PROCEEDINGS

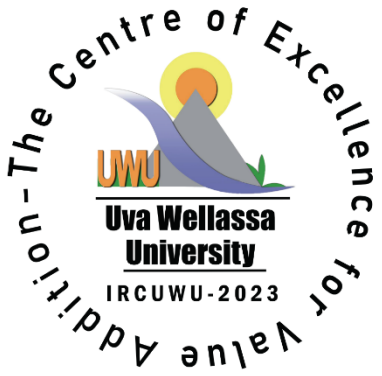
IRCUWU 2023

7th International Research Conference

17th & 18th August 2023

"Digitalization for transition to circular economy ecosystems"

Uva Wellassa University of Sri Lanka



IRCUWU 2023

7th International Research Conference - 2023

"Digitalization for transition to circular economy ecosystems"

August 17-18, 2023

Uva Wellassa University
Badulla
Sri Lanka

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Acknowledgement

The successful realization of the 7th International Research Conference of Uva Wellassa University (IRCUWU2023), centered around the theme "Digitalization for transition to circular economy ecosystems," owes its existence to the indispensable assistance, contributions, dedication, and well-wishes extended by numerous individuals. This two-day conference commenced with an inauguration session followed by twelve technical sessions.

The Chief Guest, Professor Jayantha Lal Ratnasekera, Vice Chancellor of Uva Wellassa University of Sri Lanka, along with the keynote speakers; Professor R. Balasubramani, Associate Professor, Department of Library and Information Science, Bharathidasan University, India, and Prof. YuanTong Gu, Head of School, Mechanical, Medical and Process Engineering, Queensland University of Technology, Australia, were sincerely appreciated for sharing their invaluable experiences and thoughts with us.

A special thank is deservedly extended to all track coordinators, panel members, and track conveners for their valuable contributions to this event. Furthermore, the authors and presenters deserve endless praise for their contributions and for sharing their essential research findings using various methods.

The audience had the opportunity to witness this work with the ready assistance and significant cooperation extended by the Editor-in-Chief, the members of the Editorial Board, and the Reviewers in finalizing the Proceedings while maintaining the accepted standards in scientific publications.

Heartfelt appreciation is expressed to the IT and Audio-Visual Units of Uva Wellassa University for their untiring effort in live-streaming the event, allowing uninterrupted online conferencing.

We extend our heartfelt gratitude to our esteemed partners and sponsors of the IRCUWU 2023 for their invaluable support in ensuring the resounding success of this event. A special acknowledgment goes to our Gold Partner, Bank of Ceylon-Badulla branch, and our Silver Partners, Coalition for Disaster Resilient Infrastructure, and International Water Management Institute (IWMI). We are equally thankful to our sponsors, Microtech Biological (Pvt) Ltd. and Prome Engineering, as well as our Technical Partner, Computer Peripherals (Pvt) Ltd. Your contributions have profoundly enriched the conference, facilitating the exploration of cutting-edge ideas and solutions. We extend our sincere gratitude for your dedication and collaboration, which have played a pivotal role in the making this conference a success.

Finally, sincere appreciation is extended to all the committed academic, administrative, and non-academic staff members of Uva Wellassa University and all those who actively contributed to the success of IRCUWU2023. Your efforts were instrumental in making this conference a resounding success.

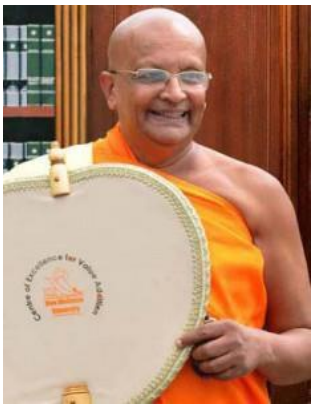
IRCUWU2023

As the trailblazer of the first Entrepreneurial and Technopreneurial University in Sri Lanka, with its vibrancy and prosperity, Uva Wellassa University (UWU) continues to generate employable, technocratic, and entrepreneurial graduates armed with knowledge, skills, and values as well as who are capable of contributing to national progress.

Being the "Center for Value Addition to the National Resource Base", UWU has been carrying out research since its inception. This year by hosting the 7th International Research Conference of Uva Wellassa University 2023 under the theme "Digitalization for transition to circular economy ecosystems" IRCUWU2023 intends to explore new avenues and contribute to the expanding research milieu efficiently and effectively.

IRCUWU2023 provides a knowledge-sharing niche for multidisciplinary research under twelve dynamic conference tracks and encourages collaboration among eminent researchers, renowned intellectuals, emerging scholars, academics, scientists, industrialists, professionals, graduates, and undergraduates to disseminate their research findings and innovative ideas in the spheres of Science, Engineering, Technology, and Management. This prominent event aims to bring together researchers and practitioners to share cutting-edge developments, with the ultimate goal of ensuring the nation's sustainable development while strengthening national and international research collaboration.

Chancellor's Message



I am very pleased to convey this message and my well wishes for the 7th International Research Conference of Uva Wellassa University (IRCUWU2023). Organized as a hybrid conference due to the prevailing conditions, the theme "Digitalization for transition to circular economy ecosystems" is most timely. During all hardships, the resilience to remain undefeated and always striving forward with fresh determination is much required. As a university, it is our foremost responsibility to bring forth innovative solutions for contemporary issues, by combining theoretical concepts with practical scenarios in the form of research. IRCUWU2023, being an international conference, will present distinctive studies, researchers and scholars from Sri Lanka and all over the world. Therefore, I believe that this research conference will present a wonderful opportunity for researchers of different fields to discuss, debate and exchange views on their novel research findings. Ultimately, in due course, I hope their knowledge and ideas will contribute to the improvement of the socioeconomic situation of Sri Lanka. I will take the opportunity to appreciate the Vice Chancellor, Academic Staff, and Non-academic Staff of Uva Wellassa University for their great commitment towards successfully hosting this international event. My blessings go to all the organizers and participants of IRCUWU2023 to have the strength and courage to strive forward surpassing all adversities. May the triple gem bless you!

Most Venerable Bengamuwe Sri Dammadinna Nayaka Thero
Chancellor
Uva Wellassa University of Sri Lanka

Chief Guest's Message

It is with great pleasure, I am sending this message on the occasion of the IRCUWU2023, organized by the Uva Wellassa University (UWU), under the theme "Digitalization for transition to circular economy ecosystems". IRCUWU2023, conducted as a hybrid conference due to the prevailing situation in the country, would provide space for researchers to present their novel findings to a diverse audience having different perspectives and interesting insights. The participants gain the opportunity to view novel advanced research in their fields of interest and interact with leading personnel in the respective fields. Also, this conference brings forward research of multiple disciplines onto an individual platform allowing participants including researchers, scholars and policy makers identify the available potential as well as the gaps in development with ideas as to how to bridge them. I wish to express my sincere gratitude to the Organizing Committee and all the members of UWU Family for their untiring efforts to make the IRCUWU2023 a success. Finally, I wish all the participants, presenters and evaluation panelists to have a pleasant and productive experience in attending the IRCUWU2023.

Professor Jayantha Lal Ratnasekera
Vice Chancellor
Uva Wellassa University of Sri Lanka

Research Committee Chairman's Message

It is indeed a great pleasure and pride for me to disclose this message on the occasion of the 7th International Research Conference of Uva Wellassa University (IRCUWU), held under the theme "Digitalization for transition to circular economy ecosystems". Uva Wellassa University has made remarkable contributions in the field of research and development over the past years and the Annual Research Conference conducted by the University is evidence of such outstanding contributions.

Producing well-rounded graduates who could make significant contributions to the nation is one of the main targets of the University and, takes the responsibility in creating the path for the same. Hence, IRCUWU2023 has been organized in addressing the need of the nation. This year the IRCUWU strives to impart frontiers of knowledge in 12 major fields.

IRCUWU has been offering the attendees a platform to learn, share, and disclose their knowledge at both national and international levels. With every passing year, IRCUWU has advanced into a bigger and better event, and it is the aim of the association and the organizers to take it to even greater heights.

I appreciate the organizing committee for efforts and dedication in organizing a successful conference and contributing new ideas and research findings. We, as an organization are overwhelmingly enthusiastic to share valuable know-how, improve skills, and stimulate ideas together.

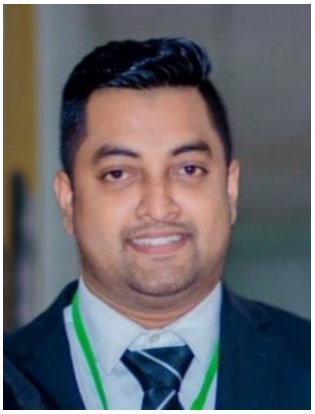
Professor H.M.J.C. Pitawala
Chairman
Research Committee
Uva Wellassa University of Sri Lanka

IRCUWU2023 Coordinator's Message

It is my great pleasure and honor to write this message for the 7th International Research Conference of Uva Wellassa University as the Conference Coordinator. The consecutive Research Conferences held by our university have continued to grow in magnitude and esteem. IRCUWU has contributed immensely to exploring value-added avenues to Sri Lanka's resources in the past. This year, we host the 7th International Research Conference as a Hybrid Conference under the theme "Digitalization for transition to circular economy ecosystems," intending to uncover new avenues for combating current challenges and reaching new horizons. The efforts and dedication of all the members of the organizing, technical, and editorial committees during the organization of this conference are highly appreciated. Indeed, IRCUWU provides a shared forum for researchers, scholars, and professionals from various disciplines to share their discoveries, information, and perspectives. Through creative approaches and the formation of collaborations, they could create stimulating environments for further investigation and invention. We expect IRCUWU2023 will be such a platform that advocates for the advancement of all fields touched by it, be it Science, Technology, Humanities, Agriculture, and Management. We are equally excited about the record number of sessions under the twelve thematic areas, and the wide variety of ideas that scholars and practitioners will bring into our fold. We believe the diversity of specializations and related expertise will enable us to achieve success at the conference. It is not an easy undertaking to develop and carry out a scientific study, let alone disseminate the knowledge with a presentation on an international stage. Therefore, we would like to congratulate all authors and presenters taking part in this conference. We wish an insightful and productive experience for all in-person and online attendees.

Dr. (Eng) H.M.C.M. Herath
Coordinator/IRCUWU2023
Uva Wellassa University of Sri Lanka

IRCUWU2023 Secretary's Message



It is with immense pleasure that I extend my warmest greetings to you all on behalf of the 7th International Research Conference of Uva Wellassa University (IRCUWU2023). As the Secretary of this prestigious event, I am truly honored to be a part of this remarkable gathering that celebrates knowledge, innovation, and collaboration. Since its inception, IRCUWU has been at the forefront of fostering academic excellence and advancing research in various fields. With each passing year, our conference has grown in stature and significance, attracting scholars, experts, and visionaries from all corners of the globe. This year, under the theme "Digitalization for transition to circular economy ecosystems," we have explored cutting-edge ideas that have the potential to shape a sustainable and inclusive future. In a world experiencing rapid transformations and challenges, the importance of generating new knowledge cannot be overstated. IRCUWU2023 has been dedicated to the dissemination of novel research findings, addressing critical global issues, and exploring innovative solutions. Our commitment to reaching wider audiences, both locally and internationally, has been unwavering, as we firmly believe that knowledge knows no boundaries. Organizing IRCUWU2023 as a hybrid conference has presented us with unique challenges, but through dedication, perseverance, and teamwork, we have triumphed. I am indebted to the Vice Chancellor, the Research Committee, and all the academic and non-academic staff of Uva Wellassa University for their unwavering support and contribution to the success of this event. My heartfelt appreciation also goes out to the members of the organizing committee for their tireless efforts and invaluable support throughout the planning and execution of IRCUWU2023. Last but not least, I extend my gratitude to all the presenters and participants who have graced us with their invaluable insights and expertise. Your passion for research and commitment to academic excellence have been the driving force behind this conference's success. As the Secretary of IRCUWU2023, I am filled with pride and optimism for the future, knowing that the knowledge shared and connections made during this event will lead to significant advancements and positive impacts in our communities and beyond.

Eng. Mr. M.N.P. Dushyantha
Secretary/IRCUWU2023
Uva Wellassa University of Sri Lanka

Keynote Speech

Revolutionizing Sustainability: The Role of Digitalization in Transitioning to "Circular Economy" Ecosystems

To educate academics and researchers about the concept of digitalization in the context of sustainability and circular economy. Today, on this international stage, I am honored to address the theme that lies at the intersection of progress and preservation "Digitization for transition to the circular economy ecosystems", which involves using digital technology to transform the traditional "take-make-dispose" linear economy into a more sustainable model. The circular economy aims to extract the resources to the maximum value based on the ideas of a "make-use-recycle from resources, minimize waste, and extend the life of products". . I would like to highlight the increasing global population, resource depletion, CO_2 emissions, and other environmental concerns as driving forces for adopting the circular economy. Several motivations for transitioning to a circular economy include meeting United Nations Sustainable Development Goals (UN SDGs), reducing inequality, and stimulating the economy through innovative waste-to-wealth concepts.

The timeline of the circular economy concept is traced back to the 20th century, with ideas of waste reduction and sustainable resources management but the formal recognition and global attention gained around year 2015 through UN SDGs and the European Commission's Circular Economy Action Plan. Target 12.2 ("sustainable management and efficient use of natural resources") of the SDGs closely aligns with the circular economy and explicitly urges the adoption of sustainable practices and resource conservation. The role of digitalization in the circular economy is emphasized, with technologies like AI, cloud computing, and blockchain being employed to optimize resource allocation, increase transparency, and support waste management efforts. Five principles for scaling up the circular economy are outlined:

(i) Design out waste
(ii) Build resilience through diversity
(iii) Rely on energy from renewables
(iv) Think in systems
(v) Waste is food

I will also discuss with juxtaposes the circular economy model with the linear economy approach and introduces a widely recognized 9R model to represent circular economy principles. Subsequently, it delves into a case study involving waste-to-wealth initiatives in Sri Lanka, highlighting the economic potential of upcycling waste materials. It further explores the role of digital technologies, like blockchain and big data analytics, in enabling the circular economy transition through knowledge sharing, data management, and transparency enhancement. The challenges of implementing digitalization to transition to a circular economy ecosystem include cultural, technological, market, and regulatory barriers.

In closing, let us remember that the circular economy, enriched by the infusion of digital technologies, is a blueprint for a brighter future. An alliance of environmental stewardship, economic prosperity, and sustainability beckons us, as we forge a path toward a more harmonious

relationship with our planet. By fostering the integration of digital innovation into the embrace of the circular economy, we are not only the architects of change but also guardians of the legacy we leave for generations to come.

Dr. R. Balasubramani
Associate Professor
Department of Library and Information Science
Bharathidasan University
India
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Keynote Speech

Physics-informed machine learning (PINN): A novel computer modelling framework for mechanics

Nowadays, the Physics-Informed Neural Network (PINN)-based computational mechanics is being rapidly developed, although it is currently still in its infant stage. PINN integrates data-driven modelling and physics-based modelling so that their advantages are kept. It has been demonstrated that the PINN has excellent potential in solving many complex problems. Therefore, it has gained increased attention in the computational mechanics field, especially for problems that contain strong nonlinearities. The PINN has been becoming a game-changer for computer modelling and simulation for engineering and science.

First, this talk will review the most recent developments of PINN for mechanics, including solid mechanics, fracture machines, structural optimization, fluid mechanics, and so on. Second, the main challenges in the application of PINN to computational mechanics are discussed. The investigation focuses on the physics-informed loss function. Using the weighted residual method, a so-called least squares weighted residual (LSWR) loss function is proposed. Then, the newly developed loss function is compared with other loss functions, including the collocation loss function and the energy loss function that are popularly used. The new loss function has shown a better performance. Third, by using the neural tangent kernel (NTK) theory, it is observed that PINN tend to be local approximators during training. Based on the discovery, a novel physics-informed radial basis network (PIRBN) has been proposed. PIRBN can well exhibit a local approximating property during modeling. The numerical examples have proven PIRBN's stability, efficiency, and accuracy. Finally, the recent research in the speaker's group on PINN will also be reported in this talk, including PINN for structural topology optimization, PINN for modelling of food drying and PINN for dynamic and nonlinear problems. It has proven that physics-informed machine learning will be the new generation of a computer modelling framework for mechanics.

Prof. YuanTong Gu
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Aquatic Sciences

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Sex determining factors in green sea turtle landed in Rekawa, Sri Lanka

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Sea turtles have Temperature based Sex Determination (TSD) in which warmer temperatures produce the majority of females and cooler temperature produce the majority of males according to the studies performed on sea turtle sex determination. Previous studies showed that Green sea turtle (*Chelonia mydas*) eggs develop only in the 25°C–34°C temperature range and the embryonic development of sea turtles depends on pit temperature, however, pit depth and shading can be directly related to pit temperature. The temperature of the pit can be determined by the sand temperature of the pit. Sex determination and temperature connection have not been well considered. There are no previous studies recorded from Sri Lanka showing that sex determination is associated with depth and pit temperature as a tropical country with no seasonal temperature fluctuations. Therefore, the present study was conducted at Rekawa beach with the goal of studying the relationship between pit depth and pit temperature particularly for *C. mydas*. Rekawa beach is considered the largest Green sea turtle rookery in Sri Lanka and has high-density nesting from October to February. Sand temperature and depth were measured using a mercury thermometer (+1°C) that was attached to a meter ruler and measuring tape respectively. Environmental factors were determined by the Tide app mobile version (calibrated to Galle, Sri Lanka). Results were analyzed (by using One Way ANOVA, p=0.109) and showed that there were no significant differences between moon days (lunar phase) and mean temperature of the surface layer of pits (One Way ANOVA, p=0.109). These results indicate that the lunar phase does not impact temperature variation. Analysis of depth and temperature data showed that (Two Way ANOVA, p= 0.000), there is a significant difference between pit temperature and three depth layers in the pit. There was a significant positive relationship between pit depth and pit temperature (R^2 =87.28 %). Further, the analysis shows that there is a higher chance that the majority of Green sea turtle hatchlings in Rekawa will be female (One Sample Wilcoxon Signed Rank Test, p=0.047). Further studies are necessary to maintain the natural population dynamics with respect to climate change.

Keywords: Green sea turtle; Pit temperature; Sand temperature; Pit depth; Lunar phase

Paper ID**:** IRCUWU2023**-**70

Comparison of color enhancement with carrot and hibiscus pigment-containing feed in Tiger Oscar (*Astronotus ocellatus*)

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The attractive coloration of ornamental fish significantly influences their commercial value. In commercial color feeds, primarily containing synthetic carotenoids are employed to enhance their color. However, the high cost of synthetic carotenoids has prompted researchers to explore natural pigment sources. In this study, carrots (*Daucus carota*) and hibiscus (*Hibiscus rosa-sinensis*) were utilized to create a naturally pigmented color feed. Tiger Oscar (*Astronotus ocellatus*) was selected due to their rapid color-enhancing ability. A total of 12 uniformly sized Tiger Oscar fish (TL: 6.25 cm) were individually housed in standardized aquaria measuring 60x30x30 cm³. Each aquarium contained 54 L of water and was aerated. The fish were regularly fed with carrot pigment extract mixed feed (T1), hibiscus pigment extract mixed feed (T2), commercial color feed (*Hong shi mei* color enhancer™, T3), and normal fish feed (T4), at doses of 5-6 pellets (~82 mg) adjusted according to their weight. They were fed daily in the morning and evening. Photographs of the fish were taken every 3 days for 30 days, using a 12MP digital camera from 20 cm above under the same light conditions. The analysis involved a visual index, with 40 random student participants, and RGB value analysis using Adobe Photoshop and MS Excel. After conducting a one-way ANOVA test, the results of the visual index revealed a significant color difference ($p<0.05$) between the fish fed with T2 and those fed with T4. Similarly, a significant color difference ($p<0.05$) was observed between the fish fed with T1 feed and those fed with T4. By analyzing RGB values of photographs using a paired-sample T-test, T1, T2, and T4 showed a significant color increment. Consequently, the natural pigmented feed exhibited color increase comparable to the commercial color feed, with the carrot feed producing similar results. Future studies are recommended to investigate potential complications associated with natural pigmented feeds and to explore alternative pigmented plant materials, such as pumpkin, marigold flower, beetroot, etc., for color feed production to further advance the understanding in this field.

Keywords: Ornamental fish; Commercial color feeds; Synthetic carotenoids; Natural pigments; Tiger Oscar fish

Paper ID**:** IRCUWU2023**-**127

Preliminary investigation of the hard corals and their interactions at Pareiwella coral reef of Southern Sri Lanka

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Several interaction types between sessile benthic communities are shown by hard corals including overgrowing, overtopping, digestion by mesenterial filaments, and stand-off. Evaluation of these interaction types is vital to understand the persistence of hard corals in the reef environment. The research aimed to; 1) identify the interaction types that exist between hard corals and other sessile benthic communities termed as interaction categories (Hard coral-hard coral, hard coral-soft coral, and hard coral-macroalgae), 2) compare the distribution of those interactions (including all the interaction types) with interaction categories between Reef Flat and Near Crest reef sites, 3) evaluate herbivore abundance which is useful when assessing macroalgae, and 4) identify the abundant hard coral genera in Pareiwella Coral Reef (6°01'18" N 80°48'01" E) of southern Sri Lanka. This research was conducted in November 2022. Four replicates were taken randomly at the two sites. Line transect which is 10 m long and 1 m wide was used to count each of the interaction types within it. The Stationary Point Count method was used to record the fish count. The underwater photos were used to identify hard corals. The two-way ANOVA test confirmed that the percentage of interactions did not show any significant differences (p>0.05) between sites and between interaction categories. However, the interaction term of the ANOVA (Site*Interaction category) was significant (p<0.05; F-value=7.37; DF=2), and the post-hoc test confirmed that the hard coral-macroalgae in reef flat significantly differ (p<0.05) with hard coral-hard coral in reef flat. The hard coral genera including *Pocillopora, Montipora, Galaxea, Psammocora, Porites, Leptastrea, Favia,* and *Acropora* were dominant in the reef. The interactions with macroalgae in the reef flat (57.39±24.26) were higher than that of the near crest (18.86±7.37), whereas the fish abundance (individual/m^3) was higher at the near crest (2.43±0.23) than the reef flat (0.69±0.36) showing possible grazing of macroalgae at the near crest thus reduction of macroalgae mediated interactions at the near crest. Herbivores fish abundance, sessile benthic fauna, and flora, and their interactions appear to be impacting the distribution of hard coral and macroalgae at Pareiwella.

