The expected findings suggest that Green HRM and digital leadership have a positive influence on innovation capability, which in turn enhances organizational resilience. Moreover, institutional support is anticipated to strengthen the link between innovation capability and resilience. The study contributes to the growing body of literature by integrating perspectives on sustainability and digitalization into research on organizational resilience within the education sector. Practical implications include policy recommendations for fostering innovative, sustainable, and adaptive educational environments.

Keywords: Green HRM, Digital Leadership, Innovation Capability, Institutional Support, Organizational Resilience, Higher Education, Pakistan.

The Impact of Artificial Intelligence on Academic Performance among University Students in District Layyah

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The study will investigate the impact of Artificial Intelligence (AI) on the academic performance of university students in District Layyah. A total sample of 30 undergraduate students from public and private universities will be selected through a survey method. A structured questionnaire will be used to measure students' AI exposure, study strategies, digital literacy and attitudes toward AI. Academic performance will be collected from students' self-reported GPA/semester results. This quantitative research will apply descriptive statistics and regression analysis to examine how AI usage will influence academic achievement. Ethical considerations will be ensured as students will be informed, and their responses will be kept anonymous. The study will expect to find that skill-enhancing and moderate use of AI tools will positively influence GPA, while excessive dependency on AI for academic tasks will negatively affect learning outcomes. The findings will help universities develop guidelines, digital literacy training and policies for responsible AI use in higher education.

Keywords: Artificial intelligence, academic performance, university students, quantitative research, digital literacy, District Layyah

From Block chain to Better Money Skills: Examining Gamification and Digital Confidence in Financial Literacy Enhancement

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This study examines how emerging digital technologies, specifically block chain and digital finance, improve financial literacy through the mediating role of gamification features and the moderating influence of digital confidence. As financial platforms become increasingly digitalized, understanding how users engage with technology-driven tools is essential for improving financial capability. The proposed model suggests that blockchain and digital finance have a positive influence on the adoption of gamified elements within financial applications, which in turn contribute to improved financial literacy outcomes. Additionally, digital confidence is expected to strengthen the relationship between gamification features and financial literacy enhancement, indicating that users who feel more competent in using digital tools benefit more from gamified learning experiences. A quantitative research design was employed, and data were collected through a structured online survey targeting users of digital financial services. A sample size of 250 respondents was deemed adequate for analysis. The study utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 4 to assess both the measurement and structural models. Reliability and validity were evaluated using factor loadings, Cronbach's Alpha, Composite Reliability, AVE, and HTMT ratio. The findings are expected to provide theoretical and practical insights into how digital technologies and confidence levels can be effectively leveraged to strengthen financial literacy in a rapidly evolving digital economy.

Keywords: Financial Literacy Enhancement, Blockchain, Digital Confidence, Gamification, digital finance, fintech.

AI and Bias: Identifying Unexplored Challenges in Algorithmic Fairness

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The integration of Artificial Intelligence (AI) and algorithmic decision-making systems across various sectors has transformed industries by increasing efficiency and providing new insights. However, these advancements also pose significant challenges, particularly in terms of fairness and bias. AI systems, while promising objectivity, often inherit and amplify societal prejudices embedded in historical data. This paper aims to explore the unexplored challenges in algorithmic fairness, focusing on the intersectionality of demographic characteristics, the sociotechnical context, and regulatory gaps. Despite significant progress in fairness research, much of the existing work overlooks how individuals with overlapping marginalized identities experience compounded biases, which can lead to unfair outcomes that are not captured by traditional fairness metrics. Additionally, AI systems are embedded in complex sociopolitical structures that influence their fairness outcomes, yet these dimensions are often neglected. This research introduces a conceptual framework that categorizes unexplored fairness challenges, including intersectionality, structural embedding, and cultural specificity. It also addresses the long-term impacts of algorithmic decisions, the need for greater transparency and

accountability, and the challenges posed by emerging technologies. By identifying these gaps, this paper contributes to the discourse on AI fairness. It provides recommendations for future research and policy development to ensure AI systems are equitable, transparent, and accountable.

Keywords: Algorithmic Fairness, Intersectionality, Sociotechnical Systems, AI Bias, Regulatory Gaps

The Role of the Bureaucracy of Pakistan in Policy Implementation: Gaps in Public Sector Effectiveness

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This study examines the role of bureaucracy in Pakistan in implementing public policies, with a focus on identifying gaps that impact overall public sector effectiveness. The research aims to understand how bureaucratic structures, processes, and capacities influence the translation of policy objectives into tangible outcomes, and why certain policies fail to deliver expected results for citizens. The study employs a mixed-method approach. It includes document analysis of key national policies and government reports, alongside semi-structured interviews with civil servants, policymakers, and public sector practitioners. This methodology enables a detailed examination of bureaucratic procedures, decision-making processes, and institutional constraints that influence policy implementation. Findings indicate that bureaucratic inefficiencies, including hierarchical rigidity, a lack of coordination across departments, and a limited capacity for evidence-based decision-making, significantly hinder policy implementation. Many policies suffer from unclear responsibilities, weak monitoring and evaluation mechanisms, and inadequate integration of feedback from citizens and stakeholders. These gaps result in inconsistent public service delivery and reduced effectiveness of welfare programs. The study concludes that enhancing bureaucratic capacity and reforming institutional structures are critical for improving policy implementation. Recommendations include adopting more flexible administrative practices, strengthening interdepartmental coordination, and integrating continuous evaluation and citizen feedback into the policy cycle. By addressing these gaps, the bureaucracy can better support effective governance, ensure equitable service delivery, and contribute to improved public sector performance in Pakistan.

Keywords: Bureaucracy, Policy Implementation, Public Sector Effectiveness, Governance, Pakistan

Bridging Nutrition Literacy and Behavioral Change: A Socio-Cultural Perspective on Sustainable Diets in Pakistan

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Nutrition literacy is increasingly recognized as a decisive determinant of dietary behavior and long-term health outcomes, particularly within developing societies undergoing rapid nutritional transition. This study investigates the socio-cultural and behavioral dimensions influencing dietary choices among urban and peri-urban populations in Pakistan. Using a mixed-methods approach encompassing structured surveys, focus-group discussions, and knowledge-attitude- practice (KAP) analysis, the research delineates the interrelations between education, income, media exposure, and sustainable food consumption. Findings reveal significant disparities in nutrition awareness across gender and socioeconomic strata, with cultural norms and affordability emerging as critical barriers to adopting balanced and environmentally sustainable diets. The study further evaluates the role of digital education platforms, public health campaigns, and institutional interventions in promoting nutrition literacy and behavioral change. It concludes by proposing a multi-sectoral framework that integrates community engagement, policy reform, and educational innovation to foster a culture of informed and sustainable eating practices in Pakistan.

Keywords: Nutrition literacy, behavioral change, sustainable diets, public health education, socio-cultural determinants.

E-Government and Digital Public Services: Technological Advancements and Gaps in Public Administration of Pakistan

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This research examines the development of e-government and digital public services in Pakistan, with a focus on technological advancements, implementation challenges, and gaps in public administration. The primary objective of this study is to assess how digital systems are enhancing service delivery, transparency, and accessibility for citizens. The methodology employs a mixed-methods approach, incorporating document analysis, surveys, and brief interviews. A sample of 120 participants, comprising citizens, university students, and public sector employees, was surveyed to collect data on user experience. Additionally, 10 short interviews were conducted with administrative staff to gain an understanding of the implementation challenges. The findings indicate that Pakistan has made notable advancements in areas such as digital identity systems, online portals, mobile applications, and electronic documentation processes. However, the results also highlight major barriers, including limited ICT infrastructure, low digital literacy, cybersecurity risks, and uneven digital service availability across regions. The data indicates that although many users appreciate faster access to services, a significant portion report difficulties navigating platforms or accessing a stable internet. The study concludes that Pakistan is progressing towards effective digital governance but requires improved infrastructure, cybersecurity policies, staff training, and nationwide awareness programs to enhance user trust and accessibility. The implications suggest that strong

policy alignment, long-term investment, and citizen-focused system design are essential for building a more efficient and inclusive digital public administration in Pakistan.

Keywords: E-Government, Digital Public Services, Public Administration, Digital Transformation, Pakistan

Public Sector Innovation: Gaps in Policy and Practice for Sustainable Governance in Pakistan

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This study examines the gaps in public sector innovation (PSI) policy and practice in Pakistan, and explores their implications for achieving sustainable governance. Despite numerous efforts by the government to foster innovation in public institutions, the study identifies significant challenges that hinder effective implementation, including bureaucratic resistance, political interference, lack of skilled personnel, and financial constraints. The research employs a qualitative approach, utilizing document analysis, semi-structured interviews, and case studies to examine existing policies, including the National Institutional Reform Agenda (NIRA), the Digital Pakistan Policy, and the Pakistan Citizen Portal. Findings indicate a persistent policy- practice gap, where well-intended policies fail to achieve their objectives due to entrenched bureaucratic structures and insufficient political will. Moreover, the study emphasizes that innovation in governance is not limited to technology adoption but also involves restructuring administrative processes, fostering a culture of accountability, and ensuring resource efficiency. The study further highlights the need for clearer implementation frameworks, leadership commitment, and capacity-building initiatives to overcome these barriers. Ultimately, the research underscores the importance of aligning innovation policies with the principles of sustainable governance in enhancing public sector performance and improving citizen satisfaction in Pakistan. By addressing the identified gaps, Pakistan can pave the way for more responsive, efficient, and transparent governance.

Keywords: Public Sector Innovation, Sustainable Governance, Policy-Practice Gap, Bureaucratic Resistance, Capacity Building

Negotiation modernity: An anthropological perspective on cultural transformation in urban Pakistan

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This study examines how urban communities in Pakistan negotiate modernity and the cultural transformations that result from the interaction of traditional practices and modern

influences in cities like Karachi and Lahore. The central research question explores how these urban populations engage with modernity: How do urban communities in Pakistan modernity, and what forms of cultural transformation occur as a result? This research is framed within the anthropological theories of modernity, hybridity, and negotiation, focusing on how local cultural practices intersect with global influences. Through ethnography, participant observation, and semi-structured interviews with a diverse range of urban residents—including migrants, youth, women, and business owners—this study provides insights into the complexities of cultural change in Pakistan’s urban centers. The main findings reveal that the negotiation of modernity in urban Pakistan is a dynamic, multifaceted process involving adaptation, resistance, and selective appropriation. Urban residents, particularly youth, embrace modern consumer culture, but they do so through a hybridization of global and local cultural practices. At the same time, many participants express resistance to aspects of modernity, such as the erosion of traditional family structures and gender roles, which points to a continuous negotiation between modernity and tradition. This study contributes to the anthropological understanding of modernity by highlighting the active role of agency in shaping cultural transformation, challenging the view of modernity as a linear progression. The findings also emphasize the impact of globalization, migration, and urban planning on cultural negotiations in Pakistan, offering practical implications for policy and urban development. The study highlights the importance of adopting a more inclusive cultural approach that strikes a balance between modernity and the preservation of local values.