Keywords: Overgrowing; Overtopping; Stand-Off; Interactions; Hard corals

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Interannual and intra-annual variability of chlorophyll-a concentration in the Northern Arabian Sea from 2004 to 2021

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The Arabian Sea is one of the distinctive tropical basins in the northern Indian Ocean that has a seasonally alternating wind pattern resulting strong surface current system accordingly. Chlorophyll-a is important as a biological indicator of biological productivity, systematic variation of ocean color, and fisheries resources of this region and this can vary with several oceanographic conditions. Therefore, this study aims to investigate interannual and monthly chlorophyll-a variability in the northern Arabian Sea in response to the variability in sea surface temperature, wind speed, and upwelling over 2004-2021. This work was done using the chlorophyll-a data acquired through the Moderate Resolution Imaging Spectroradiometer (MODIS) and sea surface temperature and wind speed data acquired through the fifth Generation European Centre for Medium-Range Weather Forecasts (ECMWF) atmospheric reanalysis of the global climate (ERA5). Obtained data were processed and analyzed using MATLAB 2020a and MS Excel 2021. The chlorophyll-a data were correlated with sea surface temperature, wind speed, and sea surface temperature gradient-based upwelling index. The August to September and February to March periods were observed with high chlorophyll-a concentrations. The minimum mean value was (0.710 mg m^{-3}) in June and the maximum mean value (2.996 mg m^{-3}) was observed in February throughout the study period. Almost year-round very high chlorophyll-a concentrations were often recorded around the coastal region of India, Pakistan, Iran, and Oman in the northern Arabian Sea and declined towards the open ocean. An annual decreasing trend of chlorophyll-a (0.024 mg m^{-3} yr^{-1}) was observed in this region during the study period. The years 2004, 2017, and 2005 were the most productive years with positive anomalies of chlorophyll-a while 2007, 2021, and 2020 showed negative anomalies indicating less productivity. Chlorophyll-a in this region showed a significant (p<0.05) positive correlation with wind speed and upwelling index and a significant (p<0.05) negative correlation with sea surface temperature. Wind speed can influence the upwelling process by moving nutrient-rich cold water masses from deep layers to the surface layer. Therefore, the weakening of upwelling and increasing surface temperature may affect surface productivity in the studied area.

Keywords: Northern Arabian Sea; Chlorophyll-a; MODIS; Sea surface temperature; Upwelling index

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Microplastic pollution in seagrass meadows along the Eastern coast of Sri Lanka

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Microplastics emerge as an insidious global menace to sensitive marine ecosystems. In the Sri Lankan context, despite the increasing rate of plastic pollution in marine waters, there is a lack of scientific studies to reveal the phenomenon of microplastics associated with seagrass meadows. In this study, the abundance and characteristics of microplastic in common seagrass blades (*Thalassia hemprichii*), surface water, surface sediment, and common sea cucumbers (*Holothuria atra*) were examined in three selected sites (Kalkudah, Adukkuparu, and Salli Beach) from the Eastern coast of Sri Lanka. The microplastic occurrence was manifested based on physical appearances (size, color, shape) and chemical characteristics were evaluated using FTIR analysis. Surprisingly, all samples were contaminated with microplastics while average microplastic abundance was 2.05±0.13 items/blade in *T. hemprichii* (n=27); 11.19±1.15 items/m^3 in surface water (n=9), 71.67±7.66 items/kg and 36.11±2.07 items/kg respectively on dry weight in vegetated sediment (n=9) and non-vegetated sediment (n=9) and 162.14±77.37 items/kg of sea cucumber (n=9) out of the total recorded microplastics (530 items). The size range of isolated microplastics from seagrass blades, surface water, surface sediment, and sea cucumbers was 0.06-4.56 mm. Comparatively, a higher percentage (61.16%) of large microplastics (1-4.56 mm) were found in surface water and surface sediment, than in seagrass blades and sea cucumbers. Fibers contributed 60.83% of the total microplastic observed across all samples while the dominant color was blue (44.45%). Low-Density Polyethylene (LDPE) (58.75%) was the most abundant polymer type found in four sample types. Salli Beach is the most significantly affected seagrass meadow among selected sites may due to high domestic waste disposal, and active fishing. The findings of this study provide evidence of the susceptibility of seagrass meadows to microplastic pollution that poses detrimental effects along the Eastern coast of Sri Lanka. Future works are recommended to focus on the bioavailability of microplastics of different types of marine organisms associated with seagrass meadows.

Keywords: Microplastic pollution; Seagrass blades; *Thalassia hemprichii*; Sea cucumber; *Holothuria atra*

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Grain size distribution of sea turtle nesting beaches on the Southern coast of Sri Lanka

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The beaches of the southern coastal belt of Sri Lanka are home to sea turtle species; Green turtles, Leatherbacks, Olive ridleys, Hawksbills, and Loggerheads, which come to nest. The nesting behaviors are influenced by sedimentary characteristics such as grain size, mineral composition of the sand, sand porosity, soil temperature, and soil pH of the nesting beach. Grain sizes have strong relationships between substratum compactness and thermal conductivity. Coarse sand and poorly sorted sand nests have been found to be generally preferred by turtles in terms of grain size distribution on sea turtle nesting beaches that have been studied extensively globally, but a lack of recent studies in Sri Lanka. Therefore, this study focuses on the grain size distribution of eight selected sites along the southern coast. The selected sites were mainly based on the most prominent turtle-nesting beaches on the Southern coast: Palatupana, Bundala, Godawaya, Ussangoda, Kalametiya, Rakawa, Mirissa, and Habaraduwa. The studied characteristic of the grain size distribution of beaches was done by collecting samples (n=40) using a piston core sampler up to 50 cm depth level as five samples per site with 100 m distance. The grain sizes were determined using the dry-sieving method, and grain size distribution parameters such as mean size and sorting, were calculated using mainly GRADISTAT$_{V\ 9.1}$ and Excel software. The mean grain size (µm) of the eight sampling sites were 434.6, 376.5, 573.4, 759.9, 455.0, 470.6, 662.2, and 326.2; Godawaya, Ussangoda, and Mirissa consisted with coarse sand while Palatupana, Bundala, Kalametiya, Rakawa, and Habaraduwa consisted with medium sand. The sorting (µm) values were 1.768, 1.805, 1.763, 1.575, 1.616, 1.578, 2.113, and 1.793 highlighting that Mirissa consists of poorly sorted sand while Palatupana, Bundala, and Habaraduwa consist of moderately sorted sand and other sites exhibit moderately well-sorted sand. Therefore, this study clearly shows that the Mirissa beach sand was coarse sand and poorly sorted. Further studies are recommended to focus on how these variations affect nested turtle eggs.

Keywords: Species; Sedimentary characteristics; Grain size; Sorting

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Effect of natural and artificial barriers on coastal erosion of Southern coast, Sri Lanka

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The development of the coastal zone in Sri Lanka holds significant importance for the country's economy and those developing activities have significantly increased during the past decades due to the rising population and the growth of coastal tourism. Coastal zones are considered highly vulnerable to climate changes and unsustainable developments leading to phenomena like coastal erosion. Therefore, identifying shoreline changes is important to combat this problem as well as public awareness. The main objective of this study used satellite images of the Galle and Matara district coastal belt from Landsat 8 and 9, Sentinel 2, and Google Earth Pro software between 2013 and 2022. The shoreline change was calculated using the Digital Shoreline Analysis System (DSAS) statistics in ArcGIS software. The distribution of barrier structures was obtained using Google Earth Pro and Allen Coral Atlas. The obtained data were analyzed by ArcGIS 10.8 software and Minitab 17. The results show that the average coastal erosion rate is -0.086±1.199 m/yr. in the overall study area. As district-wise, the average accretion of 0.0241±1.401 m/yr. in Galle district and average erosion of -0.232 ± 0.836 m/yr. in Matara district was observed. Rocky shores distribution of the study area is ≈ 18% and coral reef distribution is ≈ 60%. The anthropogenic barriers like revetments, groins, and breakwaters are higher in Galle district compared to Matara. However, Matara district consists of more rocky shore areas. There was no significant correlation (p>0.05) of Endpoint Rate (EPR) with the number of groins, length of rocky shores, length of revetments, and presence of river mouths, showing that erosion of the coastal area is a combined act of multiple factors. Therefore, it is recommended to conduct further studies on the collaborative impact of these multiple factors and identify the triggering points of coastal erosion.

Keywords: Coastal erosion; Natural barriers; Anthropogenic barriers; End point rate; Coastal vulnerability

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Preliminary study of bycatch and discards composition of shrimp fyke net fishery in Gurunagar, Sri Lanka

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The shrimp fishery is globally renowned for substantial bycatch and discards, raising ecological concerns over the potential marine ecosystem and biodiversity impacts. In Sri Lanka, shrimp fishery employs diverse methods, including bottom trawlers in marine areas and fyke nets and cast nets in lagoons. Despite fyke nets being a major lagoon fishing method, limited research has focused on shrimp fyke net fishery bycatch and discards. Addressing this gap, the study investigates biological and fisheries aspects, particularly bycatch and discard rates, associated with fyke nets in Jaffna Lagoon, Sri Lanka. Catch composition of fyke nets and length composition of major bycatch species were collected through frequent, random visits to field sampling sites and data were recorded in field data sheets from April to June 2023. In addition to that, length at first maturity (Lm) values were sourced from scientific databases and publications. This study identified 88 species belonging to 48 families, including 10 shrimp species, and bycatch species comprising 65 species of finfishes, 9 species of crabs, and 4 species of cephalopods. Results revealed fyke net catch comprised 20% shrimp, 49% retained bycatch, and 31% discarded. Among the discards, 40% were low commercial value bycatch, 30% represented small in sizes, 15% were poor quality, and remains were discarded due to inedible species. The overall catch per unit effort averaged 0.08 kg/hoop/day, with the highest effort in June (0.12 kg/hoop/day) and the lowest effort in April (0.04 kg/hoop/day). The bycatch rates showed a positive correlation with fyke net numbers (r=0.60) while exhibiting negative correlations with lunar day (r=-0.50), water depth (r=-0.50), and proximity to sea cucumber farms (r=-0.20). In this study, *Terapon puta*, *Gerres oyena*, and *Portunus pelagicus* were emerging as dominant species in the fyke net harvest. Major bycatch species length frequencies showed that the most dominant bycatch species were immature. Out of that, 100% of *T. puta*, 74% of *G. oyena*, 84% of *P. pelagicus*, 96% of *Psammoperca waigiensis*, and 64% of *Sillago sihama* were immature. The study concludes that the fishery remains unsustainable and unregulated and it leads to creates greater growth overfishing of fishery resources since best management practices are yet to be introduced.

Keywords: Bycatch; Discards; Catch per unit effort; Fyke net

Paper ID**:** IRCUWU2023**-**205

Spatial variation of water quality: A case study in upper catchment of Kumbukkan Oya, Sri Lanka

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Water quality degradation is one of the serious issues over the world, especially, in fresh surface water. This study aims to assess the spatial variation of 13 physiochemical parameters in the upper catchment area of Kumbukkan Oya from April to June 2023. The composite sampling method was used to collect samples from four different sampling sites respectively from the upper region to the lower region: a relatively pristine site (S_1), gem mining area (S_2), high agricultural practices area (S_3), and relatively urbanized and agricultural area (S_4). The mean values of the measured water quality parameters were Dissolved Oxygen (DO) 7.5±0.25 mg L^{-1}, pH 7.47±0.24, temperature 25.72±1.66℃, Electrical Conductivity (EC) 95.37±17.79 µS cm^{-1}, turbidity 34.38±18.90 NTU, Nitrate-N 3.11±0.14 mgL^{-1}, Total phosphate (TP) 0.83±0.4 mgL^{-1}, Alkalinity 96.51±16.41 mgL^{-1}, Hardness 119.14±24.07 mgL^{-1}, Total Solids (TS) 122.28±27.37 mgL^{-1}, Total Dissolved Solids (TDS) 62.22±19.02 mgL^{-1}, Biochemical Oxygen Demand (BOD) 1.50±0.35 mgL^{-1} and Chemical Oxygen Demand (COD) 9.75±3.66 mgL^{-1} in the four sites during the study period. There were no significant differences in DO, pH, EC, Turbidity, Nitrate-N, TP, Alkalinity, Total Hardness, TS, and BOD among the four sites ($p<0.05$). However, Temperature, TDS, and COD were significantly different ($p<0.05$) among the four sites. The findings proved that water quality in the upper catchment area of Kumbukkan Oya was within the limits of ambient water quality standards for inland water in Sri Lanka, proposed by the Central Environmental Authority. However, results proved that the tendency of pollution increment towards the middle catchment area with the increasing potential risk of anthropogenic effects on the water quality in the upper catchment area. Therefore, frequent water quality assessments and control of anthropogenic effects in the catchment are important.

Keywords: Water quality; Kumbukkan oya; Physiochemical parameters; Anthropogenic effects

Paper ID**:** IRCUWU2023**-**238

Blue carbon storage analysis in Dikwella seagrass bed of Sri Lanka

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Seagrasses play a significant role as marine plants, providing food, habitat, and nursery grounds. Seagrass ecosystems also contribute to a significant amount of blue carbon capturing, which is the carbon stored by the world's marine ecosystems. However, carbon storage in seagrass beds along the Dikwella coast in Sri Lanka remains understudied. This research aims to fill this knowledge gap by determining the carbon storage capacity of the Dikwella seagrass bed using a random quadrat sampling method to ensure comprehensive coverage. Samples were collected by gathering entire seagrass plants, including roots, rhizomes, and dead plant matter. Additionally, epiphyte biomass and soil carbon were assessed. The organic carbon content stored in the seagrass leaves, known as above-ground biomass, was measured using the loss of ignition method. Similarly, the organic carbon content stored in the seagrass roots and rhizomes was calculated as below-ground biomass. The dry epiphyte biomass in the seagrass leaves and the soil organic carbon content under seagrass patches were also determined using the loss of ignition method. Within the Dikwella seagrass ecosystem, a rare seagrass species known as *Cymodocea serrulata* was identified. This species has ribbon-shaped leaves. The above-ground biomass of the Dikwella seagrass bed was found to be 23.90 gCm^{-2}, while the below-ground biomass was measured at 24.88 gCm^{-2}. The dry epiphyte biomass of the seagrass leaves of the Dikwella seagrass bed was found to be 3.61 gm^{-2}. The soil organic carbon content under the seagrass patches was measured at 391.18 gCm^{-2}. Despite its ecological significance, the seagrass bed in Dikwella is currently under threat from various pollutants, predominantly hotel waste. Urgent conservation measures are needed to prevent further loss of seagrass habitats. Restoration projects and conservation efforts should focus on mitigating issues such as destructive fishing methods, and coastal pollution. Seagrasses were not uniformly distributed along the entire Dikwella coast; they were found in patches and typically associated with epiphytes. Fishes, arthropods, corals, sand, and other organisms were inhabiting these areas. Future research should assess the causes of seagrass occurrence and improve our understanding of carbon storage variability.

Keywords: Seagrass; Carbon storage; Biodiversity; Conservation

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Comparative study on fisheries and socioeconomic status of Pallikuda and Nachchikuda Kilinochchi, Sri Lanka

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Coastal fisheries provide many opportunities for Pallikuda and Nachchikuda fishing villages, in that respect both are considered as two main fishing villages situated in different fisheries inspector divisions, Kilinochchi. This study aims to collect information on fishing practices, species composition, market structure, catch per unit effort (CPUE), and the level of awareness of the fishing community on the importance of fishery sustainability. Data were collected by using a semi-structured questionnaire from selected 100 fishermen from each village out of 300 through a simple random sampling method and from the Department of Fisheries and Aquatic Resources. The study revealed that there were four types of fishing gear i.e., stake net, crab net, gillnet, and trammel net in both fishing villages, stake net was used high percentage (50%) in Pallikuda and crab net was used in a high percentage (40%) in Nachchikuda respectively. Three types of fishing crafts were identified i.e., Non-Mechanized Traditional Boat (NTRB), Mechanized Traditional Boat (MTRB), and Outboard Fiberglass Reinforced Plastic boat (OFRP). OFRP boat was operated in high percentage in Pallikuda (37%) and Nachchikuda (42%). During the study period, twenty-four species were identified in both fishing villages. The CPUE was high-for stake net (0.007451 kg/ net square meter-hours) in Pallikuda and for crab net (0.01918 kg/ net square meter-hours) in Nachchikuda. The majority of fishermen were in the age group 31-40 years (41%) in Pallikuda and 41-50 years (40%) in Nachchikuda. In Pallikuda majority of fishermen achieved secondary-level education (52%) while in Nachchikuda majority achieved ordinary-level education (43%), respectively. The economic crisis negatively affected (100%) the fishing community. The estimated annual income level of fishermen was below Rs.250,000 in Pallikuda while in Nachchikuda it was between Rs.250,000 - 500,000. Awareness level about sustainable fishing was identified as moderate (2.34<3.3953<3.66) in both villages. The current study upholds the information on the socio-economics of two fishing communities using optimum management practices.

Key words: Coastal; Fishing gears; Catch per unit effort; Socio-economic; Awareness.

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Effects of biosecurity measures and better management practices on parasitic infestations of *Xiphophorus hellerii* (Swordtail fish)

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Biosecurity measures are employed to reduce the risk of the introduction, establishment, and spread of pathogens/parasites. Better management practices could enhance the immuno-competence of fish resisting to pathogens/parasites. The present study investigates the effects of biosecurity measures and better management practices that are carried out in farms on parasitic infestations of swordtails. A survey was carried out (using a stratified questionnaire and marking scheme) in medium-scale swordtail fish farms in Ratnapura district; five farms received the highest marks (Group 1) and five received the lowest marks (Group 2) for biosecurity measures and better management practices carried out in them were selected. Four grow-out tanks were randomly selected from each farm and ten swordtails were collected randomly from each tank. Biopsy (including wet mount preparation) and necropsy were performed on each fish separately, and common external and internal parasites were identified up to the generic level, enumerated and recorded. The mean prevalence of *Trichodina* sp., *Centrocestus* sp., *Gyrodactylus* sp., *Camallanus* sp., and *Argulus* sp. in swordtails from farms of Group 1 were significantly lower than those relevant values of parasites in fish from farms of Group 2 ($p<0.05$). The mean intensity of *Gyrodactylus* sp., *Centrocestus* sp., *Camallanus* sp., and *Argulus* sp. recorded in swordtails from the farms of Group 1 were significantly lower than those corresponding values in fish from the farms of Group 2 ($p<0.05$). The mean of the total number of parasites recorded in fish from the farms of Group 1 also was significantly lower than that of Group 2 ($p<0.05$). The equation resulted from the regression analysis with a curve estimation of the correlation between the total number of parasites recorded from each farm and the total marks received during the questionnaire survey by the farm is Total parasites (y)=-37.86 Total marks (x)+2663($R=0.6679$, $p<0.05$). For every unit increase in marks received by a farm for biosecurity measures and better management practices, the total number of parasites will decrease by 37.86 and from the variation of the total number of parasites, 66.79% accounted for the marks received by a farm for biosecurity measures and better management practices.

Keywords: Biosecurity measures; Better management practices; Parasites; Swordtails

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Fluctuation of sea surface temperature over shallow coral reef ecosystems in Pigeon Island National Park, Sri Lanka during the past 25 years period (1998-2022)

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Coral reefs are the world's most dynamic and complex underwater habitat which inhabit a wider variety of reef species with more advantages. Coral reefs have been identified as highly sensitive ecosystems that suffer damage from a slight change in ocean water temperature, therefore serving as a key indicator of climate change. Usually, coral reefs are vulnerable when sea surface temperatures (SST) exceed their maximum temperature of 28°C. This causes coral loss and exposes coral reefs to numerous threats that have an impact on millions of other species that reside on the reef, both directly and indirectly. Therefore, this study was designed to study the fluctuation of inter-annual and intra-annual SST from 1998 to 2022 over the most prominent Pigeon Island National Park (PINP) coral reef in Sri Lanka. Data were obtained from the Coral Health and Monitoring Program Portal online database, which provides daily data from the established SST sensor of the relevant reef. There was an annual average SST trend increasing by 0.01°C per year. The maximum monthly average SST was recorded in May (30.18°C), and the lowest SST was recorded in January (27.33°C). Maximum yearly average positive anomalies were recorded in 1998 (0.28°C), 2010 (0.25°C), 2015 (0.23°C), 2016 (0.39°C), 2019 (0.26°C), and 2020 (0.23°C). According to different seasons, the maximum and minimum average SSTs were identified for the first inter-monsoon (29.51°C, March–April), southwest monsoon (29.37°C, May–September), second inter-monsoon (28.96°C, October–November), and northeast monsoon (27.67°C, December–February) respectively. The maximum seasonal average SST (30.19°C) was recorded during the first inter-monsoon in 2016 (30.19°C), and the lowest seasonal average SST was recorded during the northeast monsoon in 2014 (27.16°C). The First inter-monsoon and the month of May are more critical since they reach the maximum SST and the minimum in the northwest monsoon. Therefore, coral reefs in PINP in Sri Lanka are threatened by the elevation of the SST due to global warming and seasonal and interannual temperature fluctuations.

Keywords: Coral reef; Sea surface temperature; Anomaly temperature; Average temperature; Monsoon

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Investigating the prevalence of the *Penaeus monodon* densovirus infection in shrimp farms in Chilaw, Sri Lanka

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Penaeus monodon Densovirus (*Pm*DNV) infects the hepatopancreas of penaeid shrimp displaying no gross signs. Heavy infections cause stunted growth leading to a decline in farm production. While *Pm*DNV is widely distributed worldwide there is no record of its prevalence in Sri Lanka. Therefore, the study aimed to detect *Pm*DNV infection in *P.monodon* in the Chilaw region of Sri Lanka. Twenty (20) farmed shrimp samples, aged 94-105 days, were collected from two selected farms (A & B) in Chilaw, Sri Lanka. Hepatopancreas of shrimps were isolated and preserved in Davidson's fixative solution for histopathology. Fixed tissue samples were processed, embedded in wax, and cut into 4-5 µm thick sections. Hematoxylin and Eosin staining of the infected hepatopancreas revealed typical *Pm*DNV inclusions in the nuclei of infected cells. Results of the study revealed that 60% (12/20) of the studied shrimps were infected with *Pm*DNV. The average age of the shrimps on farm A was 94 days, while those on farm B were 105 days. The average body weight of the infected and non-infected groups in farm A was11.98±0.37 g (N=8) and 17.45±0.85 g (N=2), respectively. The mean total length of infected and non-infected groups in farm A was11.86±0.41 cm and 14.80±0.60 cm respectively. The average body weight of infected and non-infected groups in farm B was 8.72±1.63 g (N=4) and 14.05±0.72 g (N=6) respectively. The mean total length of infected and non-infected groups in farm B was 10.75±0.98 cm and 12.48±0.40 cm respectively. The mean body weight of infected shrimps in both farms was significantly lower compared to the non-infected group ($p<0.05$). In farm A, the total length of the infected group was significantly lower compared with the non-infected group ($p<0.05$). However, the total length was not significantly different between infected and non-infected shrimps in Farm B. These results revealed that Densovirus infection affects the growth of shrimps. This is the first study reporting the presence of *Pm*DNV in *P.monodon* in Sri Lanka with pathological findings. Although histopathology remains a more accurate and sensitive method for detecting and confirming virus infection, further studies are needed to confirm the presence of *pm*DNV in shrimps.

Keywords: *Penaeus monodon;* Densovirus; Histopathology; Stunted growth.

Paper ID: IRCUWU2023-442

Comparative study on the dietary effect of live polychaetes and frozen polychaetes for reproductive performance of *Litopenaeus vannamei*

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In Sri Lanka, initially formulated feed, squids, and bivalves were used as the primary foods in the broodstock culture process of *L. vannamei*. Recently, specific pathogen free polychaetes (*Nereies viren*) – both live and frozen have been introduced. This study aimed to investigate the dietary effect of live polychaetes, frozen polychaetes, and a 50:50 mix of both, on the reproductive performance of *Litopenaeus vannamei*. Three brood stock batches: (batch 01, batch 02, and batch 03) were cultured separately under controlled water quality and environmental conditions for 120 days. Each batch consisted of 125 males (average body weight 42.67±4.62 g) and 125 females (average body weight 46.33±4.04 g). The three types of feeds: frozen polychaetes, live polychaetes, and a mix of both (50:50%) supplemented with squids and pelleted feeds were given to each batch. The Daily Feed Amount (DFA) was calculated as 30% of the total broodstock biomass and adjusted weekly. Females were fed with 70% polychaetes, 28% enriched squids, and 2% pellet feed, while males received 40% polychaetes, 58% enriched squid, and 2% pellet feed of the DFA. The same inducing methods were followed for all three groups and the number of matured females, mated females, and spawned females were recorded, along with daily estimates of egg and nauplii quantities for each group separately. Significant variations were determined using ANOVA and post-hoc Tukey's test. The results indicated significant differences ($p<0.05$) in the number of matured females, mated females, spawned females, number of eggs, and nauplii production between the batches. The highest mean values were recorded in the group fed with live polychaetes, followed by the mixed polychaetes and frozen polychaetes groups. Post-hoc Tukey's tests revealed significant differences ($p<0.05$) in the daily matured animal, maturation rate, and mated animal among the three feeding groups. However, there was no significant difference ($p>0.05$) observed in the hatching rate of the eggs among the feeding groups. These findings can be utilized to enhance the seed production of *L. vannamei* and to introduce a new live feed species to the aquaculture industry of the country.

Keywords: *Litopenaeus vannamei*; Polychaetes; Reproductive performance; Live feed

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A preliminary study on comparative culture performances of sea cucumber (*Holothuria scabra*) farming in existing coastal pens with varying buffer zone ranges in Jaffna lagoon, Northern Province, Sri Lanka

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Sea cucumbers are marine invertebrates belonging to the class Holothuroidea. They hold significant demand in the global market due to their importance as food and medicine. Among the highly sought-after sea cucumber species, *Holothuria scabra* is naturally occurs in the Northern waters of Sri Lanka and has now been cultured on farms. As this species primarily feeds on sediment with organic substances as its natural feed; therefore, farmers depend on natural feed occurrences in their pen culture systems. Presently, the sea cucumber industry is experiencing rapid growth in the Northern region, particularly in Gurunagar area of the Jaffna lagoon. However, farmers lack a clear understanding of the buffer zone (space between farms) requirements for their facilities. Therefore, this preliminary study aims to investigate the growth performances of sea cucumbers and the total organic content of the sediment in relation to different buffer zones of selected farms located in Gurunagar area. The growth performance of sea cucumber was estimated based on field surveys while the total organic content was assessed based on loss on ignition method. Statistical analysis was conducted using Pearson correlation. The results indicated that as the buffer zone increases both the total organic content (p>0.05) and the growth rate (p>0.05) of sea cucumbers also increase, but there is no significant level increase observed. It might be due to the short-term operation of pen culture in this area (<2 years) and as the buffer zone expands more, it may be possible to obtain a significant relationship. Nevertheless, the findings from this study can be utilized in sea cucumber farm construction and maintenance in the region to improve culture practices and environmental conservation.

Keywords: *Holothuria scabra*; Sea cucumber farming; Pen culture; Buffer zone; Total organic content

Paper ID: IRCUWU2023-449

Study of phenotypic plasticity of *Rasboroides vaterifloris* in Kalu river basin, Sri Lanka

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Rasboroides vaterifloris is an endemic, endangered and environment sensitive fish species in Sri Lanka which is primarily restricted to Kalu River basin. Due to its sensitivity, alterations of environmental gradients could be affected their morphology. Understanding the phenotypic plasticity of fish in response to environmental variations is vital for their conservation and management. This study aims to investigate the morphology of *R. vaterifloris*, inhabiting the selected locations in Kalu River basin using geometric morphometric (GM) and traditional morphometrics (TM). Fish were collected from three locations in Kalu River basin (L1: Athwelthota, L2: Pahiyangala and L3: Thundola) and water velocity, depth, turbidity, and canopy cover were recorded. For GM analysis, eight landmark and six semi-landmark coordinates on the body of mature male fish (n=97) were digitized and all landmark configurations were subjected to size correction. The size effect removed variables were used for the multivariate analysis. For TM analysis, six linear measurements were standardized and tested for normality. Further, one-way ANOVA and Post Hoc tests were performed to identify the significant difference in variables. The results of environmental gradients showed a high canopy cover percentage and flow rate in L3 compared to the other two locations. The GM results revealed that both Mahalnobis and Procrustes distances of the three locations were significantly different (p<0.05) from each other. According to the Discriminant function analysis, the fish population in L3 showed narrower heads and deeper caudal peduncle. TM results validated that standardized values of head depth, maximum body depth, and caudal peduncle depth showed a significant difference in L3 compared to the other two locations. This study revealed that *R. vaterifloris* populations invade three different study locations showing significant morphological variations. The variations of water velocity and canopy cover might contribute to this body shape variation among populations in three study locations. Hence, we recommend conducting continuous measurements throughout the year to observe temporal fluctuations in environmental parameters and this approach will help to understand the exact causes of body shape variation of *R. vaterifloris*.

Keywords: Geometric morphometrics; Water velocity; Environmental gradients; Fish morphology; Traditional morphometrics.

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Assessment of fisheries and aquaculture certification in Sri Lanka: Special reference to Gampaha district

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Certifications in aquaculture and fisheries are vital in maintaining the safety, quality, and sustainability of seafood products and the industry. Seafood processing factories need to obtain several certificates before exportation. The major objective of the study is to review the existing quality certification schemes for seafood processing in Sri Lanka. Data were collected using a structured questionnaire, key informant interviews from major certificate awarding bodies of Sri Lanka, selected seafood processing companies in the Gampaha District, and reliable secondary sources. Random sampling method was used as a sampling technique and the collected data were descriptively analyzed. According to the results, three categories of certifications were obtained by seafood processing companies: food and safety certificates (33.33%), general quality certificates (38.88%), and aquaculture and fisheries-specific certificates (27.78%). Seafood processing companies obtained the main food and safety certifications: Hazard Analysis Critical Control Point (HACCP-33.33%), Good Manufacture Practices (GMP-25.64%), and British Retail Consortium (BRC -20.51%) certificates are dominating the food and safety certifications while ISO-37.5%, Food, and Drug Administration (FDA-16.66%), SLS (12.5%) and Member of SEDEX (12.5%) certificates were dominated in the quality certification category. Five major certificates in Sri Lanka have been awarded under Fisheries and Aquaculture certification. These include Friend of the Sea (FOS-44%), Best Aquaculture Practices (BAP-28%), Dolphin Safe (22%), Aquaculture Stewardship Council (ASC-6%), and Marine Stewardship Council (MSC-0%). However, no company in the Gampaha District has obtained an MSC certificate due to its high cost. Certificate awarding companies see market benefit with owning a certificate (83%), while exporters disagree (p>0.05). Despite the potential benefits of certifications for exports and sustainability, many seafood exporters are deterred by high costs, low awareness, and standard requirements. To overcome the shortcomings of aquaculture and fisheries certification, the study suggested conducting awareness programs of fisheries and aquaculture certification schemes.

Keywords: Seafood processing factories; Quality certifications; Fisheries and aquaculture certifications; Food safety certifications

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Detection of spatial and temporal variation of Unawatuna mangroves; over the past 20 years using remote sensing and GIS techniques

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Mangrove ecosystems are highly vulnerable to natural and anthropogenic threats. It is essential to assess the present status and dynamics of mangrove coverage for the implementation of conservation approaches. This study was conducted to determine the spatial and temporal variation (for the years 2003, 2007, 2011, 2015, 2019, and 2023) of the Unawatuna mangroves, using remote sensing and GIS techniques. Training data were obtained based on landward and waterward demarcations obtained from the preliminary ground survey. Training data were validated after analyzing the spectral signatures. Landsat 8 OLI images of this site for the year 2023 were classified under four macro classes; mangroves, water, built-ups, and terrestrial vegetation using the Semi-automatic Classification Plugin 7.10.11 of QGIS 3.30 using supervised classification algorithms; Minimum Distance, Maximum Likelihood, Spectral Angle Mapping, and Random Forest. The overall accuracy of each method was calculated based on ground truth data using Google Earth Pro high-resolution satellite images for Random Forest, Minimum Distance, Maximum Likelihood, and Spectral Angle Mapping classification algorithms resulting in 73%, 91%, 85%, and 89% respectively. Kappa coefficient values for those resulted as 0.5099, 0.8471, 0.7506, and 0.8087 respectively. The highest overall accuracy resulted in the Minimum Distance classifier with a producer accuracy of 88.71% for the mangroves class and Kappa coefficient of 0.8471. Then Landsat 8 OLI for 2015 and 2019 and Landsat 7 ETM+ images for 2003, 2007, and 2011 with cloud covers of less than 25% were classified using the Minimum Distance classifier. The estimated mangrove coverage (ha) was 47.0025, 61.1100, 76.3650, 62.1000, 60.3000, and 51.5700 respectively for the years 2003, 2007, 2011, 2015, 2019, and 2023; with a decreasing trend after 2011 due to the rapid urbanization. This study emphasizes the need for additional restoration efforts in an urban wetland by examining the temporal changes in mangrove coverage and the utilization of medium-resolution satellite images and open-source software presents viable alternatives for identifying both the spatial and temporal variations in mangrove vegetation, particularly in areas with limited distribution.

Keywords: Mangroves; Landsat; Supervised classification; Remote sensing

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Impact of economic crisis on the performance of the ornamental fish industry in Western Province, Sri Lanka

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The ornamental fish industry in Sri Lanka has witnessed significant growth in recent years having 4% of the global market, emerging as one of the leading foreign exchange earners, largely due to the escalating demand from aquarium hobbyists in developed countries. However, some fallbacks were observed during the last few years in the industry which could be enormous causes. Therefore, this study aimed to investigate whether there is any impact of the economic crisis in recent years on the performance of the ornamental fish industry with special reference to the Western Province, of Sri Lanka. The Likert-scale questionnaire was prepared, and the sample size was determined using XLSTAT 2022.3 software. Quantitative data were collected from 660 individuals and qualitative data were collected by recording interviews with 20 individuals including ornamental fish farmers, exporters, and importers from the Western Province. The data were analyzed using Chi-square statistical analysis and thematic analysis for pre-determined three different durations (pre-pandemic situation; 2017-2019, during the Covid-19 pandemic; 2020-2022 and during the economic crisis; 2023) to study the impact on the industry. The rising cost of feed and electricity cost had significantly challenged the efficiency of the ornamental fish industry (+<0.05) during the economic crisis. There was no significant impact of the pre-pandemic situation and the Covid-19 pandemic on the performances of the ornamental fish industry (p>0.05). It was revealed, the cost of transportation, feed, and electricity were major constraints for the farmers and exporters in the western province (p<0.05) which declined their profitability and sustainability. Furthermore, the economic downturn led to a decline in demand for ornamental fish in both the local and export market. It can be concluded that the economic crisis negatively impacted the performance of the ornamental fish industry nevertheless the pre-pandemic situation and during Covid 19- the pandemic in the Western province, of Sri Lanka.

Keywords: Ornamental fish industry; Economic crisis; Western province; Qualitative analysis

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A global-scale analysis of organic UV filters in marine biota: Seafood safety implications

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Organic UV (O-UV) filters are chemical compounds that block UV light. They are extensively used in personal care products, textiles, plastics, and in other synthetic materials. These chemicals can ultimately end up in the marine environment upon use. Organic UV filters are potently toxic at higher concentrations and there is evidence that some of them are endocrine disruptors. Contamination of marine biota by O-UV filters in the oceanic environment raises concerns for seafood safety. The approach of this research was to determine the current state of O-UV filter contamination in marine biota globally and to assess the seafood safety risk. Studies were searched through Google Scholar, Scopus, and Web of Science databases. Thirty-seven articles were selected through inclusion and exclusion criteria out of 105 studies from 2018 to 2023. Quality control and quality assurance procedures in the field studies were thoroughly evaluated in the inclusion process. As results indicated, the most abundant O-UV filters were 4-methyl benzylidene-camphor (4-MBC), benzophenone-3 (BP-3), Octocrylene (OC), benzophenone-1 (BP1), Ethylhexyl salicylate (EHS), Octyl dimethyl p-aminobenzoic acid (ODPABA) and 2-ethylhexyl-4-methoxycinnamate (EHMC). The median concentrations of O-UV filters in biota groups including molluscs, crustaceans, and fish ranged from 0.036 ng/g (dw) to 7112 ng/g (dw). There was a significant difference in the accumulation between biota groups (p<0.05). The correlation between the trophic level of the species and the O-UV filter accumulation was negligible (p>0.05). The human health risk posed by contaminated seafood species were assessed using the Hazard Quotient (HQ) and Hazard Index (HI). Organic UV filters in seafood species did not indicate potential harm to human health (HQ<1) when considered as single compounds for the regions including Asia, Europe, Africa, Latin America, and Oceania. The Hazard Index calculated considering the cocktail effect of compounds further confirmed that there is no potential harm (HI<1). Overall, O-UV filters do not pose a significant seafood safety risk at the present level of contamination in marine biota globally.

Keywords: Chemical contaminants; Contamination; Marine organisms; Seafood risk; Organic UV filters

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Impact of economic crisis on the performance of ornamental fish farms: Special reference to Polonnaruwa district, Sri Lanka

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The ornamental fish industry is an economically important industry in Sri Lanka in recent times. However, at present, severe economic crisis has influenced, especially for the ornamental fish farms in various ways. This study was conducted to explore the past and current status of the performances of ornamental fish farms and tried to identify major constraints faced during this situation and the types of strategies used to overcome those constraints by farmers. Randomly selected 260 farmers in seven divisions of Polonnaruwa District, which is one of the main fast-growing ornamental fish-producing centers of the country were used for data collection. A questionnaire survey was conducted to employ a mixed-methods approach, combining quantitative analysis and qualitative analysis. It was revealed that during 2021-2023, there were more negative impacts than in previous years on the performances of ornamental fish farms in Polonnaruwa District due to the economic crisis. The downturn in the national economy has led to reducing the demand for ornamental fish, resulting in lower profits for farmers. Moreover, increased production costs, including feed and transportation costs, have further compounded the challenges faced by fish farmers. Profitability has shown a significant positive association with demand and a negative with feed and transportation costs (X^2; $p<0.05$). However, transportation cost (32.82%) and lack of demand (30.79%) were the most constrained factors for ornamental fish farmers under the marketing theme while, the high cost of quality feed (29.38%), and proper maintenance issues (21.24%) were the main constraints in production. Moreover, lack of involvement and financial support by the government and other responsible organizations were other major problems. However, the majority of ornamental fish farmers (72.31%) have not engaged in strategies to overcome those problems. But alternative feed and reduce feeding frequency were mainly practiced. Therefore, the development of financial assistance, provision of training, technical support, and establishment of market linkages to promote domestic and international sales can be supported to mitigate the adverse effects of economic crises and enhance the resilience of the ornamental fish farms in Polonnaruwa region.

Keywords: Economic crisis; Ornamental fish farms; Performance; Major constraints; Strategies

Business Economics Accountancy & Finance

Paper ID: IRCUWU2023-12

A study on the application of accounting techniques and practices and its effect on the sustainability of small and medium enterprises in Ampara district

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Accounting techniques and practices play a vital role in evaluating the performance of small businesses. However, many small businesses face challenges including insufficient working capital, poor management skills, and a lack of effective accounting techniques. These challenges hinder their ability to sustain themselves and accurately assess performance. Without professional accounting support, small businesses often have limited access to information, which is solely based on managerial demand, thus affecting their long-term viability. The study aimed to evaluate how accounting techniques and practices impact the sustainability of small and medium enterprises (SMEs) in the Ampara District. The dependent variable of the study was the sustainability of SMEs. To measure accounting techniques and practices, the study focused on cost systems, budgeting systems, and record-keeping systems. The researchers collected primary data by administering a questionnaire to a sample of 50 SMEs in the Ampara District using the random sampling technique. The sample included SMEs from various industries and sectors, providing a diverse representation of small businesses in the Ampara District. According to the analysis, the costing system and budgeting system have an insignificant relationship with the sustainability level but there is a significant relationship between the record-keeping system and the sustainability level. Most of the SMEs have not given much attention to bookkeeping in their business transaction, despite its importance in the success of the business. This could be a lack of sound knowledge of bookkeeping practices by owners or respective managers. It was hard to determine to what extent know adherence to laid down the accounting procedure constituted the wheel of implementing a good accounting system. The study reveals a significant correlation between accounting techniques and practices and sustainability, particularly among individuals involved in SMEs who actively participate in costing and budgeting. However, there is a lack of awareness regarding the importance of maintaining proper records within many SMEs, which greatly affects their sustainability. Thus, implementing effective accounting techniques and practices plays a crucial role in SMEs. It also suggests that exploring new avenues to enhance these techniques and practices can lead to improved performance and sustainability for firms.

Keywords: Sustainability; Cost system; Budgeting system; Record keeping system; SMEs

Paper ID: IRCUWU2023-58

Impact of government budget announcement on stock market return: Evidence from the Colombo Stock Exchange

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The stock market is widely regarded as a significant barometer of a country's economic trajectory, reflecting its growth, stability, and investor confidence. Among the pivotal events that influence stock market returns, government elections and budget announcements stand out as crucial factors. These events can significantly impact investor sentiment and market dynamics due to the potential changes in fiscal policies, spending priorities, and economic outlook. The main research question addressed in this study is to understand the impact of government budget announcements on stock market returns over different time periods. Specifically, the study has examined the daily average returns and volatility in the short term (immediately after the announcement), medium term (within 15 days), and long term (within 30 days), both before and after the budget announcement. Comprehensive data spanning seventeen budget periods from 2005 to 2021 was methodically gathered and subjected to statistical analysis employing paired t-tests and F-tests. Paired t-tests were employed to assess average returns, while F-tests were utilized to evaluate variances over varying periods of 3, 15, and 30 days prior to and following the budget announcement. The chosen time span from 2005 to 2021 allows us to capture the effects of budget announcements over a considerable period, providing insights into changing market dynamics. As per the results, the average returns exhibit considerable fluctuations during this period, gradually diminishing in the medium term and eventually subsiding in the long term. The implications of our study underscore the significance of astute investor consideration during the budget period. Investors can adjust their strategies based on the observed short, medium, and long-term impacts of budget announcements to capitalize on potential opportunities and mitigate risks. However, it is essential to acknowledge any limitations associated with this choice, such as changes in the economic environment and market structures during this time frame. This study contributes unique insights to the existing literature by offering a comprehensive analysis of the impact of government budget announcements on stock market returns over different time horizons. As such, it provides valuable knowledge for investors, policymakers, and researchers seeking a deeper understanding of the interplay between fiscal policies and financial markets.

Keywords: Budget announcement; Market returns; Variances; Pre-budget period; Post-budget period

Paper ID: IRCUWU2023-65

Modeling the factors influencing intention to use cryptocurrencies, special reference to university students, professionals, and investors in Sri Lanka

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The study focuses on understanding the beliefs and perceptions of Sri Lankans regarding cryptocurrency, specifically their intention to use it. Given the increasing global demand for digital currencies and the limited number of cryptocurrency users in Sri Lanka, the research aims to identify the factors that influence individuals' intention to use cryptocurrency in the country. To gather quantitative data, a questionnaire was administered to 311 participants, including university students, professionals, and investors in Sri Lanka. The study examines several variables that may impact individuals' intention to use cryptocurrency, including perceived benefits, perceived value, structural provisions, attitudes toward using cryptocurrency as a mediator, perceived risks, social effects, self-efficacy as a moderating factor, and personal inventiveness. Based on the analysis, the research finds that perceived benefits, perceived value, structural provisions, and attitudes toward using cryptocurrency significantly influence individuals' behavioral intention to adopt cryptocurrency. However, the hypotheses related to perceived risks, social effects, the moderating effect of self-efficacy, and personal inventiveness are found to be statistically insignificant. The findings of the study have managerial and theoretical implications for enhancing the intention to use cryptocurrency. The tested model and its results provide insights for improving cryptocurrency adoption and usage in Sri Lanka, offering guidance for businesses and policymakers in promoting and facilitating the use of digital currencies among the population.