The Role of Financial Technology (FinTech) in Emerging Markets of Pakistan: A Systematic Review

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Financial Technology (FinTech) has emerged as a transformative force in global finance, particularly in emerging markets where traditional banking services remain limited. This systematic review examines the role of FinTech in Pakistan, synthesizing empirical and policy literature published between 2005 and 2025. The study focuses on key domains, including digital payments, mobile banking, peer-to-peer (P2P) lending, InsurTech, and blockchain applications. It evaluates their impact on financial inclusion, SME financing, consumer welfare, and transaction efficiency. A comprehensive search of international databases, local journals, and grey literature yielded 100 relevant studies, which were analyzed using narrative synthesis and, where applicable, quantitative meta-analysis. Findings indicate that mobile banking and digital wallets have significantly increased account ownership (by 25–40%) and reduced transaction costs (by 15–20%). At the same time, P2P lending platforms have improved access to short-term finance for SMEs, albeit with higher perceived risk and interest rates. InsurTech interventions enhanced insurance coverage and streamlined claims processing, particularly for low-income households. Adoption and impact are influenced by trust in digital platforms, regulatory frameworks, digital infrastructure, and socio-demographic factors, including urban versus rural

location, gender, and education. Despite substantial progress, challenges persist, including digital literacy gaps, cybersecurity threats, undercoverage in rural areas, and regulatory uncertainty, particularly in the adoption of blockchain and cryptocurrency. The review emphasizes the importance of targeted policy interventions, inclusive product design, and rigorous longitudinal and impact evaluations to optimize the potential of FinTech in promoting financial inclusion and economic development. Overall, FinTech in Pakistan presents a significant opportunity to strengthen the country financial ecosystem; however, realizing its full potential requires coordinated action among regulators, financial institutions, and development actors.

Keywords: FinTech, Financial Inclusion, Digital Payments, Mobile Banking, Pakistan

Development of Worker-Friendly Equipment to Reduce Musculoskeletal Disorders among Brick Kiln Workers

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Workers in the traditional brick kiln sector globally showed high rates of musculoskeletal disorders, especially in the lower back, knees, and upper limbs. This morbidity directly resulted from long periods of awkward postures and the use of ergonomic tools during the core production activities. Because the cost of full automation was financially unfeasible, a significant intervention gap persists. This research addressed the issue by designing and modeling a cost effective, hybrid ergonomic solution. Following this, an initial assessment was done through standardized tools RULA and REBA in order to quantify the high ergonomic risk scores of existing work tasks. Based on the quantified stressors, the research developed and documented three specific design blueprints: an optimized wheelbarrow for balanced material handling, an improved brick mold to reduce forceful gripping, and an adjustable coal feeding stick to correct spinal posture. The research culminated in creating detailed prototypes with engineering models that demonstrated calculated, hypothetical ergonomic risk score reduction compared to the current methods. This study provided a validated, low tech blueprint intended for immediate, sustainable adoption to improve occupational health in resource constrained brick kiln environments.

Mental Resilience and Motivation Patterns among Competitive Athletes in Pakistan: A Mixed-Methods Approach

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This study explores the role of mental resilience and motivation patterns among competitive athletes in Pakistan. The objective is to understand how psychological factors influence athletic performance and how different motivational styles support resilience during competition. A mixed-methods approach is used, combining quantitative surveys with qualitative interviews to provide a comprehensive understanding of the topic. The quantitative data are collected through standardized resilience and motivation scales completed by 120 athletes from various sports, including cricket, football, athletics, and martial arts. Qualitative insights are gathered from interviews with 12 athletes selected through purposive sampling. The findings indicate that athletes with higher intrinsic motivation exhibit stronger resilience and more effective coping strategies during stressful performance situations. Extrinsic motivation is also present; however, athletes who rely primarily on external rewards tend to exhibit lower consistency in mental strength. The interview results support these patterns, indicating that personal passion, self-belief, and long-term goals make a significant contribution to mental resilience. This study highlights the importance of integrating mental skills training and intrinsic motivation strategies into sports development programs in Pakistan. The results contribute to a deeper understanding of how psychological factors influence athletic success and provide implications for coaches, sports psychologists, and policymakers seeking to enhance athlete development.

Keywords: Mental resilience, Athlete motivation, Competitive sports, Mixed-methods research,

Pakistan athletes

Obstacles and Attitudes for Behavioral therapy in Pakistan; An Analysis of Factors and Social Boundaries

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Behavioral therapy is a fundamental kind of treatment for people struggling with meager mental well-being for overcoming emotional obstacles and seeking personal development via the use of psychological tools. This research explores the barriers to seeking behavioral therapy in Pakistan due to the fragile mental health of the population. The natives were approached through the cross-sectional study, for collecting data specifically from adults between the ages of 15 years above from all socioeconomic backgrounds. 340 responses were collected, in which the ratio of female participants was 82.4% and of male was 17.6%. The most pervasive reasons of high stress levels among people were self-doubt and negative way of thinking. The findings indicate that a sizable portion of Pakistan population is coping with mental health problems, but getting professional help is socially stigmatized. Nevertheless, the 17.1% people stated that they had sought the assistance of a counsellor or psychiatrist, and out of that 95.3% of those surveyed recommended therapy to other facing any psychological issue. The exploration end with the conclusion that Pakistani natives are in an utmost need to access towards mental health and if not managed, may lead to the social detachment.

Keywords: Behavioral therapy, Pakistan, mental health, stress, stigma.

The Misogyny of Dorian Gray: A Feminist Stylistics Analysis of Female Representation In Oscar Wilde's Writing

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Oscar Wilde's *The Picture of Dorian Gray*, despite being legally and morally questioned at the time of its publishing, has endured the passage of time to establish itself as one of the canonical classics of English literature. To this day, *The Picture of Dorian Gray* entertains a wide readership from all over the world. However, Wilde's portrayal of female characters still remains highly problematic. This paper addresses misogyny in *The Picture of Dorian Gray* and focuses on Wilde's stereotypical treatment of the female characters. It employs Sara Mills' Feminist Stylistics framework at discourse level in order to analyze whose interest Wilde portrays throughout the novel and to what extent do the female characters get to have their own voice. The analysis reveals that Wilde stereotypically categorizes women and strips them of their agency. The male characters describe most of the female experience in the book and therefore, none of the information about any woman in *The Picture of Dorian Gray* comes from a reliable source. Moreover, Wilde manipulates Sybil Vane's character to portray a highly unrealistic, eroticized woman through a girl of barely seventeen. The research uncovers how with the survival of great classics the misogyny of these books continues to survive into the present as well.

Gendered Discourse and Political Power: A Stylistic Examination of Pakistani politicians Speeches

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This study examines how gendered language both constructs and reflects political power through a comparative analysis of speech of male and female politicians of Pakistan. Drawing on Sara Mills' stylistic analysis framework, which highlights how language shapes power relations through gendered discourse, the research explores how prominent leaders employ rhetorical strategies to build leadership identities within a patriarchal political setting. The findings reveal that gendered language serves not only as a mirror of societal norms but also as a performative tool that enables political figures to negotiate and challenge existing power structures. This study contributes to feminist stylistics and discourse analysis by illuminating the dynamic interplay between gender, language, and power in political communication.

Power and Ideology in Pakistani Morning Shows: A Critical Discourse Analysis

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As Pakistan's mass media culture expands, there is a discernible interest in morning shows, evidenced by the increasing number of television stations drawing substantial viewers. The speakers' thoughts, convictions, and power relationships are most effectively conveyed in these performances. They have an impact on preconceived notions as well as the opinions and thoughts of the general public. As a result, this study employs Fairclough's Three-dimensional model (1995, 2001) to examine linguistic sexism, gender stereotypes, power dynamics, and ideology formation in spoken discourse in men's and women's languages. Purposive sampling was employed to collect data from two deliberately selected Pakistani morning programs, and discourse analysis was utilized for the qualitative research. Moreover, the findings indicate how power and ideology are formed, created, or fought through media discourse. Furthermore, the findings demonstrate how power and ideology are constructed, generated, or contested through media discourse. This study is significant because it increases awareness of the lexical and syntactic choices made by both genders and exposes the constructed ideologies represented through language. Future researchers can compare Pakistani and foreign morning shows to identify power dynamics and ideological creation through language. This study advances knowledge of how the media upholds social hierarchies and provides insights into the nuanced ways power functions in Pakistani media discourse daily.

Beyond the Fertilizer Bag: An Integrated Strategy for Nitrogen, Climate, and Food Security

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Globally, nitrogen is a dual-edged sword: essential for feeding humanity but a primary driver of environmental pollution. This presentation examines the intricate link between nitrogen use, climate change, and food security, drawing lessons from the critical case of Pakistan. To meet the food demands of a growing population, nations worldwide, particularly in South Asia, have dramatically increased their use of nitrogenous fertilizers. This has delivered undeniable gains in food production. In Pakistan, for instance, cereal output soared from 6.7 million tons to 42.7 million tons between 1961 and 2020, largely fueled by a more than tenfold increase in nitrogen fertilizer inputs. However, this success has come at a profound cost, illustrating a global challenge. Excessive and inefficient application has led to a cascade of reactive nitrogen compounds—such as N₂O, NH₃, NO_x, and NO₃—polluting our environment. These emissions degrade soil, water, and air, threaten biodiversity, and accelerate climate change. Pakistan experience is a stark example: nitrogen use efficiency in its cereal systems has plummeted from 50% to below

30%, creating a massive nitrogen surplus. Consequently, over the last five decades, agriculture-driven N₂O emissions have risen from 64 to over 1,000 million tons of CO₂-equivalent annually. This case underscores a critical global policy dilemma: mitigation efforts must be systemic. Addressing one form of nitrogen pollution (e.g., water contamination) can exacerbate others (e.g., air pollution or greenhouse gas emissions).

Socio-Psychological Determinants of Farmers' Continuance Intention toward Conservation Agriculture: A PLS-SEM Approach

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Conservation Agriculture (CA) has become a resource-efficient and climate-smart agricultural system, which improves soil health, productivity, and environmental sustainability. Nevertheless, CA usage is low in Pakistan regardless of its established advantages. The behavioral and psychological characteristics of the farmers rather than the economic or purely technical ones seem to be relevant in the willingness of the farmers to adopt and remain in the CA practices. The research was intended to understand socio-psychological factors that would affect the attitudes and behavioral intentions of Pakistani farmers towards further use of CA. It particularly aimed at incorporating the Diffusion of Innovation (DOI) and Technology Acceptance Model (TAM) models to effectively describe the perceptions, adoption, and maintenance of innovative agricultural activities among farmers. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used as a quantitative research design. The sample size used was 201 farmers to gather primary data. The model also incorporated reflective and formative constructs and it comprised variables like relative advantage, compatibility, low complexity, attitude and intention. The findings showed that relative advantage, compatibility, and low complexity had a significant impact on the attitude of farmers, whereas attitude had the most significant impact on behavioral intention. The results have shown that farmers who perceive CA to be beneficial and compatible with their existing operations and easy to conduct their operations will be willing to persist with CA significantly. It is the first empirical research in Pakistan that incorporates the DOI and TAM in explaining the CA adoption behavior. It provides a comprehensive image that how psychological factors impact the decision of farmers.

Waste Reduction Strategies for Sustainable Urban Development In The Punjab, Pakistan

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Punjab, the most populous province of Pakistan, generates more than half of the country's municipal solid waste, with major contributions from its largest urban centers Lahore, Faisalabad, Multan, and Rawalpindi. Despite significant public spending, municipal waste management remains inadequate, dominated by open dumping and uncontrolled landfilling, with minimal household-level recycling and segregation. This study aimed to assess the current status of solid waste generation and management in Punjab and propose strategies for sustainable improvement. A mixed-methods research design was employed, including household surveys, focus group discussions, and key informant interviews across the four major cities. Findings revealed that organic waste constitutes over 60% of the waste stream, indicating strong potential for composting and biogas initiatives. However, weak regulatory enforcement, lack of segregation infrastructure, low public awareness, and institutional challenges hinder effective waste management. The informal recycling sector contributes significantly to resource recovery but remains poorly integrated into formal systems. The study recommends an integrated waste minimization framework based on the 3Rs and circular economy principles, alongside community-based segregation programs, small- to medium-scale waste-to-energy projects, and strengthened public-private partnerships. These measures could reduce environmental degradation, improve resource efficiency, and support progress toward the Sustainable Development Goals.