Keywords: Block chain technology; Cryptocurrency; Intention to use; University students; Professionals

Paper ID: IRCUWU2023-66

A study on foreign direct investment, trade flows, and air pollution in Asian countries

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The cases of serious toxicological effects on human health and environmental air pollution have become a major concern in the modernized world. Especially, industrialization and globalization jointly account for the largest share of air pollution and huge environmental issues in the current globe. Rapid changes in emerging markets, foreign direct investment, imports, and exports are used by many countries to aim for the global market. The present study investigates on FDI, TF, and air pollution in Asian countries along with other variables economic growth, industry structure, urbanization, renewable energy consumption, research and development, and population. Data were collected from 1990 to 2020 according to sample countries in the Asian continent. The collected data from the World Bank website was analyzed using E-views 10, T-test, and Generalized Methods of Movements employed to achieve the objectives of the thesis. T-test used to interpret the probability of all variables of selected countries set, the mean value of all data in the Asian continent, and the mean value of all data in all countries in the world. Mainly Panel unit root test and panel cointegration test were used to test the stationary and long-run relationship in sample countries. The results of GMM indicate the relationship between all variables. There are positive relationships between all variables included in this study except renewable energy consumption and population correlated with this variable. The main findings of this article show that foreign direct investment and trade flows impact on air pollution in Asian countries. This study guides how the direction of FDI and TF should be along with the formulation of policies against air pollution in the Asian continent.

Keywords: Foreign direct investment; Trade flows; Air pollution; Economic growth; Urbanization

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Financial institution selection criteria in small and medium enterprises: Evidence from small and medium enterprises in Galle district

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Small and Medium Enterprises are a crucial sector in the economy of Sri Lanka because it contributes to generating high economic growth, employment, and regional development in the country. However, financing is a major problem for SMEs as the SME sector is continuing business under a shortage of resources. Further, they are also facing difficulties due to high-interest rates, collateral requirements, cumbersome processes, etc. As a result of that, it is a challenging task for SMEs to obtain bank loans, access capital markets and other means of financing. Therefore, it is imperative for SMEs to have means of financing in accordance with their requirements. Moreover, understanding the factors that affect the selection of financial firms is important to SMEs. The aim of this study was to investigate the factors that affect the selection of financial institutions for financing by SMEs in the Galle District. Determinants used in the selection of financial institutions are quality of the service, availability of credit, bank attributes, staff attributes, and rules and regulations. As it is challenging to access all the SMEs, SMEs from different industries based in the Galle district are selected as the population of the study. Accordingly, 75 enterprises were selected as the sample according to the simple random sampling technique. Moreover, for the collection of data, a structured questionnaire was administered within the sample of the study. Descriptive statistical techniques, correlation coefficient analysis, and regression analysis in SPSS software were used for the analysis of the data. Findings reveal that quality of service, availability of credit, bank attributes, and rules and regulations have a significant positive impact whereas staff attributes have no significant effect on the selection of financial institutes. In general, SMEs prefer to deal with well-reputed financial firms and the findings of the study will give insight to individuals who are planning to start SMEs, professionals in banks and financial institutes, and policymakers.

Keywords: Bank selection criteria; Financing; Small and medium enterprises; Sri Lanka

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The disclosure of corporate social responsibility and financial performance of listed hotels in Colombo Stock Exchange

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With the advent of globalization, businesses around the world have embraced the concept of Corporate Social Responsibility (CSR). The impact of CSR disclosure on financial performance has become an increasingly important concept among organizations and scholars. The hospitality and tourism industry in Sri Lanka has been acknowledged as the largest and fastest-growing sector since the end of the civil war. Accordingly, engaging in and disclosing CSR practices have become increasingly vital for the hotel industry to face high competition. Thus, the main objective of this study was to examine the impact of CSR disclosure on the financial performance of listed hotels in the Colombo Stock Exchange. The population of this research was thirty-five (35) listed hotels in the Colombo stock exchange under consumer service, which have operated in the years 2012 - 2021, and the sample of thirty (30) listed hotels were selected after excluding companies which cannot obtain the required data from their financial statements during the sample period. CSR disclosure was measured using content analysis based on an index, while the financial performance of the hotels was assessed using two accounting-based performance metrics and one market-based performance metric. Size and leverage were employed as control variables. Fixed-effect panel regression was utilized for data analysis. The findings revealed that CSR has a positive impact on accounting-based performance, specifically return on asset and return on equity, but a negative impact on market-based performance, namely Tobin's Q. Moreover, the results indicated a significant negative relationship between the control variables and accounting-based performance. Conversely, the results highlighted a significant positive relationship between the control variables and market-based performance. The study further identified that the listed hotels in the CSE have not made substantial improvements in CSR disclosure practices, indicating the need for further enhancements in the overall reporting of CSR practices. The findings of the study are beneficial for hotel managers, investors, policymakers, and the broader industry by providing valuable insights into the relationship between CSR disclosure and financial performance in the context of the hotel industry in Sri Lanka.

Keywords: CSR disclosure, Financial performance, Accounting-based performance, Market-based performance, Listed hotels in Colombo Stock Exchange.

Paper ID: IRCUWU2023-336

Awareness of microfinance services and small and medium sized enterprises performance: Special reference small and medium sized enterprises in Badulla district

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Microfinance has emerged as a vita tool in promoting financial inclusion and supporting the growth of SMEs, particularly in developing economies. This study aims to investigate the relationship between awareness of microfinance on the performance of small and medium-sized firms (SMEs) in Sri Lanka's Badulla area with the mediation and moderating impact of financial accessibility, and financial literacy respectively. Accordingly, 327 SME owners were chosen from a target population of 2185 SMEs using a simple random sampling technique. A quantitative research approach has been employed, and data were collected through a structured questionnaire. The research utilized structural equation modeling using Smart PLS software to examine the relationship between variables. The findings showed a positive relationship between SMEs' performance and their knowledge of microfinance services. The study also indicated that the success of SMEs is significantly impacted by financial accessibility and literacy. Financial accessibility which is performing as a mediator is statistically significance while financial literacy is not statistically significant as the moderator. As the conclusion of this study finds that increasing of financial accessibility will improve the performance of SMEs and there is no impact on the performance of SMEs when changing the level of Financial Literacy. The findings of the study highlighted the importance of awareness in driving the success of SMEs in Sri Lanka, Thus, policymakers should develop effective strategies for raising SME owners' knowledge of microfinance services, financial literacy, and financial accessibility in order to improve SMEs' access to microfinance services.

Keywords: Awareness of microfinance; Finance accessibility; Finance literacy; Performance of SMEs

Paper ID: IRCUWU2023-375

Impact of working capital management practices on financial performance with special reference to food, beverage, and tobacco industry in Colombo Stock Exchange

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The main objective of this study was to measure the impact of Working Capital Management Practices on Financial Performance with special reference to the Food, Beverage, and Tobacco industry in CSE. Working Capital Management Practices mainly focus on receivables, cash, and inventory in this study. This context of research performance of the Food, Beverage, and Tobacco industry comprised 47 firms in CSE. The population of the study comprised the whole listed 247 companies in CSE and companies in Food, Beverage, and Tobacco industry. Data was collected through Annual reports from 2017-2022 for this study. E-views 12 software was used for the analysis of the study. The main analysis is descriptive statistics, correlation analysis, and regression analysis in this study. There should be strict efficiency in the management of accounts receivables collection in the Food, Beverage, and Tobacco industry. However, reducing the accounts receivables collection period would result to increase profitability, and management of the companies doing this with a reduction of debtors' days would have negative effects on sales. Furthermore, the study recommends that companies should carefully analyze the cash conversion cycle. That it has connected with inventory, and it is the out-of-the-inventory turnover, payable days, and debtors' collection days. During the five years, financial performance has recorded low-level positive values in Food, Beverage, and Tobacco industry. This study describes that the p-value of dependent variables is more than 0.05. It means there is a strong positive value. These findings imply that the Debt collection period has a negative impact on financial performance in Food, Beverage, and Tobacco industry. Finally, management should apply advanced techniques to manage inventory in their companies to ensure that the resources have been allocated for inventory according to the cost and the value of the inventory.

Keywords: Cash conversion cycle; Debt management practices; Gross profit; Inventory management practices; Return on assets

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The impact of macro-economic variables on stock market performance in Sri Lanka

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The stock market contributes significantly to a nation's economy because it is imperative to consider any factor that can have a negative impact on its performance. Sri Lanka's economic revival in 2010 and beyond was crucial following a 30-year civil conflict. Since the COVID-19 outbreak is causing low economic development not just in Sri Lanka but also globally, 2019 will be a key year for Sri Lanka. Several empirical studies have examined the impact of macroeconomic conditions on stock market performance in other countries, despite the fact that. There are fewer academics who study this topic in Sri Lanka, and as far as I know, no recent research has been conducted, especially in light of the Covid-19 scenario. This study, in my opinion, was an effort to close this gap. This study evaluated the effects of specific macroeconomic factors, such as the Gross Domestic Product (GDP), Interest Rate (IR), Inflation (INF), Money Supply (M2B), and Exchange Rate (ER), on Sri Lanka's stock market performance from 1996 to 2020. The performance of the stock market was evaluated using the All-Share Price Index (ASPI). The study made use of secondary data from a Sri Lankan Central Bank report, and SPSS Version 20 was utilized to analyze the data using descriptive statistics, correlation and regression analysis, and multicollinearity. Exchange rate and inflation considerably affect the All-Share Price Index, according to regression coefficients. According to the findings of that correlation analysis, interest rates and the All-Share Price Index have a negligible negative association, but ER and ASPI have a large positive connection. In a nutshell, Sri Lankan policymakers who are interested in developing an energetic and attractive capital market that may boost foreign investment in the nation might take the study's findings into consideration when making judgments. Maintaining a low-interest rate and allowing the country's currency to devalue are both necessary to raise share prices. Furthermore, strategies should be concentrated on achieving future higher GDP growth while fostering peace in the nation.

Keywords: All share price index; Exchange rate; Interest rate; Gross domestic product; Inflation

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Determinants of technical efficiency of dairy farmers in Kurunegala district of Sri Lanka

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Dairy farming is one of the industries that greatly impacts income and food security in rural communities in Sri Lanka. Nevertheless, 60% of dairy consumption still depends on imports worth 282 million USD regardless of the debt-ridden economy. This study analyzes the socioeconomic conditions, technical efficiency employing the Stochastic Frontier Analysis, and the cost of production of small-scale dairy farmers in the Kurunegala district which is a highly potential area to thrive the industry. The data analysis was done through STATA 15 version. In this agriculture-dominant area, more than 90% of the population resides in rural areas. The study employed 100 small-scale dairy farmers from different veterinary zones selected by a multi-stage sampling technique. Results showed that the mean milk output of a farmer in the area is 12.25 liters per day which is higher than the average of 4.6 liters per day per cow. In addition, most farmers in the area are middle-aged and relatively less educated. Results of the stochastic frontier revealed that the average efficiency of the farmers is 68% which indicates that the production of these dairy farmers can be increased by 32% without any additional inputs. The feed intake and number of cows are identified as the variables that have the greatest impact on milk production. In addition, the grazing time, education level, and experience of the farmer affect the inefficiency of milk production. The average cost per liter of milk in the district is Rs. 88. The Benefit-Cost ratio of the dairy farmers is 1.604 implying a unit increase in cost generates 1.604 units of benefit. In conclusion, it can be recommended to provide common grazing lands for the farmers to improve the efficiency of milk production. This study suggests providing location and breed-specific training to the farmers rather than common training programs to enhance milk production among small-scale dairy farmers in the Kurunegala district.

Keywords: Benefit-cost ratio; Cost of production; Dairy production; Stochastic frontier analysis; Technical efficiency

Computing & Informatics

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Enhancing property tax assessment in Sri Lanka through Geographic Information Systems: A comprehensive analysis of the role and benefits

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Sri Lanka aims to introduce a property tax system in 2025 to enhance revenue generation and promote economic stability. The lack of a property tax system in the country creates a need for preparatory work, and the implementation of Geographic Information Systems (GIS) can play a crucial role in this process. Therefore, this research focused on the role of GIS in enhancing property tax assessment in Sri Lanka through the design of a comprehensive GIS-based Property Tax Assessment System. The objective was to support the efficient implementation of property taxation by investigating data requirements, manipulation techniques, analysis, and tax valuation methods using GIS. Accurate property mapping was emphasized, and three approaches to property mapping and tax valuation were explored; area-based, character-based, and value-based. The chosen methodology involved accurate property mapping through manual digitizing or automated vectorization using high-resolution satellite and drone imagery. Spatial data was then integrated with non-spatial data, incorporating property characteristics necessary for the property tax assessment. Area-based mapping allows for property tax evaluation based on land and built-up areas using threshold values for their sizes. Character-based mapping provides a nuanced categorization of properties as residential or commercial, with further sub-categorization based on economic activities and income. Value-based mapping focuses on assessing property worth using factors like market value and location. The implementation of such a GIS-based Property Tax Assessment System in Sri Lanka can optimize the assessment and collection of property taxes, benefiting both the government and property owners. It has the potential to enhance revenue generation, promote efficient land use, reduce wealth inequality through progressive taxation, and provide a stable source of revenue for addressing budget deficits and fostering long-term economic stability. This research highlights the instrumental role of GIS in enhancing property tax assessment in Sri Lanka and the proposed GIS-based Property Tax Assessment System offers significant benefits and efficiencies for property taxation implementation. However, this study primarily focuses on the technical and methodological aspects of GIS implementation, potentially overlooking broader socioeconomic and political factors that are needed for optimising the effectiveness of the system.

Keywords: Property tax assessment; Geographic Information Systems (GIS); Property mapping; Property tax valuation

Paper ID: IRCUWU2023-61

Identification and classification of yellowfin tuna *Thunnus albacares* (Bonnaterre, 1788) filets using CNN

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In tuna processing industries the species filets are classified as the market value is changed according to the grades of the filets. Classification of tuna species filets based on texture color is a challenging task. Hence, the objective of this research was to develop a machine learning model to categorize--A+, B, B-, and C--yellow tuna fish filets according to their texture color. It is important to note that the nutritional values, vitamin content, and fat composition can vary according to the grades of yellowfin tuna fish. Therefore, this model supports identifying the grade and hence, the consumers receive the right product. Further, this model helps someone with minimal knowledge of fish to identify the class of a Yellowfin tuna fish. The "mobilenet.preprocess" function in KERAS framework was used to preprocess the images. The image size was downscaled to 224X224, and the batch size was set to 10. The classification model was constructed using the sequential API in KERAS and was trained using the "ImageDataGenerator" function in KERAS framework. The model contains the convolutional and pooling layers. The learning rate is 0.001 and is defined using the Adam optimizer. The loss was calculated using the "categorical crossentropy" function. The model was trained several times by changing the parameters and obtained the highest accuracy of 92.5%. As this type of classification was not done in the literature it was not possible to compare the prediction quality of the model. However, the classification accuracy of 92.5% can be considered a decent value and hence, this model can be applied at the industry level.

Keywords: Convolutional neural network; Machine learning models; Yellowfin tuna species; Framework; API classifications

Paper ID: IRCUWU2023-76

CNN-based mobile application to detect and identify plant diseases using real-time plant images

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Plant diseases are a major concern, leading to a decrease in the quality and amount of agricultural productivity. Therefore, detecting and controlling plant diseases are important to address properly. Identifying and treating plants in the early stage of infection can improve crop yield. Technology facilitates in various ways, bringing advancements to the field of agriculture. This study proposed an Android application with a mathematical model of plant disease detection and recognition based on deep learning, which improves accuracy, generality, and training efficiency. The accuracy of different algorithms was studied and CNN is considered state-of-the-art in image recognition and offers the ability to provide a prompt and definite diagnosis. This study explored the performance of pre-trained ResNet34 which is a deep-learning model for detecting diseased leaves. Initially, leaves in a dense environment were recognized and localized using the Region Proposal Network (RPN). Then, images were segmented based on the results of the RPN algorithm containing the feature of symptoms through the Chan–Vese (CV) algorithm. Finally, the segmented leaf images were passed through transfer learning and trained using a dataset with diseased leaves. The Plant Disease Classification Merged Dataset, which is available on Kaggle, consists of 70000 leaf images captured in a controlled environment and was used to train and validate the model. The experiment concluded that this trained CNN model can identify the diseased leaves with an accuracy of 99.22% while other algorithms provide accuracy of 75.63%, 91.12%, 89.55%, 82.13, 90.76% and 92.57% for Decision Tree, K-Nearest Neighbors, Logistic Regression, Naive Bayes, Recurrent Neural Networks and Support Vector Machine respectively. This research contributes to the field of computer vision and provides a foundation for future studies in image classification using deep learning techniques. The finding of this study can be used to identify plant diseases by uploading a leaf image to the system and getting immediate action.

Keywords: Image segmentation; Plant leaf disease detection; Deep learning; Convolutional neural networks

Paper ID: IRCUWU2023-77

Sentiment analysis on review data of taxi-hailing app in Sri Lanka using VADER and TEXTBLOB

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Due to rapid digitization in Sri Lanka and the busy work schedules of its residents, taxi-hailing and delivery services have become popular transportation options facilitated by mobile apps. While these apps offer numerous benefits, especially for individuals in high-traffic city areas, there are still several issues with the services provided by the companies through their mobile apps. These issues primarily revolve around navigation systems, food delivery, and customer support. One major concern frequently highlighted by users is the inaccurate navigation system, which often leads to drivers taking longer routes or getting lost. To address these challenges and improve the overall user experience, it is essential to focus on enhancing the features of the apps. The main objective of this study was to address feedback issues that contribute to user confusion during the ordering and booking process across Sri Lanka. The aim was to enhance the app features and provide users with a more convenient experience. Play Store has emerged as a prominent platform for users to provide unique feedback and reviews for each app. Therefore, we collected Play Store review data specifically for taxi-hailing apps in Sri Lanka. These data were utilized to fill the research gap in classifying app review sentiment into positive, negative, and neutral categories. We compared the accuracy of sentiment analysis models, specifically VADER and TextBlob, and explored their performance. While previous research often focused on movie reviews or employed existing datasets for analysis, our approach considered the uniqueness of the data and utilized VADER and TextBlob models for sentiment analysis. Using the collected data, we conducted individual evaluations to determine the accuracy of each sentiment analysis model. Additionally, we developed a hybrid model that combines the strengths of both models to enhance overall accuracy. The results revealed that VADER achieved the highest accuracy of 73.90% among the two and Hybrid modal with 74.70%. The findings improve specific taxi-hailing apps in Sri Lanka by enhancing navigation, food delivery, and customer support, providing valuable insights for optimizing mobile app features based on user sentiment.

Keywords: Sentiment analysis; VADER; TextBlob; Natural language processing

Paper ID: IRCUWU2023-102

Word2Vec embeddings with neural models for short text classification

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The issues of improving the classification accuracy of short text have gained considerable coverage due to the explosive growth of social media sites such as Facebook, Twitter and WhatsApp, it became very vital for most businesses to improve the accuracy of classification of short text. Feature representation with distributed models such as word2Vec as well as usage of Neural architectures such as CNN [Convolutional Neural Network], LSTM [Long Short Term Memory Network], RNN [Recurrent neural networks] is a common practice with the latest research work to improve the text dataset performances. But we couldn't identify an empirical analysis for the usage of Word2Vec to determine which neural network combination works better over the other. Therefore, our aim of this research was to investigate the usage of Word2Vec Embeddings and different versions of supervised neural networks towards short text classification. We compared the usage of words with embeddings with neural network models, including variations of neural networks such as CNN, LSTM, RNN. A famous Movie review dataset was selected for this experiment. After the cleaning process was completed, document reduction was completed. Then hold out stratified training and testing set was taken with a 70% to 30% split. 70% of the training data was split as 80% of training and 20% of the validation set. The 20% validation dataset was used for neural model validation. The F Measure was used to evaluate the model accuracy. Firstly, we identified the best usage of a number of words, which is 3000 to build a neural model. Secondly, we investigated the impact of different neural models with word2vec embeddings. In comparison to all models, RNN outperformed other models. Thirdly, when we build variation models with basic neural models, we observed that CNN combined with LSTM gave the highest classification accuracy which is 83.6 over other techniques. Our work can support future researchers in selecting baseline performances when using embeddings and neural networks on short text.

Keywords: Word2Vec; CNN; LSTM; RNN

Paper ID: IRCUWU2023-126

An integrated model to identifying the learning style of the students: A machine learning approach of Felder Silverman learning style model

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Identifying the student's learning style helps to improve the teaching and learning process, as one size fits all methods do not always work in education. Through identification of the learning style of learners, teachers are capable of delivering course content focusing on the requirement and preferences of the learners. The research intended to propose an improved methodology for identifying the learning style in an online learning environment using Moodle as a platform and applying machine learning techniques based on Felder Silverman Learning Style Model (FSLSM). The significance of the study is that existing research in the field uses Moodle logs to track the student's behaviour in the learning environment. But this is not always optimal as students may click and access the course contents randomly without considering their preferences. So, the chosen methodology suggests considering the Moodle log details by getting the records of the frequency of accessing the course modules and combining it with the time spent by students in each course activity. At the end of the course modules, these records were tracked and applied machine learning classification algorithms such as Logistic Regression, Decision Tree, Support Vector Machine, Random Forest, and K-Nearest Neighbors to train the data for every four dimensions of the FSLSM. In the experiment, it has been developed a reusable time-tracking plugin for the Moodle environment to track the total time students spend on each activity. In dataset preparation, features for labelling the data were decided as per the FSLSM and validated. The results show that the Decision Tree classifier performed well, with an average accuracy of 90%. For the evaluation of the model, K-fold cross-validation was used an average accuracy of 84% with a Standard deviation of 10 was presented. MSE, Bias, and variance metrics afford lower values by showing the balance of the model. Hyperparameter tuning was done by applying the Grid search methodology.