Impact of Religious Motivation On Rate of Recidivism in Rural Areas of District Okara

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The present study “Impact of religious motivation on rate of recidivism in rural areas of district Okara” sees the critical review of religious component of probation system in community correction and would provide an insight into the overall effectiveness of religious element in probation system as this is based on empirical and scientific research. In this research human universe is all the muslim offenders (residing in rural areas of district okara) referred to probation officer for resocialization and have completed their rehabilitation process. Sampling Frame was obtained from office of district probation officer Okara whereas a sample 308 was selected from district Okara by using simple random sampling. Data was collected by researcher himself by developing two interview schedules, named Religious Motivation Scale (RMS) and Rate of Recidivism Scale (RRS), and analyzed by using Statistical Package for Social Sciences (SPSS) Version 20 and Microsoft Excel 2010. All the respondents were male and belonged to rural areas of district Okara. Majority of participants (76.0%) were businessman whereas ratio of Unemployed respondents is 9.75%. Most of participants (92.0%) fall in the age group of 26 to 45 years while (72.9%) were married. The distribution of participants based on income depicts that majority of participants (57.3%) are having income between 6100-10,000 whereas 32.6% respondents have income more than 10000 rupees. A large no. of participants (80.9%) have more than three children. There was a significant difference

among participants' rate of recidivism mean scores based on age group and income. Hence, it was found that mean difference of religious motivation was (.15972) between participants belonging to (26-45 years) and (46 & above) age groups was significant at $p < 0.05$. The mean difference of religious motivation was (.38810 & 34314) between respondents belonging to (3100-6000) and (10000 & above) income group.

Investigating the Optoelectronic Properties and Third-Order Nonlinear Optical Susceptibility of Cross-Shaped Molecules: From Molecular Insights to Material Applications

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In the present investigation, we use a dual computational approach (at single molecular and solid-state levels) to explore the optoelectronic and nonlinear optical (NLO) properties of crossed shaped derivatives. The solid-state electronic band structures of the compounds 1-3 (the derivatives of tetracarboxylic acid in cross-shaped having the core of benzene (1), pyrazinoquinoxaline (2) and tetrathiafulvalene (3)) are calculated. The calculated band gaps for compounds 1-2 are found to be direct band gaps and compound 3 to be indirect band gap with energy gaps of 2.749, 1.765 and 0.875 eV, respectively. The important optical properties including refractive index, absorption coefficients, loss functions and extinction coefficient of these semiconductors are calculated at bulk-level to seek their potential applications as efficient optoelectronic materials. Additionally, we use the Lorentz approximation to calculate the third-order NLO susceptibilities of compounds 1-3 using the molecular hyperpolarizability and solid-state parameters. The calculated third-order NLO susceptibilities of compounds 1-3 are found to be 6.92×10^{-12} , 64.0×10^{-12} and 26.3×10^{-12} esu, respectively. Thus, the present study not only provides a way to connect the calculated third-order molecular NLO polarizability to NLO susceptibilities for compounds 1-3 through Lorentz approximation but also highlights the importance of central core modifications on their NLO susceptibilities.

Electro-Optical and Charge Transport Properties of Chalcone Derivatives: A Dual Approach from Molecular to Material-Level Simulations

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In this study, three chalcone derivatives with basic skeleton [1,100-biphenyl]-4-yl)-3-(3-nitrophenyl) prop-2-en-1-one are investigated. The basic skeleton was modified with the addition of three terminal groups including hydrogen (1), methyl (2) and methoxy group (3). Using CASTEP Module, the optoelectronic properties are evaluated. The solid-state geometries of these systems are explored within the periodic boundary conditions (PBC). Among these systems, only system 3 is found much better in terms of optical properties such as dielectric function, absorption, conductivity, reflectivity, loss function and refractive index. Our system 3 showed a higher dielectric function value about 3.7 at 1.8 eV thereby absorption $6.9 \times 10^4 \text{ cm}^{-1}$ at 300 nm and conductivity 1.2 fs^{-1} at 3.5 eV in the (001) plane. Furthermore, system 3 exhibited a high reflectivity and loss function in the (010) plane. Furthermore, system 3 exhibited a high reflectivity and loss function in the (010) plane. Electronic band structure, the density of state and electronic coupling analysis also reveal that system 3 has a potential application in charge transport devices. This system can transport charge about ~25 times higher as compared to systems 1 and 2. The methoxy group in system 3 has two lone pairs on the oxygen atom, thereby more contribution for electron π -conjugation in the system through resonance. However, hydrogen and methyl moiety participate through hyper conjugation and their involvement in π -conjugation is negligible.

First-Principles Study of Structural, Electronic and Magnetic Properties of Fe-Doped MgS

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This study aims to predict the structural, electronic, and magnetic properties of the $\text{Mg}_{1-x}\text{Fe}_x\text{S}$ ($x = 0.25, 0.50, 0.75$, and 1) compound in cubic phase using a first-principles approach. The structural properties were evaluated with the Perdew–Burk–Ernzerhof generalized gradient approximation (PBE-GGA). The electronic and magnetic properties were calculated using the modified Becke–Johnson potential combined with LDA correlation (mBJ-LDA), which offers a better description of electronic behavior than PBE-GGA. The findings indicate that this compound shows half-metallic ferromagnetism with 100% spin polarization at the Fermi level. For all Fe concentrations (0.25, 0.50, 0.75, and 1), the total magnetic moment remains $4\mu_B$, with a small local magnetic contribution on the Mg and S atoms. In addition, the local magnetic moments of the Fe atom decrease compared to their free-atom values.

Stakeholder Influence under AKIS for Sustainable Agricultural Development in Pakistan

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AKIS characterizes the linkage among institutions, farmers, and academia for the purpose of knowledge generation, dissemination and utilization for sustainable agricultural development. In the context of Pakistan, it is very much critical for bringing improvements in the livelihoods of rural people. Though the impact and functionality of AKIS is associated to strengths of institutional linkages and consequences of different stakeholders i.e. researcher, extension worker, farmer, NGOs, private sector (input-suppliers) and policy makers. Considering this scenario, current study explores the dynamics of institutional linkages and stakeholders influences within AKIS framework in Pakistan. A mix-method research approach using cross-sectional survey design was adopted for the study. A total sample of 2250 was selected from 15 districts using semi-structured interview schedule as survey research instrument for quantitative data and interview guide was used for qualitative data collection. Results revealed that amongst the stakeholders; farmers, private sector/input supply agencies and research organizations are more prominent in AKIS with mean scores of $\bar{x}=3.81$, $\bar{x}=3.80$, & $\bar{x}=2.84$ respectively. Moreover, dealers of grain markets, agricultural marketing, and extension workers & progressive farmers are top three influencers respectively in AKIS framework for rural development in Pakistan. In the context of stakeholders' linkage analysis; farmers meeting ($\bar{x}=2.89$), trainings ($\bar{x}=2.77$), and on-farm visits ($\bar{x}=2.76$) are most important factors for developing strong linkages among stakeholders. Among the functional linkages of AKIS stakeholders; extension-farmer linkage ranked as highest ($\bar{x}=2.77$), extension-education linkage ranked 2nd ($\bar{x}=2.73$), whereas research-extension linkage and research-education linkage ranked 3rd ($\bar{x}=2.64$ for both). As the AKIS in Pakistan is farmer-oriented therefore, it is dire need to strengthen agriculture extension and advisory services by developing strong and resilient linkage among other stakeholders for effective knowledge management and delivery.

Emerging Technology and Sustainable Innovation's in Food and Allied Sciences for Ensuring Future Food Security

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Emerging technologies and sustainable innovations in Food and Allied Sciences are rapidly reshaping the global landscape of food production, processing, and distribution. As the world faces increasing pressures from population growth, environmental degradation, climate change, and resource scarcity, the need for resilient, efficient, and

sustainable food systems has become a critical priority. This article represented how advanced scientific approaches and technological breakthroughs can collectively address these challenges and contribute to long-term food security. Recent developments such as precision agriculture, remote sensing, genetic improvement, controlled-environment farming, and smart irrigation systems are enabling farmers to optimize crop yields while minimizing environmental impact. In the food processing sector, modern technologies including automation, artificial intelligence, Internet of Things (IoT) devices, and advanced preservation techniques are enhancing product quality, reducing food losses, and improving nutritional value. Biotechnology, functional food development, and microbial innovations also offer promising solutions for creating nutrient-dense, affordable, and sustainable food products. Sustainable packaging materials, circular economy practices, and renewable resource utilization are further contributing to eco-friendly food value chains. Additionally, climate-resilient agricultural strategies, post-harvest innovations, and digital monitoring tools are helping communities adapt to changing climatic conditions and maintain stable food supplies. By integrating technological innovation with responsible resource management, Food and Allied Sciences can play a transformative role in safeguarding future generations against food insecurity.

Deep-Feature X-SN: A Contrastive Learning Framework for Cross-Dataset Generalization in Deep-fake Detection

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The rapid evolution of Generative Adversarial Networks (GANs) and Diffusion Models (DMs) in the past years has led to the development of very realistic deep-fakes and synthetic content, causing serious risks to digital security and public trust. Current deep-fake detection models attain high performance on specific datasets but strive to generalize well on new datasets or manipulation methods. This drawback occurs due to dataset bias, insufficient feature discrimination, and the dependence on single-domain learning frameworks. Earlier studies on conventional CNN architectures and manual forensic indicators have strived to maintain robustness across emerging generative models. In order to address these issues, we propose to use Deep-Feature X-SN, an advanced deep learning framework that uses a tripartite structure of specialized feature extractors trained with Siamese networks and contrastive learning to detect discriminative features of real, GAN-generated, and diffusion-generated images. The extracted features are merged through a CNN-based classifier to improve classification. Experimental calculations across multiple datasets verify higher cross-dataset generalization, gaining 97.29% detection accuracy and exceeding prior approaches by over 10%. The proposed framework indicates improved flexibility and strength to unseen and new generative frameworks, which contributes in the development of a more robust and secure AI-driven cyber-security ecosystem.

An Interpretable, Multimodal Deep Learning Framework for Early Alzheimer Disease

Detection: Synergizing MRI, Quantitative EEG, and Clinical Biomarkers

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Early detection of Alzheimer disease (AD) is difficult due to its gradual and variable onset, along with the complex, nonlinear relationships between the loss of brain tissue and cognitive decline. Current diagnostic methods frequently struggle to efficiently integrate various data sources, such as brain imaging, electrical brain activity readings, and clinical evaluations. We created an innovative multimodal deep learning system to address this issue by integrating patient demographics, quantitative electroencephalography (qEEG), and structural brain MRI scans into one clear diagnostic framework. Our design incorporates three concurrent processing streams: (1) a 3D Residual Network for extracting advanced spatial features from T1-weighted MRI; (2) a Temporal Convolutional Network to detect frequency and timing patterns in qEEG data; and (3) a Multi-Layer Perceptron for analyzing cognitive test scores and demographic details (MMSE, MoCA). These varied data representations are combined using a Context-Aware Gated Attention mechanism that strategically evaluates each data type impact to enhance overall learning. We confirmed our method utilizing data from 840 participants (220 cognitively healthy individuals, 380 exhibiting Mild Cognitive Impairment, and 240 with Alzheimer disease). Brain imaging and clinical information were sourced from the Alzheimer Disease Neuroimaging Initiative, whereas qEEG recordings were gathered from the Temple University Hospital EEG Corpus and Open Neuro databases. We integrated SHAP (Shapley Additive Explanations) to guarantee that our model choices could be linked to clinically pertinent factors. The system showed remarkable capability in identifying early-stage AD, attaining an AUC of 0.93 [95% CI: 0.91–0.95] in differentiating MCI from healthy subjects outperforming models based on single data types (MRI alone: 0.87 AUC; qEEG alone: 0.84 AUC). The model achieved an accuracy of 88.5% in predicting which MCI patients would advance to AD over a three-year period. Analysis indicated that hippocampal atrophy (from MRI), reduced alpha brain activity in posterior areas (from qEEG), and APOE $\epsilon 4$ genetic status were the most significant predictive indicators consistent with recognized knowledge of AD pathology. This work delivers a reliable, interpretable, and validated multimodal system that successfully integrates structural and functional brain data. With its combination of explainable risk assessment and high predictive performance, this approach offers valuable potential for AI-supported clinical decision-making in early dementia detection.

Mitigating Unauthorized Access in Data Security Using IDs and IPs

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In modern highly connected era, digital devices are more closely linked together than ever. So, the demand for protecting these devices & data is also increasing rapidly. Neglecting this need can lead to the potential danger of accessing sensitive data without authorization. This unauthorized access is creating threats like financial loss, data breach & reputational damage. Traditional protective systems like firewalls, access controls & weak passwords are not enough to safeguard data from sophisticated intrusion techniques used by attackers today. Challenges like Brute-force attacks, Phishing, SQL injection Insider misuse require advanced protection strategies to ensure confidentiality, integrity & availability—three core principles of CIA triad. Addressing these challenges is a technical requirement but if left untreated, can lead to damaging customer's trust & credibility of organization. This study outlines the role of more efficient defense mechanisms like IDS & IPS to tackle unauthorized intrusions in digital environments. These offer a better security tier to track & block malicious activities. IDS monitors access to data or files & identifies potential threats. It works by comparing monitored activities with known attack patterns. If there a match, it give alerts to administrators. It only detects attacks does not block them automatically. IPS not only detects but also blocks suspicious activities instantly. This can be seen when a financial institution is facing brute-force login attempts, IDS detected that there a great number of failed logins originating from a single IP address. But, IPS terminated the origin ensuring confidentiality & integrity of system. Both IDS & IPS function like signature & pattern based systems to secure sensitive data from unauthorized access at early stages. Their limitation lies in the fact that both systems cannot identify unknown (zero-day) attacks but this can be overcome by using Anomaly-Based methods.

Soliton Dynamics and Stability in a Higher-Order Dispersive Cubic–Quintic Nonlinear Schrödinger Equation

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This work focuses on the derivation of multi-peak solitons and a variety of other nonlinear wave structures for a higher-order nonlinear Schrödinger equation with cubic–quintic dispersion, employing the modified exponential rational function method (mERFM). The proposed model is significant in several scientific and engineering fields, such as quantum mechanics, electrical transmission lines, oceanography, and optical fiber communications. Incorporating higher-order dispersive and nonlinear effects particularly the cubic–quintic nonlinear terms allow the model to more accurately describe the evolution of ultra-short pulse propagation in optical fibers as well as nonlinear wave dynamics in oceanic media. A rich family of exact solutions is obtained, including bright and dark solitons, as well as trigonometric, hyperbolic, rational, exponential, and singular wave forms. These solutions enhance the understanding of complex nonlinear wave interactions and oceanic wave phenomena in both shallow- and deep water regimes.

Moreover, graphical representations are presented to demonstrate the impact of key physical parameters on soliton behavior, providing clear physical interpretations. Overall, the results confirm the effectiveness of the mERFM and illustrate its potential for addressing a wide class of nonlinear problems arising in mathematical physics.

Fractal Geometry and Nonlinear Dynamics of Agricultural Models with Allee Effect

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Agricultural and ecological systems often exhibit nonlinear behavior due to density dependence, environmental variability, and human interventions such as harvesting. One important nonlinear mechanism in population-based agricultural models is the Allee effect, which introduces threshold-dependent growth and can significantly alter system stability. In this talk, we investigate discrete-time agricultural models incorporating the Allee effect using tools from fractal geometry and nonlinear dynamical systems. By applying fixed-point iterative schemes, we analyze equilibrium points, stability conditions, and bifurcation phenomena including period-doubling and Neimark–Sacker bifurcations. The emergence of fractal structures, such as Julia-type sets and complex basins of attraction, reveals strong sensitivity to system parameters representing growth rate, harvesting effort, and environmental stress. These fractal patterns provide valuable insight into multistability, sudden population collapse, and sustainable parameter regimes. The results demonstrate that fractal analysis is not only a powerful visualization tool but also a meaningful indicator of resilience and risk in agricultural systems. This interdisciplinary study bridges advanced mathematical theory with applied agricultural modeling and supports improved decision-making for sustainable crop and population management.

Computational insights into phthalimide-core non-fullerene acceptors for next-generation organic solar cells

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Traditional fullerene-based acceptors in organic solar cells (OSCs) suffer from limitations such as poor tunability, narrow absorption spectra, and limited morphological stability, restricting further improvements in device efficiency. To address these challenges, non-fullerene acceptors (NFAs) with tunable energy levels and broad optical absorption have gained increasing attention. In this study, seven novel phthalimide core-based donor–acceptor molecules (BPDM1–BPDM7) are computationally designed by modifying the terminal units of a reference molecule (BPDF). Using density functional theory (DFT) and time-dependent DFT (TD-DFT) calculations at the B3LYP/6-31G (d,p) level, photovoltaic

parameters such as bandgap, frontier orbital energies, absorption maxima, light harvesting efficiency (LHE), reorganization energies (λ_e , λ_h), dipole moments, open-circuit voltages (V_{oc}), and fill factors (FF) are systematically evaluated. The designed derivatives exhibit narrow bandgap (1.84–2.18 eV) and red-shifted absorption (681–829 nm). BPDM3 shows the lowest bandgap (1.84 eV). BPDM7 achieves the highest dipole moment (3.88 D), V_{oc} (1.93 V), and FF (92.96%), while BPDM4 displays the lowest λ_e and λ_h values, indicating superior charge mobility. The reduced exciton binding energies across all derivatives suggest enhanced charge separation capabilities. These results not only provide a pathway for rational NFA design but also serve as a theoretical foundation for future experimental development of high-efficiency OSCs.

Identifying Pathways for Scaling Alternate Wetting and Drying (AWD) as a Climate-Smart Technology in Punjab

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Alternate Wetting and Drying (AWD) has emerged as a climate-smart water management technique for rice cultivation, offering substantial potential to reduce irrigation water use, labor and energy costs, and greenhouse gas (GHG) emissions without compromising yield when properly implemented. Despite its proven benefits and recognition as an IPCC-accepted GHG mitigation practice, the adoption of AWD in Punjab, Pakistan remains limited. This study synthesizes a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis to identify practical entry points for scaling AWD across diverse rice-growing domains of Punjab. Key strengths of AWD include water and energy savings, reduced lodging through improved root anchorage, broad adaptability across soil types and climates, and compatibility with sustainable rice production frameworks. However, adoption is constrained by limited farmer awareness, knowledge-intensive management requirements, drainage challenges in heavy soils, the warabandi irrigation system, tenant farming arrangements, and prevailing perceptions that higher water inputs guarantee higher yields. Significant opportunities exist to enhance water productivity, earn carbon credits, improve fertilizer use efficiency, reduce salinity under brackish water irrigation, and integrate AWD with resource-conserving technologies such as laser land leveling, zero tillage for wheat, and hybrid rice cultivation. Entry points for AWD promotion include targeting water-scarce tail-end farmers, establishing demonstration plots and farmer field schools, deploying smart water tubes, incentivizing rational water use, and strengthening institutional support for GHG quantification and carbon financing. Addressing threats related to subsidized solar pumping, weak extension services, and institutional gaps will be critical for sustainable scaling. Overall, strategically leveraging AWD's strengths and opportunities while addressing systemic constraints can enable its effective mainstreaming as a cornerstone of climate-smart rice systems in Punjab.

Automated Detection of Cyberbullying-Driven Hate Speech on Social Networks Using a Stacked Ensemble Learning Approach

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As a result of the increasing use of online networks platforms such as Twitter, YouTube, and Facebook, the hate speech has grown. Nevertheless, implementing automated detection methods has been difficult because distinguishing hate speech from general offensive language requires analyzing user-generated posts, which are often short, informal, and constantly evolving. It is particularly difficult to recognize hate speech in text since it requires accurate context detection to distinguish between offensive language and neutral statements. As web-based meetings can have negative results for both minority and majority teams, escalating disputes between them. This study introduces a classification framework that categorizes tweets into three distinct groups: hateful content, abusive expressions, and neutral statements. The current system applies TF-IDF features derived from the tweet text and employs SVM, Random Forest, XGBoost, and Logistic Regression as its primary classification models. The final model performs exceptionally well when combined with the main training model in an ensemble configuration. The model was trained using Kaggle & Hate Speech dataset, which contained 24,784 tweets with eight attributes. By excluding manually derived features, the accuracy of the model was significantly improved. The proposed ensemble model achieved a high degree of accuracy of 96 %, exceeding the accuracy rates of the individual classifiers, SVM achieved 93%, Random Forest reached 94%, and XGBoost recorded 88%. The findings indicate that the stacking approach significantly strengthens hate-speech detection systems used on social networking platforms.

Resistance Potential of Different Potato Cultivars Against Early Blight Caused By Alternaria Solani And Its Management

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Early blight caused by fungal pathogen *Alternaria solani* is an important disease of potato that results in 20-30% yield losses in potato crop worldwide. Symptoms of disease on infected potato plants include brown to black colored spots on leaves. In this study, six potato cultivars were grown under field conditions to assess their resistance potential to early blight disease. Randomized complete block design (RCBD) with three replications was used to carry out the experiment. Different potato cultivars responded differently to early blight. Data of disease incidence and severity was recorded starting from the onset of disease till harvest. The influence of environmental parameters including maximum and

minimum temperature, relative humidity, rainfall and wind speed on disease development was investigated. A correlation analysis was conducted to check the interaction of environment and early blight disease development. Management of disease was conducted by using extracts of *Azadirachta indica* and *Allium sativum*. The extracts were applied at 10 days interval and their efficacy in combating the disease severity was checked. It was found that three cultivars Musica, Kuroda and Sante showed moderately susceptible response whereas Florous, Rocoo and Esmee were moderately resistant. Early blight incidence was influenced by temperature and relative humidity. Maximum disease incidence was recorded at 30°C while least was observed at 20°C. The results showed that 20 to 30°C is optimal temperature for early blight. There was negative correlation found between relative humidity and disease incidence. Results showed that increasing humidity increased the percentage of disease incidence. Results showed that application of 5% neem extract proved useful for the control of early blight of potato.

Biology and Management of Blackleg Of Potato In Punjab And Its Management

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Potato (*Solanum tuberosum* L.) is a worldwide cultivated crop that is used as a staple food in many countries. However, a number of diseases harm potatoes, lowering their yield and market value. Blackleg of potato is one of the most devastating diseases, reducing potato yield by 30–40%. In this study, sampling of potato blackleg disease specimens was performed in four districts of Punjab: Kasur, Okara, Sahiwal, and Pakpattan to study the incidence of blackleg disease. And in-vitro evaluation of biocontrol agents *Pseudomonas* spp. and *Trichoderma hamatum* against blackleg of potato performed. A field trial was established in research area of UAF sub-campus Depalpur, Okara to study disease epidemiology. The research revealed that Potato blackleg disease causes 30-40% damage to crop. Moreover in-vitro analyses showed that biocontrol agents play positive role against disease. *Trichoderma hamatum* not only control the disease but also provides nutrients to plant and helps in increase in yield. Moreover, meteorological agents also play important role in disease occurrence. Disease occurs between 18°C -28°C, high humidity 82-89%. Disease favored by high temperature and increase at low temperature. Data of blackleg disease incidence was recorded at weekly intervals. Through correlation analysis, the effects of environmental parameters such as wind speed, relative humidity, rainfall, and maximum and minimum temperatures on the development of disease was examined. Biocontrol agents i.e., *Pseudomonas* spp. And *Trichoderma hamatum* evaluated for their antagonistic potential against blackleg bacterium under in vitro conditions. Efficacy of biocontrol agent's shows antagonistic effect against blackleg pathogen was measured. The data was analyzed statistically by using standard protocols.