Keywords: Machine learning; FSLSM; Learning style; Decision tree

Paper ID: IRCUWU2023-130

A deep learning approach: Sentiment analysis on users' reviews on Google Play Store apps

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With the advancement of new technology, people are more inclined to move forward with new trends. As a result, device usability rapidly increases and new apps are also increasingly being introduced. The Google app market is the most trending app market and a good understanding of apps can be achieved through better classification of users' reviews. App evaluation is more helpful for both existing and new users to gain insights before downloading or purchasing the appropriate apps. Also, app creators and app developers can be able to gain positive advantages through user reviews. Since the potential information of reviews is growing exponentially, it cannot be manually extracted. Therefore, the main objective of this study was to identify users' experiences, thoughts, feelings, and behaviors toward appropriate Google Play Store Apps and then classify reviews into Positive, Neutral and Negative sentiments based on their nature. NLP-based machine learning techniques were used in sentiment analysis to explicitly discover and evaluate emotions. This study aimed to perform the sentiment analysis on the Google Play Store reviews based on the latest 15 apps. We gathered 33,000 daily updated user reviews using secondary sources. First, we pre-processed the data and then the feature extraction was done using Term Frequency-Inverse Document Frequency Vectorizer. Thereafter we used machine learning algorithms to sentiment analysis of the review data. Therefore, we applied three algorithms used for the comparison of the results those are the Artificial Neutral Network (ANN), Long Short-Term Memory (LSTM) and Support Vector Machine (SVM). Users' reviews were mainly classified into neutral, positive, and negative using three Sentiment categories. The overall results demonstrated that LSTM beat both ANN and SVM. It also achieved higher accuracy, recall, f-measure values, and lowest error rates for 75% of the training dataset. The results show that LSTM offers the best sentiment analysis results for monitoring user app evaluations. New users and app developers can get an idea and make decisions about the apps based on review classifications. If the majority of reviews are more positive in a particular app, it implies that such an app is good for use.

Keywords: Sentiment analysis; Machine learning; Deep learning; Users' reviews; Google Play Store app

Paper ID: IRCUWU2023-206

Customer buying product quantity prediction and forecasting company future income

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This research presents a comprehensive methodology to predict customer product quantities and forecast income for a Sri Lankan canned fish company. Addressing vital sales volume prediction for planning and risk management, researchers leverage machine learning, including Random Forest and ARIMA, to build a robust model. The methodology encompassed several key stages. Initially, researchers gathered and analyzed extensive sales data to uncover patterns in customer purchasing behavior. Subsequently, employing the Random Forest algorithm, researchers trained a model that captures intricate relationships between customer demographics, product attributes, seasonal factors and historical purchase quantities. This model enables accurate prediction of customer buying quantities in the future. The approach includes an ARIMA (Autoregressive Integrated Moving Average) forecasting model to predict the company's future income. By leveraging historical sales data and conducting time series analysis, this model identifies patterns, trends, and seasonality in the company's financial performance. Through consideration of past income trends, the ARIMA model provides reliable forecasts for future financial outcomes. In terms of methodology, researchers collected and modified data from PRF Seafood, a Sri Lankan canned fish company, spanning two years (2021-2023). The research approach involved quarterly sales pattern analysis, considering factors such as cultural and commercial occasions. The dataset included Date, Customer ID, Customer Name, Product Category, Product, Price, Seasonality, and Quantity. To enhance predictive power, feature engineering had to be performed. Researchers developed a user-friendly Django web application to provide real-time insights and visualizations of predicted customer buying quantities and company income. Research facilitates easy access and utilization of predictive models and forecasts by various stakeholders. The research introduced an innovative methodology for predicting customer buying quantities and forecasting future income in the Sri Lankan canned fish industry. By combining machine learning, forecasting techniques, and historical data, researchers enhanced sales prediction accuracy, demonstrating the transformative potential of data analytics and machine learning in optimizing financial performance.

Keywords: Customer buying quantity prediction; Future income forecasting; Machine learning; Random Forest; ARIMA

Paper ID: IRCUWU2023-209

Real-time electroencephalography signal classification using GPGPU

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Electroencephalography (EEG) is a widely used technique to evaluate brain activities reflected through the electrical impulses found on the scalp. Classifying EEG data is challenging since it is a significantly complex and computationally expensive task. The objective of the research as discussed in this paper was to classify EEG data using General-Purpose Graphics Processing Unit (GPGPU) with high accuracy and low cost. In Brain-Computer Interfacing (BCI), the EEG signal is the main approach for accomplishing human-computer communication. A key element of the BCI system is the processing of the acquired EEG data to determine the types of directives the brain is processing. However, an EEG signal is more unique than an ordinary signal. Electrical signals from the brain nerves are represented by EEG signals in the BCI system. EEG data was received according to the time domain and for ease of analysis, it was transformed to the frequency domain by applying a proprietary algorithm. Investigating the applicability of GPGPU for real-time EEG data classification was achieved by determining the most efficient algorithm for transforming real-time EEG signals from the time domain to the frequency domain and determining the best machine learning algorithm which supports the intention and detection/ pattern recognition. This research paper proposed the development of ensemble models by combining existing algorithms for signal preprocessing and classification to improve the accuracy of EEG data analysis. To expedite the process, parallel programming with the Nvidia Compute Unified Device Architecture (CUDA) computing platform was utilized to harness the power of the GPGPU. The outcome of this study was to prove the extent of appropriate usage of GPGPU for the EEG signal classification and finally a few general investigated EEG signals were classified.

Keywords: Electroencephalography (EEG); Signal classification; GPGPU; Nvidia CUDA; Parallel computing

Paper ID: IRCUWU2023-213

Individual leopard identification using black spot patterns

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Leopards are the ecosystem's apex predators because they play an important role in the ecosystem. Individual identification of leopards is crucial in effective conservation and management strategies for their protection. Traditional methods, such as radio-collaring and physical marking, are often labor-intensive, time-consuming, and invasive. This research aimed to develop a software system for individual leopard identification using their black spot patterns. The research group utilized a dataset comprising high-resolution photographs of leopards captured in various locations. The pictures were carefully selected to include diverse individuals with unique spot patterns. Image processing algorithms such as ORB and SIFT were employed to extract and analyze the black spot patterns on the leopard's coat with the combination of the Yolo Algorithm in CNN, which was used to segment and separate Leopards from input images. The developed software system provides a user interface for uploading leopard images and conducting identification analyses. Users can submit photographs of leopards encountered in the field, and the system will compare the black spot patterns with the existing database to determine the individual's identity. The system accurately matches the submitted image with the corresponding leopard in the database. With the hyperparameters such as image preprocessing, feature extraction, and machine learning model configuration, the current research results indicate a high accuracy rate of about 80% in correctly identifying individual leopards based on their black spot patterns. This accuracy amount can be increased further by using more spots in the leopard's coat for feature mapping. The software system enables wildlife researchers and conservationists to track and monitor leopards without requiring invasive procedures. Overall, this research provides a novel approach to using an automated system to replace manual methods for individual leopard identification using black spot patterns. The developed software system offers an efficient, non-invasive, automated solution for wildlife management and conservation efforts. By facilitating the monitoring and tracking of leopards, this technology can better understand their behavior, range, and population dynamics, ultimately aiding in developing targeted conservation strategies.

Keywords: Blackspot patterns; Deep learning; Image processing; Leopard identification

Paper ID: IRCUWU2023-229

A deep learning-based approach on categorization of tea buds

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Tea is an integral part of the everyday routine for most people in Sri Lanka. Drinking tea can help maintain heart health, promote weight loss, improve metabolic profiles and prevent diabetes. The Sri Lankan economy heavily relies on the tea industry. The growth and decline of the Sri Lankan tea industry is directly affected by Sri Lankan national GDP. The use of technology in the Sri Lankan tea industry is at a very low level. So the time and labor spent on tea production increase. Traditionally the degree of maturity of tea leaves is determined and the number of leaves in the tea bud is counted by looking at or touching the tea leaves. This paper focuses on improving the quality of tea by Tea Bud classification application using an object detection technique. We created a tea bud image dataset, to classify tea buds using a deep-learning approach and performed tea bud classification using a web application. The data set consists of 2500 images of single buds and 200 images of multiple tea buds and used augmentation techniques to enhance the dataset. In the first model, it performs tea bud identification and returns each tea bud image to the second model and performed the classification of tea bud as two-bud, three-bud, four-bud, five-bud, or six-bud tea leaves. The images were passed to the third model to detect the number of tender tea leaves in the sample. Customized TensorFlow object detection API (first model) with transfer learning models to classify the tea buds. It showed an accuracy of about 0.8439 for the object detection model, 0.7851 for the classification model (second model) and 0.8760 accuracy for the maturity model (third model). Our model pipeline integrated with web application using Python Flask was developed and connected to a PostgreSQL database to perform and keep track of tea plucker's performance. Our findings indicate the need to track tea bud quality before tea production, not after production. This provides new insights to improve the productivity of tea. Our research has important implications for the tea industry and contributes to tracking and improving the quality of Sri Lankan tea.

Keywords: Deep learning; Object detection; Tea buds' quality; Convolutional Neural Network (CNN); Transfer learning;

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Deep learning-based hybrid approach for priority prediction of bug reports using different feature vector generations

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When handling bugs, it takes a lot of time and effort to manually give a priority value to each bug report. Therefore, the likelihood that a developer may assign the incorrect priority value and this could negatively impact various crucial software development processes. The main objective of this research was to incorporate three feature extraction approaches to create a model for automatically predicting the priority of bugs using the Long Short-Term Memory (LSTM) deep learning algorithm and Artificial Neural Network (ANN) algorithm as a solution to address the mentioned problem. Under methodology about 20,500 bug reports were extracted using the Bugzilla issue tracking system. Following data collection, the preprocessing of the data was done using various preprocessing techniques including tokenization, stemming, stop words, and lowercasing. Using three distinct feature vectors including Term Frequency-Inverse Document Frequency (TF- IDF), Global Vectors for Word Representation (GloVe), and Word2Vec three models were created separately using the LSTM and ANN classifier after preprocessing. Then three findings from the three LSTM models, which had been combined into a hybrid model by considering the majority value, were then compared with the individual algorithms to determine the final classification results. Hybrid LSTM model results were compared with individual LSTM model and ANN model results separately. Accuracy, recall, precision, f-measure, and error rates were computed to assess the models' results. The hybrid model generated the most accurate findings compared to the other models when those models were tested. The accuracy of the ANN model was 80.28%, LSTM with Glove model was 89.58%, that of the LSTM with TF-IDF model was 88.94%, that of the LSTM with Word2Vec model was 84.84%, and that of the Hybrid model was 92% during the testing process. Additionally, the hybrid model had improved recall, precision, f-measure findings, and decreased error rates. These research findings may assist programmers, software developers, and project managers in fixing bugs in various software systems more quickly than before. In the upcoming studies, it is planned to collect data from sources including JIRA and GitHub repository. Also, try using other deep algorithms as well to increase accuracy.

Keywords: Deep learning; Bug reports; Priority prediction; Feature vectors; Hybrid approach

Paper ID: IRCUWU2023-330

Crop plant disease detection using deep learning

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Ensuring food security for billions of people worldwide requires effective measures to minimize crop damage caused by diseases. The development of strategies for early detection of plant illnesses offers a twofold advantage: increasing crop yield and reducing reliance on pesticides, irrespective of the specific disease causing the issue. The study aimed to help farmers identify and diagnose diseases affecting grapes (Black rot, Esca (Measles), Leaf blight), strawberries (Leaf scorch, Leaf spot), blueberries (Septoria spot), and cherries (Powdery mildew). It used image-based prediction techniques to develop three models for predicting diseases in different plant species, minimizing damage and providing effective measures to mitigate the impact of these diseases on crops. The dataset consisted of 1700 images collected from Kaggle and real-life field visits. Image processing techniques such as Grey scaling, RGB channel checking, image resizing, min-max normalization, and image augmentation were employed using Convolutional Neural Networks (CNN). The retrained MobileNet model is ideal for grape leaves, being efficient for smaller-sized images. The retrained ResNet50 model suits blueberry and cherry leaves, handling larger images and complex features. Lastly, a novel Keras model focuses on strawberry leaves, tailored to their distinct attributes, resulting in accurate disease predictions. These three models were seamlessly integrated into a professional-grade mobile application that accurately analyzes captured images. The Grapes model, with a batch size of 10 and a learning rate of 0.001, achieved an impressive accuracy of 96.66% after 10 epochs. The Blueberry model, trained with a batch size of 64 and a learning rate of 0.01, achieved an outstanding accuracy of 99.99% after 100 epochs. Similarly, the Strawberry model, with a batch size of 10 and a learning rate of 0.001, also achieved an outstanding accuracy of 99.99% after 10 epochs. The study proves the effectiveness of the proposed method in predicting plant diseases, leading to a mobile app that shows disease details and remedies upon detecting issues. This research using deep learning offers hope for food security, higher yields, and proactive disease control, empowering farmers and encouraging sustainable agriculture by minimizing losses.

Keywords: Crop diseases; Deep convolutional neural networks; MobileNet; ResNet50; Keras framework

Paper ID: IRCUWU2023-335

Cost-effective ECG machine synchronized to mobile phone for data display and analysis

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Medical professionals frequently use the Electrocardiogram (ECG) to detect abnormalities of heart events reflected through the electric activity measured on the skin. This research presents an implementation of a cost-effective, portable, real-time Electro Cardiogram monitoring system based on Internet of Things (IoT) technology and analyzing heart malfunctions using deep learning models. Initially, this research was initiated with the development of the ECG machine. Here, the AD8232 sensor was used to quantify the heart pulse. ESP 32 microcontroller was utilized to process the transmitting and receiving data. Then a mobile application was implemented to monitor the ECG diagram. The IoT device ESP32 has an inbuilt Wi-Fi connector module, which involves transforming the ECG readings to the mobile application. In addition, this research aimed to analyze ECG data and predict heart malfunctions (early detection of heat failures) using deep learning algorithms. To fit a model, the secondary data were extracted from the Physio-Net online repository, more specifically from the MIT-BIH Arrhythmia Database. The next steps were the acquisition of primary data and preprocessing to minimize artefacts that could mislead the neural networks. The next step was the feature extraction process which learns from the dataset, provided and attempts to predict the input ECG diagram using the feature vector acquired from feature extraction. In this work, 1D convolutional neural network (CNN), and Long Short-Term Memory (LSTM) were trained in an ensemble method and a Transformer algorithm was employed to train them. Heart malfunctions were studied under 5 different categories; Normal (N), Left bundle branch block beat (LBBB), Premature ventricular contraction (PVC), Right bundle branch block beat (RBBB), and Atrial premature beat (APB).

Keywords*:* Arrythmia; IoT; ECG; Deep learning; Ensemble

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Recognition of the Sri Lankan trademarks using deep learning

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The misuse of trademarks has brought many challenges for companies and led to the loss of customer trust. Trademark similarity detection is crucial when registering a new trademark to avoid conflicts. Considering a trademark's combined factors like colours, shapes and characters is important for similarity detection. Previous studies have mainly focused on either colour or shape, neglecting the importance of all three features together. This research aimed to comprehensively examine trademarks, focusing on an identification method combining the three factors; colours, shapes and characters. A dataset was obtained from Kaggle, which consists of 10 trademark folders each containing 100 images taken from different angles. Using the above data three models were trained for detecting shapes, characters, and colours. For detecting shape similarities of a new trademark with the existing ones, the TensorFlow object detection model was used. And also, to improve the speed, efficiency and accuracy of the model SSD mobile net has been used. For character detection, to identify a character section of a trademark, Open CV image segmentation techniques have been used. Image augmentation techniques were used to increase the dataset and get different image angles. Then we considered non-block letters as templates and for detecting similarities between those templates, the TensorFlow Keras CNN model was used. To read block letters Pytesseract OCR library was used. For colour detection, a clustering algorithm was used to extract the RGB colour values of the image and segmented the image into a specified number of colour clusters. The k-means CNN model was trained to compare the median of the obtained colours. In the proposed approach, the system allows users to enter a new trademark for analysis and detects its similarities with the existing trademarks. A weight matrix has been used to prioritize the order in which the human eye perceives those three features of an image; shape similarity has a weight of 50%, while colour and character similarities carry 25% each.

Keywords: Trademark similarities identification; Convolutional Neural Network (CNN); TensorFlow; Keras; k-means CNN model;

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Supervised learning techniques for predicting the personality of employees in Sri Lanka after the Covid-19 pandemic

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Since personality affects a person's entire existence, it is a hugely interesting topic in modern culture. Due to changes in the way of living style by the Covid-19 pandemic, several countries experienced a variety of problems and occurred considerable behavioral changes throughout the world. Those situations also directly affected Sri Lankan employees since they move to online working. It has become important to find the personality changes of employees after the Covid-19 pandemic to manage the organizations and cover up the losses in the country. The objective of this study was to use supervised machine learning algorithms to predict the personality of Sri Lankan employees after the Covid-19 pandemic. We found limited experiments related to this topic and to achieve the objective of this research, 500 primary data were collected from employees in Sri Lanka through a Google form. Health issues, sleeping and working patterns, relationships and etc. were considered in data collection. Then data were preprocessed by data cleaning, reduction, and ranking. The study utilized three categorical variables: Positive, Negative, and No Change. Positive indicates a positive shift, Negative signifies a negative shift, and No Change indicates no alterations in the individual's personality. The data was classified using supervised machine learning algorithms such as Naive Bayes, Support Vector Machine (SVM), Decision Tree, Random Forest, and Multilayer Perceptron. In this study, accuracy, precision, recall, f-measure, true positive, and true negative rates were used to evaluate the prediction results. Percentage split and k-fold cross-validation test options were utilized here. SVM gives the best results, with the highest accuracy at 63.37% and the highest in precision, recall f-measure also. Further, the SVM performs with a low error rate in Mean absolute error and Root mean squared error. The findings of this study will enable organizations to recognize the various personalities of their employees and assign the appropriate duties. And also, employees can make necessary changes to their personalities in an effective manner for the betterment of the future. In future work in this study, we are planning to increase the accuracy of the model by using different algorithms including ensemble learning.

Keywords: Individual behavior; Machine learning; Prediction; Personality

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Sentiment analysis and ratings prediction of Google Play Store applications: Leveraging machine learning for enhanced user insights

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The Google Play Store is a vast platform housing a diverse array of applications. With numerous apps being added daily and a large user base, user reviews and app ratings have become critical factors in app success. Users heavily rely on reviews and ratings to make informed decisions about which applications to install. Consequently, application developers must identify their target user groups and understand the factors that influence user responses. This research paper aimed to conduct exploratory data analysis on real-world Google Play Store application data to identify the key factors influencing user sentiment. By analysing this data, we were able to gain insights into user behaviours across various applications. Additionally, the study focused on the prediction of app ratings using various machine learning models. The goal was to develop a reliable model that can accurately predict an app's rating based on specific input fields. First, the study explores the real-world data from the Google Play Store, examining factors such as app category, user reviews, and ratings. Through exploratory data analysis techniques, patterns and correlations were identified to understand the impact of these factors on user sentiment. Next, machine learning models were employed to predict app ratings based on the gathered data. Various models, such as decision trees, random forests, and support vector machines, were trained and evaluated to identify the best-performing model. The selected model with XGB classifier and Logistic Regression was then used to develop a user interface that accepts relevant input fields and generates a prediction of the app's rating. By analysing real-world data, developers can gain insights into the factors that influence user satisfaction and ratings. The prediction model enhances decision-making processes for developers, allowing them to make informed choices regarding app development and deployment. In conclusion, this research offers a comprehensive exploration of sentiment analysis and rating prediction for Google Play Store applications. Through the analysis of real-world data and the development of accurate prediction models, this study provides valuable insights for developers aiming to enhance user satisfaction and improve app success rates. Ultimately, the findings aid in maximizing user engagement and improving the overall user experience within the Google Play Store ecosystem.

Keywords: Machine learning; Neural networks; Prediction model; Data analytics; Sentiment analysis

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Legal cases summarization using abstractive and extractive methods

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The field of law plays a crucial role in society, but the complexity of legal documents and vocabulary often makes them difficult to comprehend for individuals outside the legal domain. This study was conducted to develop a hybrid summarization approach for legal documents to increase their readability and understandability for non-law-related individuals. Existing research in legal document summarization has mainly focused on extractive methods which focused on law professionals while providing them with key information about the law cases without focusing on generating human-friendly summaries. In this study, we proposed a hybrid summarization model using extractive and abstractive models. By utilizing the extractive summarization model, significant sentences were extracted from lengthy legal documents. These extracted sentences were then paraphrased and simplified using a pre-trained abstractive model to generate a concise and easily comprehensible summary paragraph that can be readable and understandable by the common public. These generated summaries were tested using ROUGE score matrices and achieved a 0.08 of the rouge-1 score. This solution includes checking the feasibility of focusing on selected significant parts of the legal document to reduce the load on the summarization models and improve the quality of the generated summary by getting the information from the domain professionals. According to that, focusing only on the latter part achieved a 0.09 rouge-1 score and better model performance.

Keywords: Abstractive; Extractive; Hybrid; Automatic text summarization; Legal cases summarization

Paper ID: IRCUWU2023-355

Identification of gemstone based on absorption band spectrum image and refractive index using machine learning

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Gemstone identification is a crucial task in the gemstone industry, requiring skilled experts and specialized equipment. In this approach, a simple and efficient computer vision method was introduced for the automatic classification of gemstones based on their images. This method leverages the power of machine learning models trained on a dataset comprising high-quality gemstone images, along with labeled absorption band spectrum images and refractive index values. This approach encompasses preprocessing gemstone images to enhance their distinctive features and eliminate noise, followed by employing image-processing techniques to compute refractive index values. Notably, this research revealed that the Convolutional Neural Network (CNN) model achieved exceptional training accuracy of 95% and validation accuracy of 93%, underscoring its aptitude in accurately discerning gemstones based on their absorption spectra. The results corroborate the efficacy of the proposed approach, exemplifying a notable accuracy rate in gemstone classification. By automating the gemstone identification process, this method offers a more accurate and cost-effective solution for the gemstone industry, potentially revolutionizing gemstone classification and reducing reliance on human expertise and expensive equipment.