Training Needs Assessment for Strengthening Women-oriented Rural Entrepreneurships in District Sargodha

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Current study was conducted to assess the Training Needs Assessment (TNA) of rural women for participation in Women Business Groups (WBGs) in District Sargodha under the Australian Centre for International Agricultural Research (ACIAR) funded project HORT/2020/129, which supports livelihood improvement through the establishment of women-led business groups (WBGs). Two FGDs were conducted in Village 118-NB (Sillanwali) and Village 10-NB with participants from 9-NB (Bhalwal), involving 20 rural women in total (10 per group). The results showed that most participants were young (21–30 years), had 5–16 years of education, and were directly or indirectly involved in agriculture. About 70% of their households depend on agriculture for livelihoods. Although the women expressed strong motivation to engage in entrepreneurship, they faced significant barriers, including limited involvement in household decision-making, cultural constraints, poor access to financial services, and lack of transport facilities. All participants expressed interest in capacity-building programs for WBGs. They preferred training in kitchen gardening, value addition and food processing, stitching and embroidery, and arts and crafts. They favored short, village-based programs with support for transport, mentoring, business start-up kits, and assistance with business registration, branding, and marketing. Women's preferences for practical, village-based training and start-up support highlight the need for market-oriented, accessible programs that build skills, expand opportunities, and strengthen their participation in WBGs.

Harmful Effects of Pesticides on Human Health and Environment: Case Study of Punjab, Pakistan

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Pesticides are chemical compounds that are used to kill pests. Since many decades there is a debate regarding beneficial and harmful use of pesticides in Agriculture and its impact on human health and environment. The study was conducted in randomly selected three districts of Punjab province. For the purpose, the questionnaire was used as a research instrument containing various study related factors. Total sample consisted of 384 respondents from three selected districts. Total sample size was equally distributed among three districts resulting in 128 respondents per district. Findings of the study

revealed that majority (108) of the respondents was in age group of 26-40 years (28.1%) and 89 were in the age group of 41-45 years (23.2%). Out of 384 people 17.2% were illiterate with no formal education. Matriculation was the most common educational level among the respondents as majority (43.0%) of respondents belongs to this group. The largest percentage, 63% depend solely on farming as their principal source of income supporting the fact that the community is mostly engaged in farming activities. However, 37% combine farming with other off-farm income sources, though the level of diversification is low. All the respondents (100.0%) used to apply pesticides in order to increase their farm production and to control pests. It was found that decision of the farmers generally in the Punjab province and particularly in the targeted research areas is mainly influenced by socio-economic, agronomic and institutional factors. There exists a complex interaction of these factors particularly for the farmers of targeted research area. In the research area pesticides' application was most common on wheat and cotton as reported by 94.01% and 92.19% of respondents, respectively. A wide variety of insects, weeds and diseases widely present in the research area that damage the crops. This is fact that farmers in the Punjab (Pakistan) mostly rely on pesticides for gaining maximum production and this is due to the availability of insufficient knowledge and expertise regarding safe use of pesticides. Other than the synthetic pesticides, some farmers were also using plant-based pesticides, but the ratio of these farmers is very few mainly due to the non-availability of these pesticides at market competitive rate. Awareness about advantages of naturally occurring and plant-based pesticides over synthetic pesticides among farming community was also identified as the major reason. Pesticide application disturbs the pH of soil. High effect of pesticides on bio-diversity and environment is through contamination of soil and water. Use of oil and sun glasses by the farmers were very common precautionary measure adopted. The ill-Health Symptoms after Pesticide Application table classify the minor health complaints made by farmers. The studies presented here show health effects from pesticide exposure, both current and future, should pesticide use persist. Safe application training for farmers should also be provided and adequate medical treatment for farmers exposed to these threats should also be made available. The results of correlation analysis showed a significant association between adoption levels of protected measures and occurrence of different ill-health symptoms reported by the respondents. A negative correlation was found between the use of mask/respirator and the incidence of cough ($p=0.42 < 0.01$). Before buying a pesticide, identify the pest correctly was the best tip for minimizing pesticide risk for environment and health.

Modeling of surface plasmon polaritons in indium antimonide embedded between plasma layers

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Numerical and analytical investigations will be carried out in indium antimonide (InSb) embedded between plasma layers. Maxwell's equations in differential form will be used to solve the numerical problem. Impedance boundary conditions will be employed to obtain the characteristics equation. Influence of tensorial permittivity parameters i.e., plasma frequency and cyclotron of different characteristics of surface plasmon polaritons will be analyzed. Furthermore, influence of InSb temperature and plasma features on effective mode index, propagation length, phase velocity, group velocity, and figure of merit and propagation loss versus THz plasmonic frequency will be analyzed. Normalized field distribution will also be analyzed to verify the conditions of surface plasmon polaritons. These results will contribute in nanoplasmonic devices, thermo optic applications and near field communication in THz frequency spectrum.

Transverse magnetic mode in black phosphorus sandwiched between uniaxial chiral layers

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Numerical analysis of transverse magnetic mode in black phosphorus sandwiched between uniaxial chiral layers will be carried out THz frequency region. Different cases of uniaxial chiral medium will be studied to tune the EM waves. Impedance boundary conditions and transfer matrix technique will be used to obtain the dispersion relation. Influence of chirality, black phosphorus thickness, carrier concentration and number of black phosphorus layers with respect to operating frequency on effective mode index, propagation length, phase velocity, group velocity, and figure of merit and propagation loss will be analyzed along armchair and zigzag conductivity of black phosphorus layers. Power flux distribution will also be analyzed to explore the behavior of EM wave. These results will provide an additional degree of freedom due anisotropy of black phosphorus which control the EM wave for modulators, sensing, communications and waveguides.

Dyakonov surface wave supported at plasma dielectric interface

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Theoretical analysis will be performed in plasma dielectric interfaces in THz frequency regime.

The extended electromagnetic wave theory will be used to solve numerical problem. Transfer matrix technique will be used to obtain the characteristics equation. Influence of isotropic plasma parameters and anisotropic plasma parameters of the different characteristics of electromagnetic surface waves i.e., real part of propagation constant, imaginary part of propagation constant, normalized propagation length, normalized phase velocity and group velocity as the function of THz wave frequency will be analyzed. Wolfram Mathematica Software will be used for numerical modeling of proposed structure. Field profile for plasma medium will also be analyzed to verify the electromagnetic surface wave condition. These results will provide an additional degree of freedom due anisotropy of plasma medium which control the EM wave for advanced THz devices.

Light plasmon coupling at anisotropic chiral-graphene interface

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Light plasmon coupling at anisotropic chiral graphene will be analyzed at THz frequency regime.

For the physical modeling of graphene conductivity Kubo formulism will be used. Advanced electromagnetic wave theory will be used to solve the numerical problem. Anisotropic chiral provides additional degree of freedom to control the chirality. Due to anisotropy of chiral medium two types of modes appeared namely as: lower plasmonic frequency mode and higher plasmonic frequency mode. Impact of physical parameters of anisotropic chiral i.e., chirality and gyrotropy will be studied to tune the characteristics curves. Furthermore, effect of graphene conductivity parameters i.e., chemical potential, scattering rate, number of graphene layers and temperature on effective mode index, normalized propagation constant, normalized propagation length, normalized phase velocity, figure of merit, cut-off frequency will also play a crucial role to modulate plasmon mode. This research will open a new avenue in chiral sensing, microwave devices, antennas, and magnetic resonance imaging (MRI) applications operating in the terahertz (THz) frequency range.

Aqualitative study of the issues in adopting entrepreneurial skills in the livestock business among women farmers in the central punjab, pakistan

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Entrepreneurship has emerged as an upcoming field in attracting and making men and women to have their own start-ups in different field of business. The rural women are contributing a lot in the field of livestock management. However, they have been lacking in having their own independent initiatives to come forward with new ideas & start-ups in the livestock business. This can play a great role in making women farmers empowered and enhancing their status and roles in the society by empowering them. Therefore, this study was designed to know the factors influencing the adoption of entrepreneurial skills among women farmers involved in the livestock business in the Central Punjab, Pakistan. A multistage sampling technique was used for data collection from the women farmers in the Jhang district. At the first stage a rural tehsil was selected and a union council was selected, at the second stage. At the third stage, a village was selected. Two groups of women farmers were selected for conducting focus group discussions (FGDs). An Interviewing-Guide was developed and used for discussing different issues in the adoption of entrepreneurial skills in the livestock business. The discussion participants were asked to sit in a semi-circle. A moderator was trained to conduct the discussion and a note-taker was arranged to take the notes. The recording was made and checked twice in between the discussion for its proper working. The qualitative information was analyzed by using the “Analysis-Continuum” and “Content-Analysis” techniques. The results show that illiteracy, lack of participation in the decision-making process, both at the farm & household levels and lack of awareness, knowledge & training opportunities were the three most important factors hindering the adoption of the entrepreneurial skills among women livestock farmers. Furthermore, improper knowledge of the animal diseases and their treatment, poor knowledge and practices about balance-feed and bi-products value-addition also had negative implications for quantity & quality of milk-production, selling-price of the animals and bi-products. It is suggested to arrange training sessions at village/farm level to learn entrepreneurship skills in livestock business. The attitudinal and behavioral change sessions should also be conducted by the experts with husband and elders of the household to make them convinced for women’s participation in the decision-making process and entrepreneurship-training sessions.

A Kap Survey of The Wheat-Losses During And After Harvesting Process In Southern Punjab, Pakistan

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The wheat-harvesting mechanism in the Punjabi society, including the Southern Punjab, has been, mainly, shifted from manual harvesting to mechanical harvesting. Again, small farmers who are still practicing manual harvesting are used to hire thresher for threshing their wheat. Modern thresher harvests and threshes wheat, simultaneously. A very considerable amount of wheat losses occurs during the wheat-harvesting & wheat-threshing process. Similarly, a reasonable amount of grain-loss happens while shifting wheat from farm to household or market and in the storage. In all these processes, this is knowledge, attitude and practices (KAP) of the farmers that make their mindset to follow various ways & means for the purpose. However, farmers have been facing low to medium losses of wheat-grains which can be a good source of ensuring food-security at household and national level, if controlled by having proper knowledge, attitude and practices. The study was carried out both at the farm and household levels in Tehsil Chowk Sarwar Shaheed of district Muzaffargarh. A combined methodology was used for data collection, both, at the farm and household levels. A participatory observation, a checklist and in-depth interviews were used as methods of data-collection. The checklist was used to record the approved or non-approved practices of saving wheat-losses both at the farms and households and also while shifting wheat grains to market or selling to the middle-man/dealer. The results show that although the wheat-grains dropped at the farm were collected by the poor servant or small farmer's family members, yet that was not weighted/counted towards the total production per acre. The wheat-grains loss on the way during shifting from farm to house/ market were also causing economic loss to the farmers. The small farmers were particularly suffering economically as well as socially. Similarly, the traditional methods of wheat-storage and carelessness during storing-process caused losses in the shape of different diseases or leakage of grains. This was also causing, both, food security and food safety at the household level. This leads to food shortage in the shape of wheat shortage towards the end of the year. The Agriculture Department, Govt. of the Punjab, has been running wheat campaign, every year, in collaboration with the staff & students of the Agricultural Universities in the province, during the wheat-sowing season. It is suggested that these teams should also visit farms and households or gather men & women of the farming household at a common place, during the wheat-harvesting season, to make their knowledge, attitude and practices favorable towards saving wheat losses during and after its harvesting.