Keywords: Gems; Spectroscopy; Refractive index value; Machine learning; CNN

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Mobile application based smart solution for dyslexic children and improve their learnability

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Dyslexia, a learning disorder affecting reading and writing abilities, presents significant challenges for dyslexic children, particularly during their early school years. This research provides an innovative mobile application-based smart solution aimed at assisting dyslexic children in improving their writing skills. The primary objective was to develop a tool that utilizes machine learning algorithms for real-time identification and correction of handwritten words. The research methodology involved collecting a dataset of handwritten word samples from dyslexic students in grades 3 and 4, focusing on the frequency of time taken to correct word writing and the time taken to recognize the word. A specialized mobile application was designed to employ a supervised learning algorithm that analyzes each letter of the input word. The model was trained to consider all possible letter positions, enabling the identification of the correct word. Utilizing the collected dataset, the algorithm accurately identifies errors in handwriting and provides immediate corrections. Additionally, the mobile application generates audio and visual feedback corresponding to the inputted word. This multi-sensory approach enhances the learning experience by audibly pronouncing the word and displaying an associated image, reinforcing the visual representation of the word. The research methodology involved iterative data collection from dyslexic children, and enabling the measurement of their progress over time. Regular usage of the mobile application allowed the research team to assess the intervention's effectiveness in improving the children's writing skills. Preliminary findings indicated promising results, demonstrating notable enhancement in the children's written outputs. The successful implementation of this mobile application-based smart solution has the potential to revolutionize dyslexia intervention strategies. By harnessing the power of machine learning and incorporating audio and visual feedback, this research offers a promising approach to address the challenges faced by dyslexic students, providing them with an accessible and interactive tool to enhance their writing abilities.

Keywords: Dyslexia; Learning disorder; Writing skills; Mobile application; Machine Learning

Paper ID: IRCUWU2023-385

Advancing gemstone identification: A deep learning-based approach for accurate gemstone classification and identification

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Reliable and accurate gemstone identification is essential in industries like gemology, jewelry appraisal, and the gem trade. This paper presents a cutting-edge framework that uses deep learning algorithms to ensure correct gemstone identification, in contrast to conventional systems that rely on visual features. The framework consists of two distinct systems, one based on a convolutional neural network (CNN) for recognizing visual features and the other utilizing a feed-forward neural network for text categorization using physical characteristics. The CNN system was trained using 1,500 high-resolution photographs of 15 distinct types of diamonds. The CNN aimed to learn from this information and capture the distinctive visual characteristics associated with each gem variety to identify each one based on colour and shape correctly. The physical features of gemstones, including their hardness, specific gravity, and refractive index, were another focus of the feed-forward neural network. This network was trained using an extensive dataset that contained 45,000 parameter measurements for the 15 different types of gems. A robust text classification model for gem identification was created by including pertinent traits from these physical properties. These systems underwent extensive training and assessment and used cross-validation techniques and performance indicators to assess accuracy and generalizability. To understand the strengths and weaknesses of each method, the outcomes from each were carefully contrasted and analyzed. The study demonstrated the enormous potential of the suggested solutions for use in gemology labs, the gem commerce sector, and jewelry appraising. The results of this study have broad ramifications and provided better methods for identifying gemstones that will be useful to gemologists, jewelry appraisers, and the larger gem trade community.

Keywords: Gemstone identification; Deep learning; Convolutional neural network; Feed-forward neural network

Paper ID: IRCUWU2023-389

Soil horizon delineation using image processing

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Accurate delineation of soil horizons is essential in soil classification and in assessing soil profile characteristics for land use purposes. Delineation of soil horizons is one of the first steps in studying a soil profile. In this study, we developed an image-based approach to delineating soil horizons in major soil orders in Sri Lanka (O,A,E,B,C,R). The soil profile images were used to extract soil colors and image texture features. First, each soil profile image was cropped to a target area and then applied low-level processing which includes image sharpening to enhance the image texture features. Then elbow method was applied to define the most suitable K value for clustering the image based on the major colors that appear in the image. Thereafter, a horizontal and vertical blur was added to the image to smoothen the imperfections like rocks, roots and rugged surfaces that appear in the image. Then K-means clustering was used to segment the soil profile based on the color with the value obtained by the Elbow method. Thereafter, each layer in the segmented image was labelled with its corresponding letters. The final horizon was displayed and each horizon was identified from the ground (O) with their relevant letters (O,A,E,B,C,R) in each different horizon. Therefore, a graphical horizon delineation of soil profiles with image processing was created. We have also tested the Watershed algorithm, Bounding color with HSV and bitwise masking, Laplacian filter, Thresholding with binary conversion, Canny edge, DB clustering, Convolutional neural network and lastly, K-means to measure the accuracy of delineating soil horizons. The accuracy of those methods is also compared in this study with K-means being the selected method for the delineation process. The outcomes of this study will help agriculturists, researchers, soil scientists, soil ecologists, soil conservationists, hydrologists and sometimes farmers evaluate soil profiles to automate the process of delimitating the soil horizons.

Keywords: K-means; Image processing; Machine Learning; Soil horizon; Soil delineation

Paper ID: IRCUWU2023-390

The impact of AI tools on the critical thinking skills of university students: A case study on information technology undergraduates

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The integration of AI tools in education has gained widespread popularity due to their ability to offer customized learning experiences, automation of tasks and enhancing student's outcomes. However, there are growing concerns about the possible adverse effects of AI tools on critical thinking skills. This study investigated the impact of AI tools on the critical thinking skills of Information Technology (IT) undergraduates of General Sir John Kotelawala Defence University. The study surveyed 50 IT undergraduates using a first-come-first-served sampling technique to explore their use of AI tools, perceptions regarding their impact on critical thinking skills, and recommendations for utilizing AI tools to promote critical thinking among this target population. A Google form survey questionnaire with ten questions was utilized to collect primary data for this study. This was chosen due to its cost-effectiveness and efficiency in gathering data from many participants. The questionnaire explored AI tool usage and its effects on critical thinking and academic performance. It also addressed challenges in test-taking without AI assistance and areas, where AI tools lack in fulfilling critical thinking, needs. Participants were also given space for additional insights. The results indicate that most IT undergraduates use AI tools for academic tasks with varying degrees of reliance. While some reported a significant improvement in their critical thinking skills, others perceived a decrement. Mixed beliefs were observed regarding the potential hindrance of critical thinking skills by heavy reliance on AI tools. Many respondents rated their academic performance as satisfactory with a positive impact of AI tools on their academic performance reported by a significant proportion. Furthermore, over half of the IT undergraduates were challenged to take exams without relying on AI tools. These findings provide insights into the complex relationship between AI tool usage and critical thinking skills among IT undergraduates. The findings of this study highlight the importance of using AI tools in an intentional manner, balancing their benefits with the need to cultivate students' independent critical thinking abilities. Future research should explore strategies to mitigate the potential negative impact of AI tools and promote a more balanced approach to their utilization within educational contexts.

Keywords: Artificial Intelligence (AI); Critical thinking skills; Information Technology (IT); Undergraduates

Engineering & Technology

Paper ID: IRCUWU2023-29

Misaligned expectations in implementing integrated management systems (ISO 9001:2015 and ISO 14001:2015): An exploratory qualitative case study at a manufacturing facility

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The present study aims to qualitatively assess the effect of misaligned expectations (scopes and objectives) in implementing ISO 9001:2015 and ISO 14001:2015 International Standards through integrated management systems (IMSs) at a multidisciplinary manufacturing facility in Sri Lanka, specializing in manufacturing automotive, medical and sports gear products for the global market. An exploratory qualitative case study in an interpretive research paradigm was devised with a participatory research approach by observations and interviewing the top management, departmental managers and subordinate management staff, totalling 20 participants. Active observations were conducted for a period of 10 days covering the departments of merchandising, logistics, production, quality management, human resources, maintenance, information technology, and accounting. The chain of command depicted in the company's approved organizational chart documented evidence of continuing professional development of the staff, competencies of the staff (education and professional experience), designated authorities and responsibilities, and key performance indicators of the business defined by the company pertaining to the IMSs were qualitatively reviewed. A discourse analysis was performed to unveil the shared meanings. Participant bias was eliminated by exempting the personal liability for opening by officially classifying all interviews held as informal meetings, and the researcher's unconscious bias was obviated by self-awareness (reflexivity). Results revealed that perceptions of the participants on the IMSs in terms of beneficial impact to the company were insignificantly varied, despite the distinguishable prevalence of organizational silos and disintegration in achieving corporate sustainability goals (i.e. sustainable production and consumption) of the company. A scientifically irrational combination of subsystems was observed, and related document controlling was manifested to be disorganized and inefficiently communicated interdepartmentally, and the electronic archiving methods adopted were problematic. Duplication of works was evident (e.g. coincidental implementation of Kaizen, 5S, ISO 9001:2015, ISO 14001:2015, and Health & Safety Risk Management by five independent staff members reporting to two hierarchical levels). Misaligned scopes and objectives, organizational silos and technical incapacities in measuring outcomes of ISO compliancy impede a company from achieving its corporate sustainability goals. Integrated thinking and behavioral changes promoting synergies among subsystems are proposed. The development of empirical evidence based actionable frameworks remains as future research.

Keywords: Environmental-Management-Systems; Key-Performance-Indicators; Organizational-Silos; Participatory-Research-Approach; Quality-Management

Paper ID: IRCUWU2023-47

IoT-based patient monitoring system for Sri Lanka

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The Internet of Things (IoT) has profoundly transformed the healthcare industry, introducing continuous remote patient monitoring to improve patient care, treatment outcomes, and cost-effectiveness. This research project presents a comprehensive IoT-based patient monitoring system designed to enable doctors and healthcare professionals to remotely examine their patients anytime and anywhere, eliminating the need for physical presence for routine checkups and saving valuable time for both medical staff and patients. The system's core objectives include the development of a hardware driver to monitor patient health, the creation of a web application for real-time data collection, the establishment of communication channels for relaying patient information to doctors and caretakers, and the implementation of data analysis to provide regular updates on patient conditions. This IoT-driven approach facilitates the organization and accessibility of patient details and reports for all patient care stakeholders. Central to the system's implementation is the NodeMCU, which seamlessly integrates various sensors with the IoT infrastructure. Low-power sensors are utilized to gather patient data, which is then displayed through open-source software, specifically Thingspeak. The collected data is stored securely on personal computers and the cloud, while an Android app enables doctors and healthcare professionals to conveniently access and review patient data in real time. This research project significantly contributes to enhancing patient care and healthcare delivery by enabling informed decision-making based on real-time patient data. The IoT-based patient monitoring system presented here is a scalable and convenient solution for healthcare professionals to continuously monitor and care for bedridden patients, regardless of location. The seamless integration of IoT technologies and medical devices empowers doctors and nurses to utilize mobile devices, facilitating their participation in a global network of healthcare providers. This IoT-based patient monitoring system exemplifies the potential of IoT in revolutionizing healthcare delivery, increasing healthcare efficiency, and offering continuous care to bedridden patients. By providing remote monitoring and access to real-time patient data, the system paves the way for a new era of healthcare, characterized by enhanced patient outcomes and proactive medical interventions.

Keywords: Internet of Things; Health; Sensors; Realtime

Paper ID: IRCUWU2023-67

Design and implementation of prototype personal food computer for Sri Lankan agriculture

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When focusing on the climatic conditions of Sri Lanka, they are divided into several climatic zones such as dry zone, humid zone and intermediate zone. Several differences were observed in the crops grown in these regions. Because crops grown in the upland wet zone were very difficult to grow in the lowland dry zone. Attempts were made to grow those crops in greenhouses, but did not show much success and productivity. The aim of this research was to change the environmental conditions and achieve high productivity in an artificially prepared chamber of a crop that was cultivated only in the upland wet zones and was in high demand in the market. For this, our team created a room called "Personal Food Computer". Sensors artificially create a climate similar to an upland wetland in this chamber. The conditions in the chamber change according to the growth of the plant. After red cabbage *("Brassica oleracea L. var. capitata f, rubra")* seeds are planted in soil medium and reach the required level for transplanting into the field, they are planted in the chamber using the hydroponic method. In addition, some other plants obtained from this process should be planted in gardens in the external environment. After that, the growth of these plants is monitored on a daily basis and at the end of the experiment, an assessment is made to determine which plants have the highest productivity. The final observation of this research is that the productivity of the plants created in the chamber is higher compared to the productivity of the plants outside the chamber. Consequently, the concept of 'personal food computer' can be utilized to facilitate the establishment of such crops in the dry zone. The concept of personal food computing can be introduced to agriculture in Sri Lanka.

Keywords: Personal food computer; Sri Lankan agriculture; Artificial conditions; Hydroponic; Climatic zones

Paper ID: IRCUWU2023-078

Development of an automated robotic arm for the streak plate method

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The Streak Plate Method (SPM) is a widely used technique in microbiology for isolating pure microbial cultures. Traditionally, the SPM involves manually streaking a sample onto an agar plate using a sterilized loop, which is a labor-intensive and time-consuming process. This research paper presents a reliable and efficient robotic arm for accurately streaking microbial samples onto agar plates without human contamination. The design and development of the robotic arm involved integrating various components, including a robotic manipulator, and a control system. The manipulator was equipped with a specialized tool holder to securely hold and maneuver the sterilized loop used for streaking. The control system enabled the manual and coordinated motion system of the robotic arm but manual functions were limited because of high sensitivity. To evaluate the automated system's performance, experiments were conducted comparing the robotic arm's streaking accuracy and efficiency with manual streaking. The results demonstrated that the robotic arm achieved comparable streaking accuracy while significantly reducing the time required for the process with perfect design. Additionally, the system minimized the risk of contamination associated with human error. The developed automated robotic arm offers several advantages over traditional manual streaking techniques. It eliminates human involvement in repetitive and time-consuming tasks, allowing microbiologists to focus on more complex laboratory procedures. Moreover, the system has the potential to increase the throughput of microbial culture isolation and standardize streaking techniques across different laboratories. In conclusion, this research paper presents the successful development of an automated robotic arm system for the Streak Plate Method. The productivity and standardization of microbiological laboratories might be greatly enhanced by this development, which would ultimately be advantageous for the domains of medical research, food safety, and industrial microbiology.

Keywords: Robot arm; Streak plate; Pathogens; Contamination; SCARA robot

Paper ID: IRCUWU2023-100

Building a low-cost impedance tube to investigate sound absorption coefficients

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One of the most popular ways to determine a material's acoustic properties is the impedance tube technique. Various kinds of impedance tubes are available in the market, but all these are very expensive. Therefore, the primary objective of this study was to build a high-frequency cost-effective impedance tube for measuring sound absorption coefficients. The designed impedance tube consists of five main components: tube, microphone, speaker, Arduino-based motor system, and TrueRTA software. A sound wave generated by the speaker propagates through the air medium in the tube. When the sample to be studied is placed other end of the tube, the standing wave is generated near the sample. The movable microphone detected sound levels within the tube. Sound levels corresponding to the first maxima and the first minima were determined in decibels by the TrueRTA software. These values were used to calculate the sound absorption coefficient according to the standard wave ratio (SWR) theory. The reference samples, such as plywood and glass, were used to test the accuracy of the built low-cost impedance tube. The sound absorption coefficients found for plywood were 0.10, 0.11, and 0.13 for the frequencies of 1000 Hz, 2000 Hz, and 4000 Hz, respectively. At 25^{o}C, the sound speed was calculated by this impedance tube which was 344.0 ± 8.0 ms^{-1}. These results were consistent with standard sound absorption coefficient and sound speed values.

Keywords: Sound absorption coefficient; Impedance tube; Sound absorption materials; Sound absorption

Paper ID: IRCUWU2023-104

Approach to reduce breakdowns due to lightening strikes in 33kV distribution network

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Lightening strikes pose a significant threat to the reliability and operation of 33kV distribution networks. This study focuses on minimizing breakdowns resulting from lightning strikes in the Balangoda-Pelmadulla feeder line. An examination of the existing line was carried out, and data analysis was conducted from January 2, 2021, to December 26, 2021. On-site line inspections were conducted and feeder tripping data was collected from the Ceylon Electricity Board (CEB) to gather crucial information about the transmission line and towers. A risk assessment was carried out to identify vulnerable areas within the 33kV distribution network that are susceptible to breakdowns caused by lightning strikes. The research indicates that failures caused by lightning are mainly due to the improper use of tapping points, issues with soil resistivity, and broken shielding wires. To resolve issues arising from tapping points being used incorrectly, it was suggested that relocating the tapping point of the spare line and converting it into Aerial Bundle Connectors could be viable solutions. Aerial. Implementing improvements such as shifting tapping points, installing surge arrestors, addressing soil resistivity issues, and repairing broken shielding wires can effectively mitigate the impact of lightning strikes on the feeder line. After implementing the suggested solutions, data on tripping incidences were collected and found a significant decrease in their occurrence. Additionally, increasing the quantity and depth of grounding electrodes, selecting optimal tower sites, and conducting thorough soil resistivity checks during new line construction contribute to maintaining a reliable and efficient grounding system. Continuous monitoring and tracking of soil resistivity changes further ensure the effectiveness of the grounding system over time. These measures collectively enhance the safety and reliability of the transmission line, minimizing power disruptions and potential damages caused by lightning strikes.

Keywords: Lightning strikes; 33kV distribution network; Electricity breakdowns; Lightning protection

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Production of a coir combing machine to increase the efficiency of coir manufacturing

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The coir industry in Asian countries heavily relies on the use of retted fiber for various coir-related products. However, the process of combing and categorizing the fibers according to their lengths is labor-intensive and time-consuming. In Sri Lanka, this task is predominantly performed by women in their households, posing challenges in terms of efficiency and cost-effectiveness. To address this issue, a coir combing machine is introduced through this project. Currently, the fibers are not arranged in parallel and consist of a mixture of short and long fibers. The introduced machine utilizes an AC motor with 0.5 hp and 1800 RPM which is connected to a 230 V power source, a spike roller, a belt system, a paddle system, and a switch to achieve the desired outcomes. By combing the coir fibers using the rotating spike roller, the machine effectively separates the short fibers from the long fibers, resulting in clean and parallel fiber strands. The belt system ensures the motor operates at the required rotational speed. A paddle system is implemented to facilitate the insertion of coir into the machine, ensuring safety through a closed entrance. Additionally, a switch is incorporated to control the machine, meeting safety requirements. This machine can be used to simplify the coir combing process to reduce the time consumption and effort required thus increasing the efficiency of the production.

Keywords: Coir industry; Coir combing machine; Fiber separation; Increased efficiency

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Sustainable cutting fluids for composite machining - A short review

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Composite materials are widely employed because they provide fascinating design opportunities for new products with their better specific qualities like low density, wear resistance, high strength, high stiffness, etc. when compared to metals. Traditional machining methods like turning, drilling, and milling are frequently used to process composite materials. Delamination, burning, fiber pull-out, uncut fibers, high surface roughness, and dimensional deviation can be caused by this machining condition. Reducing these damages by using mineral-based cutting fluids is currently being done in the industries. This practice is quite problematic due to the high cost of mineral-based cutting fluids as well as their negative impacts on the environment and human health. In recent years, efforts have been made to overcome these issues in machining with sustainable cutting fluids. Based on information obtained from previous research works, this short review examines the possibility of achieving sustainable green production through the use of cutting fluids. Accordingly, vegetable oil-based cutting fluids are preferred. It provides an alternative to mineral-based cutting fluids because they are more environmentally friendly. Also, it provides lower temperature, cutting force, vibration, and delamination percentage and increases the tool life. Their absorption ability, and physicochemical qualities, are led to these benefits. Some researchers concluded vegetable oil-based machining fluids with nanoparticle enhancements have significantly better thermal and tribological characteristics than regular vegetable-based machining fluids. In addition to vegetable oil-based cutting fluids, there are other types of sustainable cutting fluids such as Liquefied CO_2, which also provide benefits such as improvement in tool life, lower power consumption, improvement in heat conduction capacity, and lower tool chip interfacial friction. In conclusion of referred research, it can be said that vegetable oil-based cutting fluids are giving successful outcomes and novelty embarking for future research. Depending on the methods of machining used, the materials used, and the way the cutting fluid is applied, there may be some differences in cutting fluid benefits from one another. Accordingly, various types of sustainable cutting fluids can be used to serve the needs.

Keywords: Cutting fluids (CFs); Composites; Eco-friendly; Sustainable machining

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Analysis of corrugated baffles on sloshing characteristics of rectangular containers

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Sloshing is the flow of fluid inside a vessel caused by movement or disturbance. If the liquid is not adequately controlled, this movement might cause it to splash or spill out of the container. The installation of baffles lessens the effect of sloshing on the container's walls. The 2D modeling was performed using volume of fluid technique and the corresponding pressure values were noted. By altering the horizontal span length and degree of inclination with regard to the horizontal baffle, several baffle designs were created. This study shows theeffectiveness of corrugated baffles by reducing impact strength acting on the walls of the tank. The corrugated baffles were being evaluated for various incitement amplitudes, incitement frequencies, fill levels, and submergence depths. It was discovered that the L75-A45 corrugated baffle layout produced higher suppression than the remaining corrugatedbaffles, with a pressure decrease of 27.64% compared to no baffle arrangement.

Keywords: Sloshing; Corrugated baffles; Rectangular tank; Volume of fluid; Fluid-solid interaction

Paper ID: IRCUWU2023-185

Smart automatic transfer switch with phase failure condition monitoring

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Secondary power supply is one of the crucial elements of a power system which has critical loads which require continuous operation. Similarly, a power system can contain sensitive loads with lower voltage and frequency immunity levels that requires continuous monitoring of parameters of the supplied power source. Depending on such requirements, power systems with critical loads are commonly implemented with automatic transfer switches (ATS) with phase failure relays (PFR) to ensure proper operation of the load. ATS is responsible for the switching the power supply to secondary power supply in case of any abnormality of the main power source. This paper presents a low-cost smart ATS unit which is capable of monitoring conditions of both primary and secondary power sources. In currently available ATS units in the market, the phase failure conditions are monitored using a separate device called the phase failure relay (PFR), this device will monitor several parameters of the supply power source and notify the ATS unit to make the switch. In some cases, the ATS can be a very bulky design which is implemented using contactors and relays and controlling is done using relay logic. The presented unit in this paper has phase failure conditions monitoring capabilities integrated to the ATS unit itself to drastically reduce the bulkiness and cost of ATS units currently in use. The designed device will monitor the voltage and frequency of both primary and secondary power sources in accordance with the Table 4AB (I) of IET Wiring Regulations, Eighteenth Edition, BS 7671:2018 and in case of detected incompliances, unit has the capability to intelligently shift to the secondary power source. The device is equipped with an ATmega2560 microcontroller unit (MCU) with several sensors to perform the continuous condition monitoring and decision making to initiate the switching mechanism. Additionally to the main MCU, the designed smart ATS is equipped with Internet of Things (IoT) capabilities with the help of ESP32 low-power MCU. IoT capabilities enable the device to have remote controlling and recording capabilities of occurred events, power source parameters into a cloud database and the user can remotely monitor and control the device using a developed web interface.

Keywords: Automatic transfer switches; Phase condition monitoring; IoT; IET BS7671; Smart ATS

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Smart power monitoring device with redundant residual current fault detection

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Power monitoring has become an essential part of a power distribution system to keep track of information such as real-time power consumption, fault detection, and energy usage. In this paper, a smart device is presented that is capable of monitoring real-time parameters of an electrical distribution system with novel additional capabilities which can be utilized as a redundant system for providing protection against electric shock. Usually in an electrical installation with Terra-Terra (TT) earthing configuration, the residual current device (RCD), or residual current circuit breaker (RCCB), or sometimes identified as the "trip switch" in Sri Lankan context is responsible for providing protection against electric shocks resulting from current leakages. In an installation, RCD should be tested for its proper operation in regular short intervals to ensure proper protection. Usually, most manufacturers recommend testing the RCD once a month, but in most installations, this inspection is rarely conducted. The presented system in this paper can act as a redundant system to ensure the safety of the occupants in case of a failure to operate of the installed main RCD of the electrical installation. With the installation of this unit to the electrical installation, the system can be upgraded as a one out of two (1oo2) redundant system for residual current protection. Additionally, this system is equipped with Internet of Things (IoT) and Global System for Mobile Communication (GSM) enabled hardware to communicate fault conditions and monitored parameters of the distribution system. The system is linked with a database to store monitored values with the timestamp through the connectivity enabled by IoT-capable ESP32 hardware. As the capabilities of the finalized system, it is determined that the completed unit is capable of measuring the root mean square (RMS) voltage, frequency, and total current parameters of the electrical distribution system with less than 1% error from validated measurements from properly calibrated instruments.

Keywords: Power monitoring; IoT; Residual current protection; RCD; GSM

Paper ID: IRCUWU2023-210

Design and development of a medium scale dehydration machine for food

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Food dehydration methods are used to reduce the moisture content of fruits and vegetables. Food preservation helps to change the food's storage condition. Micro-scale entrepreneurs followed different food dehydration methods to dry fruits and vegetables. One of the most famous methods is using medium scale electrical food dehydrators. The current study presents a design and prototype of a food dehydrating machine. The major problem regarding conventional electrical food dehydrators is using unstable heated air circulation mechanisms. It is leading to heat loss and a time consuming process. To resolve this problem, the existing food dehydration machine has been dismantled and the heat flow lines were studied. The objectives of this work research are to optimize the heated airflow, to reduce the heat losses during the production time. Subsequently, the new flow circulation mechanism was designed and modeled using Solidworks software, and CFD simulations were carried out to identify the optimum flow parameters. During the simulations, the heat flow rate was kept at $5.09\times10^{-4}ms^{-1}$, and the temperature was kept at 50℃, the findings of the CFD simulation were, it was proven that within 40 minutes the entire drying chamber heated to the expected level. The flow of the heated air was uniformly distributed within the chamber and the flow pipelines. Based on the CFD results, the design was fabricated. The working principle of the proposed machine is by making a high-speed airflow by using blowing fans. This high speed air allowing to flow through a heating coil located inside the main airflow line. The main airflow line is divided into three equal sections and each section is divided into two sub-sections. These sub-sections are designed with equal holes to make heated air distribution uniformly. The proposed design will facilitate, time-efficient, and low budget for micro-scale production industries, and hope to fully automate this system in the future.

Keywords: Food preservation; Dehydration machine; Uniform heat distribution; Air circulation mechanism; CFD; Arduino

Paper ID: IRCUWU2023-223

Detection of coating thickness and notch analysis by eddy current inspection for carbon-coated materials

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Carbon coating is done on materials such as Aluminum and Stainless Steel in various fields of the world. For example, the automotive industry, construction and architecture, the energy industry, and the manufacturing industry of electronic components such as lithium-ion batteries fall under this category. This coating is subject to defects that cannot be seen by the eye due to drying temperature, changes in thickness, and external forces. Their effectiveness may be reduced as a result of small fissures on these surfaces that are not visible to the human eye. The eddy current test which is a non-destructive testing method can be used to identify the notches and coating thickness of these carbon-coated materials. The main objectives of this research are how to accurately detect the cracks through the utilization of eddy current testing, assess the thickness of the coating using liftoff insensitivity, and minimize the occurrence of cracks while achieving an optimum level of carbon coating. Graphite, coal, carbon black, and Paint were used as coatings. Carboxymethyl cellulose binder was used as a binder to create the slurry. Then, the conductive and non-conductive coating was applied to the samples. The Taguchi method was used to analyze the number of experiments. The test samples underwent testing at different temperatures, various coating thicknesses, and different mixing ratios of CB:CMC: Water. In eddy, current testing of coating materials, signal attenuation, penetration depth, and coating thickness add effects to the results. For this, testing was done by changing the frequency, lowpass and high pass filters, phase angle, gain, and amplitude. Experiments showed positive outcomes, especially with conductive coating and non-conductive coatings on conductive materials. That is, Surface cracks and notches of different sizes and orientations were detected very clearly by the eddy current signal. And also, for a lift-off range extended to 10 mm, the predicted coating thicknesses were obtained as 0.1 mm and 0.2 mm. Research enhances eddy current testing for better quality assessment of carbon-coated materials in various industries.

Keywords: Eddy current testing; Lift-off insensitivity; Cracks; Coating thickness; Notches

Paper ID: IRCUWU2023-227

Development of a Delta-X robot-controlled conveyor belt system with virtual reality interface for enhanced production efficiency

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A new virtual reality (VR)-enabled delta X robot-controlled conveyor belt system is being developed to improve production efficiency in Sri Lanka. The system consists of a delta X robot, a conveyor belt, and a virtual interface. The robot is controlled by the virtual interface, which allows the operator to interact with the system in a virtual environment. This allows the operator to see the entire production process from a bird's-eye view and make adjustments to the robot's movements in real-time. The system has the potential to revolutionize the way products are manufactured in Sri Lanka. By improving accuracy, speed, and safety in the production process, the system can help businesses reduce costs and increase productivity. The VR platform could be used to enhance the efficiency of production in several ways, such as: Training new employees on how to operate the conveyor belt system and the delta x robot. Testing new ideas and optimizing the production process before making any changes to the real system. Troubleshooting problems and identifying and rectifying them more quickly. Performing maintenance on the conveyor belt system and the robotic arm without shutting down the production line. The main output of the research would be the development of a delta X robot-controlled conveyor belt system with a virtual reality interface for enhanced production efficiency. This system has the potential to make a significant impact on the manufacturing industry in Sri Lanka and beyond.

Keywords: Virtual reality interface; Production; Delta x robot; Conveyor belt; Sri Lankan industry.

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Deep learning-based traffic sign recognition and auditory alert system for Sri Lankan drivers

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Traffic signs play a crucial role in keeping the roads safe and providing efficient awareness to drivers. They play a vital role in helping drivers, navigate and understand the rules of the road. Road accidents occur when drivers fail to follow traffic signs or disregard traffic rules, resulting in injuries, property damage, and even deaths. It's important to always pay attention to traffic signs, follow the provided instructions, and drive responsibly. Sri Lanka stands out with its distinct traffic signs, differing significantly from those seen in other countries. This study aims to develop a deep learning-based traffic sign alert system with good accuracy and efficiency in traffic sign recognition and enhance driver awareness through the integration of an auditory alert system. This alert system was implemented under two main divisions: object detection system and auditory alert system. The traffic signs dataset images were labeled and preprocessed using the Roboflow software tool. The system was trained using the YOLOv5 model, allowing it to learn complex patterns and features associated with 15 different sign classes. To further enhance driver awareness, an auditory alert system was developed using the PyDub library to generate real-time alerts in the form of voice messages. These alerts are triggered whenever a traffic sign is detected, providing an additional layer of information to the driver. The integrated and fine-tuned YOLOv5 model achieved the F1 score of 90.09% and mean average precision (mAP) of 87.55% on the test dataset resulting in good evaluation metrics values for detection. This YOLOv5 model-based traffic sign auditory alert system was highly effective and efficient in enhancing driver awareness.

Keywords: Traffic signs; Recognition; Auditory alert; YOLOv5; Roboflow

Paper ID: IRCUWU2023-358

Design and development of a small-scale automated filling machine for seeding tray

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The agriculture sector is playing a significant role in Sri Lanka's economy. The demand for a machine that can efficiently select individual vegetable seeds and place them in seed trays has become increasingly evident among growers. Therefore, this study is focused to design and develop an automated, small-scale seeding tray-filling machine for making seedlings. The main components of this technology include a seed injector that facilitates the accurate selection and placement of seeds, the seed tray itself that acts as a container for seedling growth, the hole maker that makes holes in the medium for seed placement, and the seed injector for handling and positioning the seeds with the assistance of a vacuum pump. This innovative unit has multiple functions, (i) Filling of growing media into seed trays, (ii) compacting the media within the tray, (iii) making holes in the compacted cells, (iv) selectively placing single vegetable seeds into those holes and finally cover the seeds with the media for germination, (v) leveling it to ensure uniformly, these operations are performed systematically on a flat belt conveyor that moves in increments equal to the inner-holes distance of the seed tray. This allows for row-by-row sequencing of the seed tray. All the movements required by the machine are done using a stepper motor and IR sensors are used for all the necessary sensors. Also, all the operational processes are controlled by an ArduinoUno Board. Providing a practical solution to nursery management, this electromechanical machine significantly streamlines the process of turning seeds into seedlings in seed trays, increasing efficiency and productivity for horticulture growers.

Keywords: Vegetable seeds; Nursery; Seed tray; Seed injector; Vacuum pump

Paper ID: IRCUWU2023-362

Development of automated image capturing for Zebrafish embryo toxicity model

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Zebrafish embryo is considered as one of the most suitable alternatives to animals in toxicity testings due to their special features like a transparent embryo, high fecundity (200-250 eggs), and the short period of embryonic development. The main problem with Zebrafish embryo toxicity model is the manual image inspection. The process is complex and unfeasible sometimes leading to misunderstanding sub-lethal endpoints. To help address this problem, this study aimed to develop a deep-learning model to analyze images. The deep-learning model was developed to detect seven embryonic development stages and ten morphological features of Zebrafish using the YOLOv5 algorithm. Different augmentation and preprocessing methods were used to improve the accuracy. The developed and fine-tuned model performed well with the mAP (Mean Average Precision) of over 85% in detecting most of the embryonic development stages. But it had mAP values of less than 80% in detecting the morphological features. The study results have shown that the proposed deep-learning model is a very promising step in detecting embryonic development stages and needs minor improvement in detecting morphological features.

Keywords: Zebrafish, Toxicity, Image inspection, Deep learning model

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Obtaining power during the curtailment period of a grid-connected solar panel system

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Recently, the world is focusing on generating green energy. Appropriately, the number of grid-connected solar photovoltaic (PV) systems in low-voltage networks have considerable growth around the world. In Sri Lanka, many residential and industrial organizations have installed solar systems in their places with the intention of making a good profit. Currently, the investors are not interested in investing due to the low profitability of their installed solar panels, due to the potential impact of high penetration of solar on the operation of the utility grid. Many studies are being carried out to give a solution for frequency instabilities and harmonic impacts are occurs in the utility network due to the high integration of renewable energy sources into the grid. This study proposes to track the voltage and frequency fluctuation after the inverter and effectively utilize the daytime solar photovoltaic generation by implementing a consumption mechanism for the excess energy developed in the PV systems that can result in voltage stability issues. And this paper will initially describe the solar infrastructure in Sri Lanka, covering its history, current status, and future directions. Further, it will explore the net metering system used in Sri Lanka and Issues that arise in the net metering system and find a solution for the issues. The primary concern of the whole research is to reduce wastage from grid-connected solar power systems by introducing an automated system to allocate existing power to consumption mechanisms. This research has designed and developed a MATLAB Simulink model for the needful simulations. A feasibility study was conducted within a distribution transformer service area, to analyze the result to compare and contrast the energy requirements for implementing a consumption mechanism for the excess energy.

Keywords: Photovoltaic systems; Low voltage networks; Frequency instability; Renewable energy; Voltage instability

Paper ID: IRCUWU2023-433

Classification of the maturity status of fruits and vegetable based on machine learning approach

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Manual classification of the maturity status of fruits and vegetables is a time-consuming task which needs skills personals. The aim of this research is to identify which machine learning technique could be used to automatically classify the maturity status of the vegetable and fruits with high accuracy. We have collected and labelled selected fruits and vegetable dataset of 2000 images. The dataset contains 800 images of mangos and 720 images of papayas. This fruit dataset has three different classes such as partially ripped, ripped and unripped fruits. The dataset contains 250 images of unripe mangos, 300 images of ripe mangoes and 250 images of partially ripe mangoes. The dataset contains 250, 220, 250 images of unripe, ripe and partially ripe papaya. Further, we have collected 480 images of ladies' fingers. These lady finger images are labelled as good and bad and in each class, 240 images are included in the dataset. We have split the dataset into two groups such as training and testing which contains 1450 images for training and 372 images for testing. Two machine learning models YOLOV5 and CNN were trained and the classification performance of these models was evaluated on the dataset. We developed a machine learning approach to classify the maturity level of mango and papaya and to identify the good or bad condition of ladyfingers. From the experiments, it has been observed that YOLOV5 based approach provides the state-of-the-art performance with 97% accuracy compared to the CNN based approach which is 93%.

Keywords: Fruit maturity classification; Machine learning; Yolo algorithm; Vegetable maturity classification

Entrepreneurship & Business Management

Paper ID: IRCUWU2023-22

Influence of gamification on online purchase intention: Mediating role of customer engagement intention and enjoyment of online shopping experience

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Gamification has been one of the fastest-growing trends in the field of marketing in recent years for influencing, motivating, and controlling consumer behavior. As a fresh method of taking advantage of customers, gamification has become a top priority for marketers. Gamification is becoming more and more popular in a variety of fields, including healthcare, education, online shopping and etc. Gamification is the process of incorporating game elements into non-game environment platforms. According to the gap explored, this study aims to investigate how gamification influences on online purchase intention e-commerce sector with the mediator of customer engagement intention and enjoyment of online shopping experience in the Sri Lankan context. This study fills the empirical and knowledge gaps under this research topic. The main objective of this research study is to investigate the influence of gamification on online purchase intention in the e-commerce sector and to identify the mediating effect of customer engagement intention and enjoyment of online shopping experience in Sri Lanka. The data were collected from a sample of 384 online shopping customers in Sri Lanka. Smart PLS statistical package was used to analyze survey data using Partial Least Squares – Structural Equation Modeling. By using the PLS path modeling, was identified that gamification has a significant positive influence on online purchase intention and also customer engagement intention, and enjoyment of the online shopping experience in the e-commerce sector in Sri Lanka. Further, the current study identified that there is a partially mediating effect of customer engagement intention on the relationship between gamification and online purchase intention. And also identified that there is a partially mediating effect of enjoyment of online shopping experience on the relationship between gamification and online purchase intention. This study's findings provide some useful insights for any business that is looking to embrace gamification through marketing activities. The main Recommendation is marketers in the e-commerce industry must constantly build and implement gamified services in their websites or platforms to increase online purchase intention.

Keywords: Customer engagement intention; Enjoyment of online shopping experience; Gamification; Online purchase intention

Paper ID: IRCUWU2023-37

Determinants of value-added tea exportation in Sri Lanka: The exporters' view

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The performance of Ceylon tea exporters in value addition is poor relative to the performance of many other tea producing countries in the world. Therefore, the market exploration for the value-added tea is lesser than the bulk tea market share. However, the increase in the production of value-added tea for exportation will generate higher income and enhances the country's profit margin accordingly. In this scenario, analyzing the factors affecting the value-added tea exportation, determination of the impacts formed by such factors and suggesting strategies to improve the country's tea production and exportation were aimed in this study. Ten factors were identified based on the previous literature and 60 value-added tea exporters were selected by the stratified random sampling technique. The Sri Lanka Tea Board has categorized the exporters under their annual exportation (kg) into three categories therefore, 2 companies from large, 14 and 44 from medium and small categories were chosen respectively. Descriptive, correlation and multiple regression analyses were applied to determine the relationship among variables and estimate its impact on value-added tea exportation. The findings of the study proved variables which market destinations (r=0.607), international certifications (r=0.594), skilled-laborers in production (r=0.549), and adaptation on trade restrictions (r=0.544) have a strong positive relationship with the value-added tea exportation while variables including market and technological approaches (r=0.372, 0.432), and company experience (r=0.482), have a significant moderate positive relationship (p<0.05). The multiple regression analysis revealed positive influences from variables which are market destinations (p=0.022), and technological approaches (p=0.043) at 0.05 significant level and variables which are international certifications (p=0.005), and adaptation on trade restrictions (p=0.010) at 0.01 significant level. In order to compete with international players and to expand the exportation, marketing and technological strategies in both value-added tea production and exportation should be developed. Therefore, new product developments and technological inventions through research and development should be available to meet international buyer expectations. Moreover, exporters should endeavor to obtain internationally approved certifications to be credible to international buyers and thereby expand the market destinations. Especially, small and medium-category exporters should be adapted to trade restrictions since it positively influences exportation.

Keywords: Multiple regression analysis; Tea exports; Trade restrictions; Value-added tea

Paper ID: IRCUWU2023-137

The role of university social responsibility on student loyalty: Empirical evidence from private universities in Sri Lanka

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In the contemporary landscape of higher education, a discernible trend towards marketization has emerged in transforming the traditional dynamics between educational institutions and students. This transition has repositioned higher education as a service industry, consequently transforming students into customers. In this context, fostering student loyalty has become indispensable for attracting new students and ensuring the retention of existing ones within higher education institutions. Thus, this study examines the role of University Social Responsibility (USR) on Student Loyalty (SL) with special reference to private university students in Sri Lanka using two mediators: Service Quality (SQ) and Student Trust (ST). The quantitative research approach has been utilized, and the data was collected through a structured questionnaire. The sample of the study consisted of 384 students in private universities in Sri Lanka and the respondents were selected using Purposive and Convenience sampling techniques. The data was analyzed using Partial Least Square Structural Equation Modeling (PLS-SEM) using SmartPLS software. Moreover, SPSS software was used for the demographic data analysis. The findings of the research study revealed that University Social Responsibility and Student Trust are the most significant factors which impact student loyalty. Furthermore, the findings revealed that the ST does mediate the relationship between University Social Responsibility and Student Loyalty. Further, it was recommended to spend more on University Social Responsibility activities by the Higher Education Institutions to enhance the Student Trust.

Keywords: Higher education institutions; Student loyalty; Service quality; Student trust; University social responsibility

Paper ID: IRCUWU2023-174

Learning capabilities, social innovations, resilience capabilities and performance of social enterprises in the current situations in Sri Lanka

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Social enterprises play a pivotal role in the growth of nations today. While the total number of social enterprises has increased worldwide, it remains considerably less compared to other SMEs and large-scale organizations. Over the past five years (2018-2022) in Sri Lanka, particularly, learning capabilities, social innovation, and resilience have emerged as the strongest attributes of social enterprises. This research employed a mixed methods approach, encompassing both qualitative and quantitative data collection methods. The purposive sampling method was employed to select samples in accordance with the researcher's knowledge and alignment with the research objectives. In the quantitative approach, the research sample consisted of 284 participants, while in the qualitative method; the sample size comprised 12 social enterprises in Sri Lanka. Data was collected through interviews and open-ended questionnaires, developed based on the research objectives of the study. Further, the PLS-SEM method was adopted and data were analyzed using SPSS and Smart PLS Software. The findings reveal a weak positive correlation between Internal Learning and Social Innovations, a strong positive correlation between External Learning and Social Innovation, and a strong positive correlation between Social Innovation and Resilience Capabilities, underscoring how innovative solutions aid in confronting dynamic environments. Moreover, social enterprises with robust learning capabilities were found to adapt more effectively to changing circumstances, showcasing heightened resilience capabilities during challenging times. The study identifies several successful case studies of social enterprises that have made significant contributions to addressing social issues in Sri Lanka. The research underscores the importance of continuous learning and adaptability for social enterprises to thrive in dynamic environments. The implications of these findings for policymakers, investors, and practitioners are discussed, emphasizing the necessity for supportive policies and resources to nurture social innovation and resilience capabilities within Sri Lanka's social enterprises.

Keywords: Learning capabilities; Resilience capabilities; Social enterprises; Social innovations

Paper ID: IRCUWU2023-194

Corporate social responsibility and customer loyalty; The mediating role of corporate reputation, customer satisfaction, and trust in the insurance industry of Sri Lanka

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Corporate Social Responsibility (CSR) is the commitment of companies to act responsibly towards society and the environment. Customer loyalty is a vital factor for business success and sustainability. Thus, this study explores how CSR initiatives influence customer loyalty through their impact on corporate reputation, customer satisfaction, and trust. Moreover, the study adopts an evidence-based perspective and stakeholder theory to propose a mechanism through which CSR affects customer loyalty, taking into account the mediating effects of corporate reputation, customer satisfaction, and customer trust. The study has adopted a quantitative research approach and data was collected from insurance policyholders across Sri Lanka using a survey questionnaire. The sample size of the study was 150 and the respondents were selected using the Danielsoper method as a sampling technique. Further, the PLS-SEM method was adopted and data were analyzed using SmartPLS software. The study demonstrated a significant positive correlation between CSR initiatives and corporate reputation, customer satisfaction, and customer trust. The results of the mediation analysis indicate that corporate reputation, customer trust, and customer satisfaction play a mediating role in the relationship between CSR and customer loyalty. The findings of this study provided valuable insights for insurance companies in Sri Lanka to develop effective CSR strategies that positively impact customer loyalty through reputation management, customer satisfaction, and trust-building initiatives.