Electrochemical corrosion behavior of chitosan-hydroxyapatite coated dental implant

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The article investigates the electrochemical corrosion behavior of chitosan-hydroxyapatite (CS-

HA) encapsulated rust resistant steel (SS) substrate which are commonly used in dental plant. Chitosan a naturally derived polymer from chitin, exhibit biodegradable and

biocompatible properties whereas hydroxyapatite (HA) is a synthetic calcium phosphate-based ceramics, replicates the mineral composition of bone, making it an ideal material for bone tissue engineering. Utilizing a sol gel dip encapsulating technique, a thin layer of (CS-HA) composite was assembled onto the (SS) substrate. The result show that (CS-HA) encapsulating improves the corrosion resistance on the substrate in oral environment. The study also evaluates the tensile power of the CS-HA encapsulating on the SS substrate which is critical for ensuring the long-term durability of the implant. The finding of this research has important suggestion for the development of more reliable and the long-lasting dental implant.

Effect of temperature on mechanical and bioactive properties of glass ceramic

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The research shows that antibacterial properties of metal-ceramic composites, consisting of titanium (Ti) or stainless steel (SS) and hydroxyapatite (HA) or alumina (Al₂O₃), were investigated. The composites were fabricated using a powder metallurgy technique and their purifying activity was performed averse to (*E. coli*) and (*S. aureus*) using the disk diffusion process. The results showed that the metal-ceramic composites shows significant antibacterial activity, with the Ti-HA composite showing the highest activity. The antibacterial activity was assigned to the release of metal Ions, which disrupted the bacterial cell membrane. The study proves the potential of metal-ceramic composites as antimicrobial materials for biomedical applications.

Review of Effects of Ag, Cu, or Fe Addition on Microstructure and Properties of Biodegradable Zn–Mg Alloy

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Zn–Mg alloys are promising candidates for biodegradable implants due to their superior corrosion resistance compared to Fe- and Mg-based alloys. This review investigates the influence of Ag, Cu, and Fe additions on the microstructure, morphology, and electrochemical behavior of Zn–0.5 wt% Mg alloys. Results indicate that Zn–0.5 wt% Mg–0.2 wt% Cu exhibits the highest corrosion resistance (0.0120 mm/year), strong optical absorbance at 230 nm, and improved conductivity with low resistivity ($1.335 \times 10^{11} \Omega \cdot \text{m}$). The alloy also forms stable MgZn and Mg₂Zn₁₁ phases, enhancing both mechanical and biomedical performance. Overall, Zn–0.5 wt% Mg–0.2 wt% Cu is identified as a promising material for cardiovascular and orthopedic implant applications.

Biological investigation of metal (Ag, Cu, Fe) and Ceramic Composites

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The antibacterial activity of the composites can be attributed to the release of metal ions (Ag⁺,

Cu²⁺, and Fe³⁺) from the composite surface, which disrupt the bacterial cell membrane and inhibit bacterial growth. The Ag-containing composites showed the highest antibacterial efficacy due to the strong antimicrobial properties of silver ions. The Cu-containing composites also exhibited significant antibacterial activity, which can be attributed to the antimicrobial properties of copper ions. The Activity was evaluated against *Staphylococcus aureus* (*S. aureus*) and *E. coli* using disk diffusion. The result showed that Fe doesn't show the antibacterial Activity as it is highly toxic to microorganisms whereas the Ag-containing composites showed the highest antibacterial efficacy followed by the Cu-containing Composites.

Machine learning assisted prediction of the mechanical properties of Graphene/Aluminum nanocomposite based on molecular dynamics simulation

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Predicting the mechanical properties of graphene-reinforced metal matrix nanocomposites typically involves atomistic simulations, which are computationally intensive and difficult to scale, or micromechanics models like the Halpin-Tsai model, which can often produce significant errors. In this research, we integrate molecular dynamics (MD) simulations with machine learning (ML) techniques to forecast the mechanical behavior of graphene-reinforced aluminum (Gr/Al) nanocomposites and to improve the Halpin-Tsai model accordingly. We generate extensive MD data for Young's modulus and ultimate tensile strength, varying parameters such as graphene volume fraction, alignment angle, chirality, and temperature. This data is used to train and enhance ML models capable of predicting Young's modulus and tensile strength. Finally, we adjust the classical Halpin-Tsai model by incorporating the modulus values predicted through MD and ML, resulting in a straightforward explicit formula with markedly better accuracy. This combined approach allows for quick and reliable estimation of the composite's mechanical properties, supporting the design and analysis of Gr/Al nanocomposite structures.

Genetic Investigation Of Potential Intraspecific Hybrids Of Canola For Seed Yield Using Diallel Analysis

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Canola (*Brassica napus* L.) is considered as one of the most significant oilseed crops globally that is appreciated due to the presence of healthy edible oil and meal, which is rich in protein. To examine the genetic determination of seed yield and other related characteristics, a full 6x6 diallel (including reciprocals) was carried out with *B. napus* L. genotype. Hybridization among these cultivars was done during the crop season of 2024-25, the resultant F₁ seeds, and their parents, are going to be assessed under a randomized complete block design with two repeats in the 2025-26 growing season. Some of the important morphological and physiological characteristics including Plant height, siliquae per main raceme, days to 50 percent flowering, days to flowering, days to physiological maturity etc. will be recorded. The combination of ability effects (GCA and SCA), gene action (additive and non-additive), and heritability estimates will be assessed. As presented in earlier research, these methods allow considerable insights into the pattern of inheriting traits of yield and are helpful to determine the best hybrid combinations. The results of this study are expected to build breeding plans to develop high yielding canola cultivars with high oil content and incorporating the available information on the recently achieved innovations of canola genetic enhancement.

Effects Of *Sesbania Aculeata* As Green Manure On Fertility Of Different Soil Types And Wheat Growth Parameters

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The present study evaluated the effect of *Sesbania aculeata* leaf biomass as green manure on soil fertility and wheat (*Triticum aestivum* L. cv. Khyber-2023) growth in garden and red soils. Soil physicochemical properties, including pH, EC, organic matter, nitrogen, phosphorus, and potassium, were analyzed before and after the experiment. Wheat growth was assessed through germination, plant height, root and shoot length, biomass, and leaf number, while biochemical parameters including chlorophyll a, chlorophyll b, carotenoids, total soluble protein, soluble sugars, carbohydrates, and vitamin C were determined. Results showed that *Sesbania aculeata* leaf biomass significantly improved soil fertility by increasing organic matter and nutrient availability. Treated plants exhibited enhanced germination, greater root and shoot growth, higher biomass, and improved photosynthetic pigments compared with the control. Significant increases in protein, soluble sugars, carbohydrates, and vitamin C were also observed. Overall, *Sesbania aculeata* proved to be an effective, eco-friendly green manure that enhances soil quality

and wheat productivity, offering a sustainable alternative to chemical fertilizers for environmentally friendly crop production.

Keywords: *Sesbania aculeata*; Green manure, Wheat; Soil fertility, Soil physicochemical Properties, Biochemical traits, Sustainable agriculture.

Isolation Of Fermented Food-Derived *Lactobacillus* Spp. With Potent Activity against Multidrug-Resistant Human Pathogens And Detection Of Their Inhibitory Mechanisms

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Antimicrobial resistance (AMR) has emerged as a major global public health challenge, reducing the effectiveness of conventional antibiotics and creating an urgent need for alternative therapeutic strategies. Probiotic lactic acid bacteria (LAB), particularly members of the genus *Lactiplantibacillus*, have gained considerable attention because of their safety, health-promoting properties, and ability to produce antimicrobial metabolites. Fermented foods represent an important natural source of beneficial LAB; however, information regarding the probiotic potential and antimicrobial mechanisms of LAB isolated from traditional fermented pickles against multidrug-resistant (MDR) pathogens remains limited. Therefore, this study aimed to isolate, characterize, and evaluate the probiotic properties, antibiotic susceptibility, antibacterial activity, molecular identification, and inhibitory mechanisms of LAB isolated from fermented pickles. LAB were isolated on de Man, Rogosa, and Sharpe (MRS) agar and characterized using morphological and biochemical methods. All selected isolates were Gram-positive, rod-shaped, catalase-negative, oxidase-negative, non-motile, and exhibited γ -hemolytic activity, indicating their suitability as potential probiotic candidates. The isolates demonstrated high tolerance to acidic pH and bile salts, suggesting their ability to survive under simulated gastrointestinal conditions. Molecular identification was performed by amplification of the 16S rRNA gene using universal primers followed by DNA sequencing and phylogenetic analysis. PCR amplification produced clear single bands corresponding to the expected size of the 16S rRNA gene, confirming successful amplification. Sequence analysis and phylogenetic comparison with reference sequences from the NCBI GenBank database identified the selected isolates as members of the genus *Lactiplantibacillus*. The cauliflower pickle isolates clustered closely with *Lactiplantibacillus pentosus*, whereas the mixed pickle isolate grouped with *Lactiplantibacillus plantarum*, confirming their taxonomic identity. The isolates exhibited a favorable antibiotic susceptibility profile and demonstrated broad-spectrum antibacterial activity against multidrug-resistant human pathogens, including both Gram-positive and Gram-negative bacteria. Investigation of the inhibitory mechanism using treated and untreated cell-free supernatants revealed that antibacterial activity was primarily associated with organic acid production, while hydrogen peroxide and bacteriocin-like substances did not contribute significantly under the experimental

conditions. The findings indicate that fermented pickles are a valuable source of probiotic Lactiplantibacillus strains with promising antimicrobial potential against multidrug-resistant pathogens. These isolates may serve as promising candidates for future applications in functional foods and as natural antimicrobial agents.

Keywords: Antimicrobial resistance (AMR), Probiotics, Lactic acid bacteria (LAB), Fermented pickles, Multidrug-resistant (MDR) pathogens.

Tritrophic Interactions Revealed Predator Mediated Constraints on the Sustainable management of *Parthenium hysterophorus* by *Zygogramma bicolorata*

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Zygogramma bicolorata is an important biological control agent of an invasive weed *Parthenium hysterophorus*. *Z. bicolorata* is successfully being used for sustainable management of *Parthenium* in Pakistan and worldwide. The association of its existing natural enemies within the *Parthenium* system has direct implication for the field establishment and efficacy of *Z. bicolorata*. The current study evaluated the tritrophic interactions among *Parthenium hysterophorus*, its biocontrol agent *Zygogramma bicolorata*, and the three associated natural enemies (*Coccinella septempunctata*, *Perillus bioculatus*, and *Eocanthecona furcellata*) for the first time in Pakistan. In caged trials, predator presence significantly reduced *Z. bicolorata* efficiency of *P. hysterophorus* defoliation. The maximum defoliation was 88.33% in predator free treatments to as low as 18.32% under combined predator pressure. Similarly, the increases in flower production, seed output, and plant biomass as predator pressure increased. The predation assays showed that *P. bioculatus* showed the highest predation on *Z. bicolorata* eggs (37.25%) and grubs (17.67%) respectively, followed by combined predator treatments and *E. furcellata*, while *C. septempunctata* exerted comparatively lower predation pressure on both life stages. The predation intensity increased consistently with exposure duration. These results demonstrate that existing predators substantially reduce the feeding and reproductive potential of *Z. bicolorata* on *P. hysterophorus* by directly suppressing its immature life stages, thereby limiting its establishment potential. Our findings demonstrate that predator abundance should be assessed prior to augmentative *Z. bicolorata* releases, and that integrated management strategies minimizing predator pressure during the establishment phase are needed to improve the long-term efficacy of *parthenium* biological control programs.

Keywords: *Zygogramma bicolorata*; *Parthenium hysterophorus*, Tri trophic interactions, predation, *Perillus bioculatus*, *Coccinella septempunctata*, *Eocanthecona furcellata*

Molecular Characterization And Phylogenetic Analysis Of *Echinococcus granulosus* Isolates From Small Ruminants Based On The Antigen B Subunit 2 Gene

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Cystic echinococcosis (CE), caused by the larval stage of the tapeworm *Echinococcus granulosus* (*E. granulosus*), remains a significant zoonotic disease burden in livestock-producing regions of Pakistan, particularly Khyber Pakhtunkhwa. Genetic diversity among *E. granulosus* genotypes influences disease transmission dynamics, host specificity, diagnostic accuracy, and zoonotic risk assessment. This study was conducted to molecularly characterize *E. granulosus* isolates from small ruminants (sheep and goats) in District Kohat using the Antigen B subunit 2 (AgB2) gene and to determine their phylogenetic relationships with global isolates. A total of 164 hydatid cysts were collected from slaughtered sheep (n = 102) and goats (n = 62) at abattoirs in Peshawar Chowk and Dhoda Chowk, Kohat, from January to July 2026. Following aseptic collection, protoscoleces and germinal layers were processed for genomic DNA extraction using a commercial kit. PCR amplification targeting a 310 bp region of the AgB2 gene was performed using specific primers, followed by agarose gel electrophoresis. Thirty-nine samples (23.78%) were PCR-positive, with comparable prevalence in sheep (23.53%) and goats (24.19%). Organ-wise distribution showed the highest cyst prevalence in the liver (47.56%), followed by the lungs (31.71%). Fertile cysts were observed in 20.73% of cases, while 34.76% were sterile. Month-wise analysis showed peak positivity in May (39.13%) and July (38.10%). Five PCR-positive products were sequenced using an ABI DNA sequencing system, and the resulting sequences were analyzed using BioEdit and BLAST for identity confirmation. Phylogenetic analysis performed in MEGA12 using the maximum likelihood method showed that isolates from District Kohat clustered closely with the G1 genotype (*E. granulosus*), exhibiting high sequence homology with reference isolates deposited in GenBank. These findings confirm the circulation of the G1 genotype among small ruminants in District Kohat and represent the first molecular characterization of *E. granulosus* from this region using the AgB2 gene. The G1 genotype is the most widespread and zoonotically significant genotype worldwide, responsible for the majority of human CE cases, underscoring the public health importance of CE in this endemic area. This study provides baseline data for understanding local transmission dynamics, developing region-specific diagnostic tools, and designing effective control strategies. Future research should expand sampling to include human isolates and additional livestock species to more comprehensively assess the genetic diversity and zoonotic transmission pathways of *E. granulosus* in Khyber Pakhtunkhwa, Pakistan.

Keywords: *Echinococcus granulosus*, Antigen B subunit 2, G1 genotype, small ruminants, cystic echinococcosis

***Serratia Marcescens* (Hrm-2) Mediated Physiological And Metabolic Responses In Maize Seedling Under Bisphenol A (Bpa) Toxicity**

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Bisphenol A (BPA) is a widespread environmental contaminant that poses a significant threat to agricultural productivity by impairing plant growth, physiology, and metabolism. Maize (*Zea mays* L.), an important cereal crop, is particularly vulnerable to BPA-induced toxicity, which adversely affects seed germination, root development, photosynthesis, and antioxidant defense mechanisms. Biological remediation using plant growth-promoting bacteria has emerged as an environmentally sustainable strategy to mitigate BPA stress. This study aims to investigate the protective role of the endophytic bacterium *Serratia marcescens* strain HMR-2 in enhancing the physiological and metabolic responses of maize seedlings under BPA toxicity. Two maize varieties, Azam (BPA-tolerant) and Jalal (BPA-sensitive), will be evaluated under four treatment conditions: control, BPA (100 mg/L), bacterial inoculation alone, and bacterial inoculation combined with BPA. The experiment will be conducted under a completely randomized design with three replications. Morphological and physiological traits, including root and shoot growth, biomass, chlorophyll, and carotenoid contents, will be assessed. Oxidative stress indicators (MDA and H₂O₂) and antioxidant enzyme activities (CAT, SOD, POD, and APX) will also be determined. Furthermore, metabolic profiling of maize roots and leaves will be performed using gas chromatography–mass spectrometry (GC-MS). The collected data will be analyzed using one-way ANOVA, correlation analysis, and principal component analysis (PCA). The findings are expected to demonstrate the ability of *Serratia marcescens* HMR-2 to alleviate BPA-induced toxicity by improving plant growth, strengthening antioxidant defense, and modulating metabolic responses. This research will provide valuable insights into sustainable bioremediation approaches for improving maize productivity under environmental pollution stress.

Keywords: Bisphenol A (BPA), *Serratia marcescens* HMR-2, Maize (*Zea mays* L.), Bioremediation, Physiological Responses, Metabolic Profiling, Antioxidant Enzymes, GC-MS, Oxidative Stress, Plant Growth-Promoting Bacteria (PGPB).

The impact of economic diversification on economic resilience in SAARC region.

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This study examines the impact of economic diversification on economic resilience in the South Asian Association for Regional Cooperation (SAARC) region over the period 2000 to 2024. Recent global shocks, including financial crises, climate-related disruptions, and the COVID-19 pandemic—have exposed the structural vulnerabilities of developing economies, particularly those with concentrated production bases. Economic resilience,

defined as the ability to absorb, adapt, and recover from shocks while maintaining long-term growth, has therefore become a key policy concern. Drawing on portfolio diversification, structural change, and regional economic resilience theories, the study argues that greater diversification enhances resilience by reducing sectoral dependence and improving adaptive capacity. Using panel data analysis, Economic Resilience is modeled as the dependent variable, with Economic Diversification as the key independent variable, alongside control variables including Human Development Index (HDI), trade openness, urbanization, and remittances. The study employs an econometric framework incorporating panel unit root tests, cointegration analysis, and the CS-ARDL model to capture both short-run and long-run dynamics while addressing cross-sectional dependence. By filling a gap in the SAARC-focused literature, the findings provide policy-relevant insights for promoting structural transformation and strengthening economic resilience in developing economies.

Biochemical Characterization and Antibacterial Efficacy of *Atriplex halimus* (Salt bush) Against *Aeromonas hydrophila* Isolated from *Labeo rohita*

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Aeromonas hydrophila is an opportunistic Gram-negative pathogen of freshwater fish and represents a significant constraint to aquaculture production due to its association with motile aeromonad septicemia and other infectious conditions. The present study was designed to characterize *A. hydrophila* isolated from *Labeo rohita* and to investigate the in vitro antibacterial activity of *Atriplex halimus* leaf extracts prepared in ethanol, methanol, and acetone. The bacterial isolate was subjected to conventional microbiological and biochemical characterization, while the antibacterial efficacy of the plant extracts was evaluated by the agar well diffusion assay. Extracts were tested at concentrations of 25, 50, and 75 mg, and antibacterial activity was quantified as the diameter of the inhibition zone (mm). All tested extracts exhibited measurable inhibitory activity against *A. hydrophila*, with a concentration-dependent enhancement in antibacterial efficacy. The ethanolic extract produced inhibition zones of 20.33 ± 0.58 , 24.00 ± 1.00 , and 26.67 ± 1.53 mm at 25, 50, and 75 mg, respectively. The methanolic extract demonstrated inhibition zones of 21.67 ± 1.53 , 25.33 ± 0.58 , and 27.33 ± 2.31 mm, whereas the acetonetic extract exhibited 22.00 ± 2.00 , 25.67 ± 0.58 , and 28.67 ± 1.15 mm, respectively. The highest antibacterial activity was recorded for the 75 mg acetonetic extract, indicating comparatively greater efficacy than the corresponding ethanolic and methanolic preparations. These findings provide experimental evidence that *A. halimus* leaves contain solvent-extractable bioactive constituents with substantial in vitro activity against *A. hydrophila*. The pronounced inhibitory response of the acetonetic fraction highlights its potential as a source of antibacterial phytochemicals for further investigation. Phytochemical profiling, compound isolation, mechanistic studies, and in vivo evaluation are warranted to establish the therapeutic and prophylactic potential of *A. halimus*-derived compounds in fish disease management.

Keywords: *Atriplex halimus*, *Aeromonas hydrophila*, *Labeo rohita*, antibacterial activity, biochemical characterization, agar well diffusion, phytochemicals, aquaculture

Structural Characterizations and Homomorphic Properties of Soft Left Almost Semirings

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Soft set theory provides a parameterized mathematical framework for dealing with uncertainty, while left almost semirings (LA-semirings) provide a non-associative algebraic structure governed by the left invertive law. Although soft semirings and soft LA-semigroups have been studied separately, the development of a systematic theory of soft LA-semirings remains largely unexplored. In particular, the structural properties of soft LA-ideals, soft operations, homomorphisms, and congruence relations in the non-associative setting require further investigation. The aim of this research is to develop the theory of soft left almost semirings by integrating the parameterization of soft sets with the algebraic structure of LA-semirings. The study will first establish the axiomatic foundations of soft LA-semirings and define and characterize different classes of soft LA-ideals. It will then investigate the structural properties of these soft algebraic structures under fundamental operations, including bi-intersection, union, AND, and OR operations, with particular emphasis on the conditions required to preserve the underlying LA-semiring structure. Furthermore, soft LA-semiring homomorphisms will be developed by studying mappings that preserve both addition and multiplication, together with their kernels, images, and associated congruence relations. Analogues of the First, Second, and Third Isomorphism Theorems will also be investigated within the soft LA-semiring framework. The research will employ precise definitions, algebraic constructions, formal proofs, finite examples, and counterexamples to establish and verify the proposed results. The study is expected to provide a foundational framework for soft LA-semirings and contribute new structural and homomorphic results to the field of non-associative algebra.

Keywords: Soft Sets, Soft Semirings, Left Almost Semirings, LA-Semirings, Soft LA-Semirings, Soft LA-Ideals, Homomorphisms, Congruence Relations, Isomorphism Theorems, Non-Associative Algebra.

Ecofriendly Synthesis of Silver Nanoparticles Using *Withania coagulans* Dunal Ethanolic Extract: Comprehensive Characterization and Assessment of Biomedical Potential

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Introduction: The development of environmentally friendly nanomaterials has gained significant attention due to increasing concerns regarding the toxicity and environmental impact of conventional nanoparticle synthesis methods. *Withania coagulans* Dunal

(Vegetable Rennet), a medicinal plant widely recognized for its antidiabetic and antioxidant properties, contains diverse phytochemicals that can act as natural reducing and stabilizing agents during nanoparticle synthesis. This study aims to synthesize silver nanoparticles (AgNPs) using ethanolic extracts of *W. coagulans* and evaluate their physicochemical characteristics and biomedical potential.

Methodology: Different parts of *W. coagulans* (fruits, leaves, stems, and roots) will be collected, authenticated, dried, and extracted using 80% ethanol. Green synthesis of AgNPs will be carried out by reducing aqueous silver nitrate solution with plant extracts under optimized reaction conditions. The synthesized nanoparticles will be characterized using UV–Visible Spectroscopy, Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Energy Dispersive X-ray Spectroscopy (EDX) to determine their optical properties, morphology, crystallinity, elemental composition, and surface functional groups.

Results: Preliminary findings are expected to demonstrate successful synthesis of stable silver nanoparticles, indicated by characteristic surface plasmon resonance peaks and confirmed through structural and morphological analyses. The phytochemicals present in *W. coagulans* are anticipated to facilitate nanoparticle formation and stabilization while enhancing their biological properties.

Conclusion: The study is expected to establish *W. coagulans* as an effective bioresource for ecofriendly synthesis of AgNPs and provide insights into their potential biomedical applications. The findings may contribute to the development of sustainable nanomaterials with improved therapeutic and pharmaceutical relevance.

Keywords: *Withania coagulans*, Silver Nanoparticles, Green Synthesis, Nanobiotechnology, Biomedical Applications

Human Carbonic Anhydrases Activity Of The Phytochemicals Isolated From *Haplophyllum Erythraeum*

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This study reports the isolation, structural characterization, and human carbonic anhydrase (hCA) inhibitory evaluation of phytochemicals from *Haplophyllum erythraeum* Boiss. (Rutaceae). The shade-dried plant material was extracted with methanol and successively fractionated using n-hexane, chloroform, ethyl acetate, and n-butanol. Three compounds were isolated from the ethyl acetate fraction through column chromatography and identified as flindersine, folimine, and β -sitosterol by UV-Vis, IR, and NMR spectroscopic techniques. The isolated compounds were evaluated for in vitro inhibitory activity against human carbonic anhydrase II (hCA-II) using a spectrophotometric assay with 4-nitrophenyl acetate as substrate. Folimine exhibited the most potent activity ($IC_{50} = 14.10 \pm 0.42 \mu M$), followed by flindersine ($IC_{50} = 21.52 \pm 0.83 \mu M$), while β -sitosterol

was inactive. The standard drug acetazolamide showed an IC_{50} value of $19.3 \pm 1.0 \mu M$. These findings highlight folimine and flindersine as promising natural hCA-II inhibitors with potential therapeutic applications in glaucoma, epilepsy, and related disorders. **Keywords:** *Haplophyllum erythraeum*, flindersine, folimine, β -sitosterol, carbonic anhydrase inhibitors, hCA-II, natural products.

Detection of Androgen Receptor Gene Polymorphisms rs1204038 and rs1337076 in Infertile Pakistani Males Using Tetra-ARMS PCR

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Background: Male infertility is a major reproductive health problem, contributing to nearly half of infertility cases worldwide. Genetic factors, particularly alterations in genes involved in androgen signaling and spermatogenesis, may play an important role in idiopathic male infertility. The androgen receptor (AR) gene, located on chromosome Xq11–12, encodes a nuclear receptor essential for testosterone- and dihydrotestosterone-mediated regulation of male reproductive development and sperm production. Single nucleotide polymorphisms (SNPs) within the AR gene may influence androgen signaling and have been associated with reproductive abnormalities. However, limited information is available regarding AR intronic variants in the Pakistani population.

Objective: This study aims to investigate the AR gene polymorphisms rs1204038 and rs1337076 in infertile Pakistani males using Tetra-ARMS PCR, with particular emphasis on determining their inheritance patterns and estimating their population frequencies.

Methodology: The study will be conducted following approval from the Research Ethical Committee of Kohat University of Science and Technology (KUST), Kohat. Approximately 20 samples will be collected from infertile families from different regions of Pakistan after obtaining written informed consent. Genomic DNA will be extracted from peripheral blood samples using the phenol-chloroform method. Tetra-ARMS PCR will be employed for allele-specific genotyping of AR rs1204038 and rs1337076 using four primers for each SNP. PCR products will be separated by 2.5% agarose gel electrophoresis and analyzed according to allele-specific band patterns. Family-based genotyping will be used to assess inheritance patterns, while the observed genotypes will be used to estimate allele and genotype frequencies.

Results The study is expected to provide preliminary information on the distribution and inheritance of AR rs1204038 and rs1337076 polymorphisms among infertile Pakistani males. The findings may contribute to understanding the genetic basis of idiopathic male infertility and provide baseline data for future large-scale genetic association studies and the identification of potential genetic markers for male infertility.

Keywords: Androgen receptor, AR gene, male infertility, rs1204038, rs1337076, SNPs, Tetra-ARMS PCR, Pakistani population.

***Prunus Persica* Seed -Mediated Fabrication Of Silver-Doped Zinc Oxide Nanoparticles; Characterization And Acaricidal Potential Against Hyalomma Ticks**

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Ticks of the genus *Hyalomma* are important ectoparasites of livestock and may transmit several animal and zoonotic pathogens. The extensive use of synthetic acaricides has contributed to resistance, environmental contamination, non-target toxicity, and chemical residues. This study investigated the green synthesis, characterization, and acaricidal activity of silver-doped zinc oxide nanoparticles (Ag/ZnO NPs) prepared using aqueous *Prunus persica* seed extract. Pure ZnO and Ag/ZnO nanoparticles containing 1%, 3%, and 5% silver were synthesized through a precipitation method. The nanoparticles were characterized by ultraviolet-visible (UV-Vis) spectroscopy, Fourier-transform infrared (FTIR) spectroscopy, X-ray diffraction (XRD), and scanning electron microscopy (SEM). Their efficacy against adult *Hyalomma* ticks was evaluated using adult immersion and adult packet tests. Lethal concentrations were determined through probit analysis. UV-Vis analysis showed absorption bands between 370 and 395 nm, confirming the formation of ZnO nanoparticles. Silver incorporation enhanced the optical response, and the 3% Ag/ZnO formulation exhibited the highest absorbance. A slight red shift was observed in the 3% and 5% formulations. FTIR spectra showed O–H stretching at approximately 3400–3500 cm^{-1} , H–O–H bending at 1600–1650 cm^{-1} , C–O vibrations at 1400–1500 cm^{-1} , and Zn–O vibrations below 600 cm^{-1} . XRD analysis of 5% Ag/ZnO confirmed the hexagonal ZnO structure, while additional reflections at 38.1°, 44.3°, 64.4°, and 77.4° indicated the presence of metallic silver. The average crystallite size was 16.7 nm. SEM showed mainly spherical and well-dispersed nanoparticles with an average particle size of 27 nm. The nanoparticles produced concentration-dependent acaricidal activity. In the adult immersion test, the LC_{50} values of 1%, 3%, and 5% Ag/ZnO were 20.08, 9.19, and 6.60 mg/L, respectively, while their LC_{90} values were 638, 156, and 49 mg/L. In the adult packet test, LC_{50} values were 28, 13, and 9.24 $\mu\text{g}/\text{cm}^2$, and LC_{90} values were 492, 123, and 50 $\mu\text{g}/\text{cm}^2$, respectively. The 5% Ag/ZnO formulation was the most effective in both assays. These findings demonstrate that *P. persica* seed extract can support the synthesis of Ag/ZnO nanoparticles and that silver doping improves their acaricidal efficacy. The 5% formulation may serve as a promising plant-mediated nanoacaricide against *Hyalomma* ticks, although further safety and field studies are required.

Keywords: *Prunus persica*, Ag/ZnO nanoparticles, green synthesis, *Hyalomma*, acaricidal Activity

Association of the BMP15 rs3810682 and rs17003221 Variant with Female Infertility in the Pakistani Population

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Background: Female infertility is a major reproductive health problem caused by various environmental, anatomical, hormonal, and genetic factors. Genetic variations in genes involved in ovarian function and oocyte development may contribute to impaired fertility. Bone Morphogenetic Protein 15 (BMP15) is an X-linked member of the transforming growth factor-beta (TGF- β) superfamily and plays an essential role in follicular development, oocyte maturation, ovulation, and maintenance of normal ovarian function. Variants in the BMP15 gene have been associated with reproductive disorders, including premature ovarian insufficiency and infertility. However, limited information is available regarding the contribution of specific BMP15 variants to female infertility in the Pakistani population.

Objective: This study aims to investigate the association of BMP15 rs3810682 (C>G) and rs17003221 (C>T) variants with female infertility among Pakistani women and to determine whether the rs17003221 polymorphism is associated with an increased risk of female infertility.

Methodology: The study will be conducted after obtaining approval from the Research Ethics Committee of Kohat University of Science and Technology (KUST), Kohat. Approximately 20 female participants will be recruited from different regions of Pakistan following informed written consent. Peripheral blood samples will be collected, and genomic DNA will be extracted using the phenol-chloroform method. DNA concentration and quality will be assessed before genotyping. Tetra-ARMS PCR will be used for the detection of BMP15 rs3810682 and rs17003221 variants using allele-specific primers. PCR products will be separated through 2.5% agarose gel electrophoresis, and genotypes will be determined based on allele-specific amplification patterns. The observed genotype and allele distributions will subsequently be analyzed to evaluate their potential association with female infertility.

Results: The study is expected to provide preliminary data regarding the distribution of BMP15 rs3810682 and rs17003221 variants among infertile Pakistani women. The findings may help clarify the possible contribution of BMP15 genetic variation to female infertility and provide baseline genetic information for future large-scale association studies. Identification of potentially associated variants may also contribute to a better understanding of the genetic mechanisms underlying impaired ovarian function and female reproductive disorders.

Keywords: BMP15, female infertility, rs3810682, rs17003221, SNPs, Tetra-ARMS PCR, ovarian function, Pakistani population.

Structural Characterizations and Homomorphic Properties of Soft Left Almost Semirings

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Soft set theory provides a parameterized mathematical framework for dealing with uncertainty, while left almost semirings (LA-semirings) provide a non-associative

algebraic structure governed by the left invertive law. Although soft semirings and soft LA-semigroups have been studied separately, the development of a systematic theory of soft LA-semirings remains largely unexplored. In particular, the structural properties of soft LA-ideals, soft operations, homomorphisms, and congruence relations in the non-associative setting require further investigation. The aim of this research is to develop the theory of soft left almost semirings by integrating the parameterization of soft sets with the algebraic structure of LA-semirings. The study will first establish the axiomatic foundations of soft LA-semirings and define and characterize different classes of soft LA-ideals. It will then investigate the structural properties of these soft algebraic structures under fundamental operations, including bi-intersection, union, AND, and OR operations, with particular emphasis on the conditions required to preserve the underlying LA-semiring structure. Furthermore, soft LA-semiring homomorphisms will be developed by studying mappings that preserve both addition and multiplication, together with their kernels, images, and associated congruence relations. Analogues of the First, Second, and Third Isomorphism Theorems will also be investigated within the soft LA-semiring framework. The research will employ precise definitions, algebraic constructions, formal proofs, finite examples, and counterexamples to establish and verify the proposed results. The study is expected to provide a foundational framework for soft LA-semirings and contribute new structural and homomorphic results to the field of non-associative algebra.

Keywords: Soft Sets, Soft Semirings, Left Almost Semirings, LA-Semirings, Soft LA-Semirings, Soft LA-Ideals, Homomorphisms, Congruence Relations, Isomorphism Theorems, Non-Associative Algebra.

Prevalence And Associated Risk Factors Analysis Of *Fasciola Gigantica* In Cattle Of Kohat Khyber Pakhtunkhwa

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Fasciolosis is an important parasitic disease of livestock caused by liver flukes of the genus *Fasciola*. Among these, *Fasciola gigantica* is widely distributed in tropical and subtropical regions, including Pakistan, and can negatively affect livestock health and productivity. The present study is designed to determine the prevalence of *Fasciola gigantica* and its associated risk factors in cattle of District Kohat, Khyber Pakhtunkhwa, Pakistan. Approximately 150 fecal samples will be randomly collected from cattle of different ages and sexes from different areas of Kohat, including Tehsil Lachi and selected areas of Kohat. Fecal samples will be examined microscopically for the detection and morphological identification of *F. gigantica* eggs using prepared fecal smears. A structured questionnaire will also be used to collect information regarding management practices, grazing patterns, deworming schedules, environmental conditions, and other potential risk factors. The collected data will be analyzed using MS Excel and SPSS to determine prevalence and assess the association between infection and selected risk factors. The findings of this study will provide useful epidemiological information about *F.*

gigantica infection in cattle of District Kohat and may contribute to the development of appropriate control and prevention strategies for fasciolosis in the region.

Keywords: *Fasciola gigantica*, prevalence, risk factors, cattle, Kohat