Keywords: Customer loyalty; Customer satisfaction; Corporate social responsibility; Customer trust; Insurance industry

Paper ID: IRCUWU2023-258

Effect of entrepreneurial orientation on innovative performance of small and medium-sized enterprises: The mediating role of strategic orientation (Manufacturing small and medium-sized enterprises in Colombo district)

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The entrepreneurial orientation exhibited by small and medium-sized enterprises (SMEs) emerges as a crucial determinant influencing innovation and organizational performance. Therefore, this study aims to assess the impact of entrepreneuria orientation on the innovative performance of small and medium-sized enterprises, focusing on the mediating role of strategic orientation. This study focuses on and addresses a knowledge gap in the existing literature by investigating the relationship between variables that have been understudied and the lack of research conducted in the Sri Lankan context. This study specifically examines how SME owners in Sri Lanka utilize strategies and entrepreneurial behaviour to improve organizational performance during the current economic downturn. A sample of 156 SMEs was selected to achieve the study's objectives, and data was collected using a self-administrated questionnaire. The questionnaire showed high reliability with Cronbach's alpha values > 0.7 for each variable and data was analyzed using the structural equation method. The findings of the study reveal a significant positive relationship between entrepreneurial orientation and the innovative performance of SMEs. This suggests that SMEs with a strong entrepreneurial orientation are more likely to exhibit higher levels of innovative performance. Moreover, the study uncovers that strategic orientation acts as a mediator in this relationship by partially mediating the relationship between entrepreneurial orientation and innovative performance. As per the findings, this study provides implications by proving that SMEs with higher entrepreneurial levels engage in innovative activities and strategic orientation acts as a mediator by enabling businesses to align entrepreneurial efforts with their strategic objectives, leading to improved innovation. Also, the study highlights that strategic orientation empowers innovative performance by building up better strategies to achieve better innovation. Additionally, the study provides a tool for SMEs to assess their strengths and weaknesses and develop action plans to enhance their innovation and assist SMEs in improving their capacity for invention by focusing on entrepreneurial and strategic orientation, leading to a competitive edge, higher market share, customer satisfaction, and increased profitability. Finally, this study offers recommendations to SME owners, policymakers, and scholars on how to enhance innovative performance by focusing on entrepreneurial orientation and the behaviour of SME owners or managers.

Keywords: Entrepreneurial orientation; Innovative performance; Manufacturing SMEs; Strategic orientations

Paper ID: IRCUWU2023-261

Impact of mobile augmented reality in E-commerce on purchase intention with the mediating effect of consumer innovativeness (with special reference to the generation of digital natives in Sri Lanka)

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This study explores the impact of Mobile Augmented Reality (MAR) in the context of e-commerce on purchase intention, with a particular focus on the generation of digital natives in Sri Lanka. The objective of the research is twofold to identify the relationship between MAR in e-commerce and purchase intention and to examine whether consumer innovativeness acts as a mediator in this relationship. A sample of 384 respondents, consisting of digital natives in Sri Lanka, was selected using purposive sampling. A self-administered questionnaire was used to collect primary data for this quantitative research study. Descriptive and inferential statistics, along with the SmartPLS software, were employed for data analysis. The key findings of this study reveal that the utilization of MAR in e-commerce is positively associated with consumer innovativeness among Sri Lanka's digital natives. Moreover, a strong correlation was observed between consumer innovativeness and purchase intention, indicating that individuals with higher levels of innovativeness are more likely to exhibit greater purchase intentions. Surprisingly, no significant direct relationship between MAR and purchase intention was found. However, the study highlights that consumer innovativeness mediates the link between MAR and purchase intention, suggesting that the influence of MAR on purchase intention is partially explained by its impact on consumer innovativeness. These findings imply that while the direct impact of MAR on e-commerce purchase intention may be limited, companies can still benefit from its implementation by fostering consumer innovativeness. By stimulating innovative behavior among digital natives, firms can positively influence purchase intentions. These insights have important implications for companies seeking to enhance their e-commerce performance and cater to the preferences of Sri Lanka's digital natives. Additionally, they contribute to future research on the application of MAR in e-commerce.

Keywords: Consumer innovativeness; E-commerce; Mobile Augmented Reality; Purchase intention

Paper ID: IRCUWU2023-265

The mediating effect of workplace counseling on job stress and employee performance in the apparel industry

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Job stress refers to the negative physical and emotional responses to a job that do not realize the workers' capabilities, resources, or demands. It hinders the employee's success and resulting in employee ill health. Workplace counseling is the provision of brief psychological therapy to such employees in order to assist employees overcome workplace stress. In the context, this study addressed the gap in the literature regarding the mediating role of workplace counseling of job stress and employee performance in Sri Lankan apparel industry. The quantitative research approach was followed to identify the impact of job stress on employee performance and investigate the mediating role of workplace counseling on job stress of employee performance. There are 375 operational level employees in Export Processing Zone Biyagama were selected for the sample by following the stratified sample method. The primary data were collected through five-point Likert scale questionnaire and analyzed by Structural Equation Modeling (SEM), Smart PLS, and SPSS software. The finding revealed that job stress and workplace counseling have a significant effect on employee performance. The family difficulties, relationship problems, and drug addiction problems were identified as the leading causes of job stress among operational level personnel. Further, it signified that workplace counseling partially mediates the impact of job stress on employee performance. These findings provide directions to organizations for implement counseling and coaching sessions within the workplace to combat occupational stress and improve employee performance. In addition, it is advised to have at least two professional counselors, including at least one male counselor.

Keywords: Apparel industry; Employee performance; Job stress; Workplace counseling

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The mediating role of consumer attitude on YouTube video marketing on consumer purchase intention special references in instant food industry in Sri Lanka

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In the age of information, YouTube Video Marketing has become the trendiest style for every marketer. The ever-growing user base has propelled YouTube to dramatically pave the way for driving high-converting traffic. Since it is the internet's second-largest search engine, consumers are increasingly turning to YouTube for product searches. YouTube is growing exponentially and YouTube adverts have been endlessly employed to communicate with customers globally. With the growing online presence of products and services, YouTube Videos have become an integral part of Internet users' online experience. Even though the snowballing interest of scholars has focused on YouTube Video Marketing, there is a lack of insights on areas such as the mediating role of consumer attitude on YouTube Video Marketing on consumer purchase intention, specifically in industries like instant food which have become a frequently seen YouTube Ad for consumers. To bridge this gap, this study emphasizes the mediating role of consumer attitude on YouTube Video Marketing on Sri Lankan consumers' purchase intention of Instant Foods. The primary objective of this study examines the impact of YouTube video marketing on consumer purchase intention while the secondary objective is to identify the mediating effect of consumer attitude on YouTube Video marketing on purchase intention in the Instant food industry in Sri Lanka. The quantitative approach of this study examines YouTube viewers' purchase intention in relation to YouTube advertisements' emotional appeal, entertainment, informative, and advertising value. This study accommodated a self-administered questionnaire to 384 YouTube users in the Western Province of Sri Lanka between the ages of 18 and 37 drawn from a convenient sampling technique. Correlation and Coefficient Analysis Revealed the impact of YouTube Advertising variables on the Purchase Intention of YouTube Users. It was found that YouTube advertisements' emotional appeal, entertainment, informativeness, and advertising value favorably impact purchase intention. In addition, consumer attitude affects the purchase intention of YouTube viewers in the Western Province of Sri Lanka as a mediator. The study recommends Marketers enhance the emotional appeal, entertainment, and information while establishing, planning, and advertising on YouTube

Keywords: Consumer attitude; Instant food industry; Purchase intention; YouTube video marketing

Paper ID: IRCUWU2023-346

Impact of Instagram influencers as Micro-Celebrities on the purchase decision of cosmetic brands: With mediating effect of consumer trust

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People have the power to influence others and organizations frequently use this power to market their organizations within the marketplace. Based on the context of using these celebrities in the marketing activities within the organization, the purpose of this study is to analyze the real impact of celebrity involvement on the influence on consumers. Therefore, this study focuses on the impact of social media influencers as micro-celebrities on the consumer purchase decision of consumers in cosmetics brands. The study is conducted with special reference to Instagram. Consumer trust will be used as the mediator. The research will be conducted on a sample of female professionals in the private sector, aged 21 to 45. The sample will be selected from the western province. Morgan table will be used to select the sample and the purposive sampling technique will be used. The findings of this study can help marketers make informed decisions when it comes to choosing the appropriate social media influencers for their marketing campaigns. The rise of social media has led to an increase in the number of people using it more frequently. This has also resulted in a change in the way they communicate with one another. Despite the positive effects of social media, it is still important for entrepreneurs to keep their business operations in order. Building the trust of the consumers is really important in order to influence their purchase decision. As a result of that maintaining that trust and building the trust is really important and that why it has stated in this study by proving the fact that the mediating effect of consumer trust will strengthen the relationship between the consumer purchase decision and the social media influencers.

Keywords: Consumer purchase decision; Consumer trust; Cosmetics industry; Micro celebrities; Social media influencers

Paper ID: IRCUWU2023- 349

Impact of entrepreneurial orientation on marketing innovation performance on small and medium-sized enterprises, the mediating effect of environmental dynamism

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An entrepreneurial mindset will lead a person to act in different ways within the community. This concept is concerned with the Entrepreneurial orientation concept. Entrepreneurial orientation with respect to different people has been studied from different perspectives. When concerned with this study, it focuses on the to check the relationship between entrepreneurial orientation and a firm's marketing innovation performance. Therefore, past researches have conducted this study in different contexts and are not applicable to the Sri Lankan context. With this study, the sample was selected to examine the entrepreneurial orientation of Sri Lankan SMEs, their ability to undertake innovative marketing activities. Furthermore, environmental dynamism was considered a mediator in studying the relationship between entrepreneurial orientation and innovative marketing performance. As we need to examine how the dynamic nature of the environment affects this relationship. Previous studies show that the effectiveness of SMEs depends on the status of environmental influences. This study seeks to gain an understanding of how environmental dynamics can be meaningfully used to shape the objectives and overall innovation performance of SMEs.The target population of the study is the SMEs located in the Western Province, Sri Lanka and the sample for the study consisted of 132 respondents. A self-administrated questionnaire was used to collect data. Descriptive statistics techniques and Partial Least Square – Structural Equation modeling techniques have been used to analyze the collected data. Results of the analysis, indicated that there is a positive relationship between environmental dynamism and marketing innovation performance and there is the mediating effect of environmental dynamism between entrepreneurial orientation and marketing innovation performance. Therefore, the entrepreneurial practices of SMEs are helpful to become successful and lead to create novel marketing activities. In organizations. Therefore, being entrepreneurial in nature will create an atmosphere to face challenges faced by organizations.

Keywords: Environmental dynamism; Entrepreneurial orientation; Marketing innovation performance; Small and medium entrepreneurs

Paper ID: IRCUWU2023-356

Entrepreneurial orientation and strategic agility in enhancing resilience capabilities of export-oriented small and medium-sized enterprises in Sri Lanka: A special reference with food and beverage export-oriented small and medium-sized enterprises

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The resilience of Small and Medium-sized Enterprises (SMEs) is of paramount importance in today's dynamic and uncertain business environment. Export-oriented SMEs in emerging economies, such as Sri Lanka, face unique challenges due to globalization, changing market trends, and economic uncertainties. Achieving resilience is critical for these SMEs to adapt, survive, and thrive in such conditions. Against this backdrop, this research aims to explore how the entrepreneurial orientation and strategic agility of export-oriented SMEs influence their ability to overcome external shocks and disruptions, sustain their export activities, and maintain long-term competitiveness in the global market. This study is mainly based on primary data collected by the physical and online survey questionnaires. The secondary data will be collected to fulfil other purposes by data from websites, government publications and statistics, paper articles, CBSL reports, etc. The researcher has got the sample as the food and beverage export-oriented SMEs in Sri Lanka. There are 230 businesses registered under the Export Development Board in 2022. The researcher used a convenience sampling technique to collect data. The collection of primary data from respondents via questionnaires, the collected data will be evaluated using IBM SPSS 25 software. The research findings hold several implications for both theory and practice. SMEs may increase their resilience capacities and efficiently adapt to changes in the global business environment by being entrepreneurial and agile. Future studies should look at the specific ways in which organizational resilience is improved by EO and strategic agility as well as the conditions that help or hinder the development of these skills in SMEs. By cultivating a culture of innovation, risk-taking, and creativity, creating strategic partnerships and alliances, investing in new technologies and tools, and putting money into their human resources, SMEs may use EO and strategic agility to increase their resilience capabilities. By doing this, SMEs can generate a competitive advantage that allows them to increase their resilience skills while also being able to respond to changes in the global business environment. Recommendations also extend to policymakers, industry associations, and business support agencies, suggesting measures to create an enabling environment that fosters entrepreneurial behavior and strategic agility among SMEs. In conclusion, research has shown that both entrepreneurial orientation and strategic agility are important factors that contribute to organizational resilience.

Keywords: Dynamic capabilities; Entrepreneurial orientation; Organizational orientation; Strategic agility

Paper ID: IRCUWU2023-369

The study of the impact of Facebook advertising appeals on impulsive buying with mediating effect of customer's perceived value (special reference to online clothing and accessories items in the Western Province)

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The evolving usage of Facebook Advertising is altering the business world in response to the customer's needs and desires. The Facebook platform empowers marketers to endorse their brands in a more tailored and customized way. In order to entice consumers' attention and address the customization of their needs, advertising experts tend to use rational and emotional advertising appeals in Facebook Advertising. Rational and emotional appeal can become a catalyst for the impulsive buying behavior of customers. Even though there is a growing interest of scholars to inspect factors influencing impulsive buying behavior, there is a lack of insights in the fields such as clothing accessories which is popular in Facebook advertising. Thus, this study aimed to investigate the impact of rational and emotional advertising appeal in advertisements on impulsive buying of clothing and accessories items products in Facebook in Sri Lanka. The prime objective of the study was to examine the impact of Facebook advertising appeals on impulsive buying while the secondary objective determine the impact of Facebook advertising appeals on impulsive buying with mediating effect of consumer's perceived value. 347 Facebook users from Western Province who purchased clothing and accessories products were selected using a convenient sampling technique. Primary data has been gathered through Online Structured Questionnaire and SmartPLS statistical program used for the regression analysis. Salient findings of the study reveal that the Emotional Appeal in advertisements has a substantial impact on impulsive buying through the mediating effect of consumer perceived value. Further, it has been found that both dimensions of emotional appeals and advertising appeal significantly and positively affected impulsive buying with the mediating effect of consumers' perceived value. It was recommended that emotional responses to Facebook advertising are significant to businesses since they represent the customer's current emotional states, which in turn reflect the person's impulsive buying toward advertised products. Therefore, marketers can employ the outcome of this study to advance the marketing strategies on target audiences in a more customized way.

Keywords: Advertising appeal; Consumers' perceived value; Facebook advertising, Impulsive buying behavior

Paper ID: IRCUWU2023-395

Impact of viral marketing on consumer purchase intention with mediating effect of consumer perceived value (with special reference to licensed commercial banking consumers in the Western Province)

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Viral marketing is a business tactic that primarily uses social media platforms to advertise a product or service on already-existing social networks. Due to the increasing number of marketing techniques being used by companies, viral marketing has become one of the most effective ways to promote organizational brands. When concerned with viral marketing, a smaller number of studies were conducted based on the Sri Lankan context. There is a lack of knowledge about how viral marketing impact on customer purchase intention from the marketer's perspective and customers' point of view. As a result, there is a gap in the empirical research on viral marketing, and this study will examine the relationship between viral marketing and customer purchase intention. The stratified sampling technique is used as one of the most common sampling techniques used by researchers for this study. Therefore, the sample is narrowed down to 384 people who are lived in Western Province using the Morgan table. The partial least squares structural equation model will use as the data analysis method. Smart PLS software will use as a data analysis tool to analyze the data collected. Primary data is collected by giving an online questionnaire to a randomly selected population in Western Province under the banking industry. The findings of this study show that there is a positive relationship between viral marketing and consumer purchase intention and consumer perceived value will mediate the relationship between viral marketing and consumer purchase intention. The findings of this research help to get identify how viral marketing impact on consumer purchase intention by mediating the effect of consumer perceived value in the banking industry and it helps to get managerial and theoretical decisions to both managers and consumers as well as policymakers.

Keywords: Banking industry; Consumer perceived value; Consumer purchase intention; viral marketing

Paper ID: IRCUWU2023- 416

The impact of green marketing on consumer purchase intention with mediating effect of consumer knowledge (with special reference to young workers in the Sri Lankan BPO industry)

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The concept of green has become an important topic in the world since the past and it can be identified that the concept of green is linked with the concept of sustainability, and now it has become a weapon that can be used as a powerful competitive strategy for companies. Today, the organizational concern for the environment led to the development of the "Green Marketing" concept. These initiatives understand that their existence and integrity lie in the coordination between its interest and the benefits of the consumer and society. In the Sri Lankan context, one of the fastest-growing industries in Sri Lanka is the Business Process Outsourcing industry (BPO), which consist of young workers who are vulnerable to health issue due to their shift schedules. This research examines the impact of green marketing on consumer purchase intention through customer knowledge with special reference to young workers in the Sri Lankan BPO industry. The objective of this study is to examine the correlation between the three concepts. These are Green Marketing, Consumer Knowledge and Consumer Purchase Intention with an emphasis on the BPO industry in Sri Lanka. This study collected primary data from a total of 384 respondents from young workers who work in BPO industry in Sri Lanka using self-administered questionnaire method and tested hypotheses using the Partial Least Squares Structural Equation Model. This study suggests that green approaches can be used as a brand marketing strategy to enhance consumer purchase intention. Further, this study will offer managerial implications for the development of green firms.

Keywords: BPO Industry; Consumer Knowledge; Consumer Purchase Intention; Green Marketing; Sustainability

Paper ID: IRCUWU2023-421

Evaluation of small and medium-sized enterprises' involvement in strawberry cultivation in Nuwara Eliya district

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The COVID-19 pandemic had a significant impact on Sri Lanka's current economy, and as a result, both the export and import markets experienced an economic downturn. The strawberry farmers' cultivation had come to an end due to the rising costs of fertilizers, chemicals, and plant materials as well as the declining prices and decreased demand for their products. Thus, the purpose of this study was to look into the involvement of SMEs in strawberry cultivation in Sri Lanka's Nuwara Eliya district. The primary objective of this study was to conduct a survey to assess how small and medium-sized businesses (SMEs) engaged in strawberry farming in the Nuwara Eliya district after the impact of COVID-19. A structured questionnaire and the personal interview method were used to obtain data. Then, using a multistage sampling technique, data was collected from total 100 different strawberry farms. Microsoft Excel software was used to analyze the responses. In this study, descriptive statistics such as averages and percentages will be used. The year 2020 will have less import quantity and less export quantity respectively, according to Sri Lanka Customs' statistical division. There was a research gap to detect farmers' challenges to increasing production capacities. The current study examines SMEs' current status in strawberry cultivation. The results of this study were as follows, the majority of farmers sold their strawberries as fresh fruit while the minority sold their strawberries both as fresh fruit and value-added products. The monthly income level of strawberry farmers was mainly between Rs: 1000 - 25000.00. The majority of farmers in the Nuwara Eliya district sell their products in fresh form, and the study's findings indicate that they are less knowledgeable of the market and innovative processing methods for value-added products.

Keywords: Descriptive analysis; Small and medium-sized enterprises (SMEs); Strawberry cultivation; Value added products

Paper ID: IRCUWU2023-482

Market feasibility of establishing a new tea center: A study of Kelani Valley plantations

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Tea center concepts are emerging in the Sri Lankan tea industry as innovative business models to attract a new set of customers. In light of this trend, Kelani Valley Plantations Company PLC proposes to establish a new tea center in the Dehiowita area. The goal of this study is to assess the market feasibility by examining customer readiness to visit the tea center using the 7Ps marketing mix elements, namely product, price, place, promotion, people, process, and physical evidence. Additionally, the study aims to identify socio-demographic factors that affect customer readiness and determine preferable product-specific factors for customers. Data were collected from a purposive sample size of 120 respondents, including 80 local and 40 foreign travellers passing through the Dehiowita area between Awissawella and Karawanella, using an interviewer-administered, pre-structured questionnaire. The study employed descriptive analysis, Chi-square analysis and a binary logistic regression model. The results revealed that 78% of respondents were willing to visit the tea center. The majority of respondents were married males in the 26-35 age group. Among the socio-demographic factors, education, and occupation significantly influenced customer readiness to visit the tea center. The combined effect analysis using ordered logistic regression indicated that price, promotion, people, process, and physical evidence were significantly related to customer readiness, whereas product and place showed no significant relationship. Furthermore, the study identified people as the most influential driver and promotion as the least influential driver of customer readiness. Based on the findings, the study recommends that management should focus on improving the marketing mix elements by applying the right mix to attract and retain customers. Overall, the results demonstrate a strong willingness among the interviewed participants to visit the proposed tea center.

Keywords: Binary logistic regression; Customer readiness; Market feasibility; Tea center; 7Ps marketing mix

Environmental Sciences

IRCUWU2023-28

Remediation of copper contaminated soil by char derived from used disposable baby diapers

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Plastic, including used disposable baby diapers (UDD), is a growing soil pollutant due to increasing single-use plastic consumption. UDDs contain 50% plastic such as super absorbent polymers that take over 100 years to degrade. This study focused on pyrolysis as a recycling method to produce plastic char from UDDs, evaluating its efficacy in the soil as an amendment to immobilize the copper in contaminated soil. Uncontaminated soil was spiked (240 mg/kg) with copper (ll) sulphate. Based on the thermogravimetric analysis of UDD, 550°C was selected as the pyrolysis temperature. The plastic char produced was characterized before being applied to the soil. The contaminated soil was incubated after applying plastic char at the rates of 0% (control), 1%, and 2.5%. Immobilization of Cu was measured after one month of incubation by single extraction using 1M NH4OAc and consecutive extraction using 0.01 M CaCl2 methods. The soil pH, electrical conductivity, and availability of Na, Mg, K, P, Ca, and N were analyzed. The consecutive extraction analysis revealed a significant (p < 0.05) reduction in extractable Cu concentration in the soil treated with plastic char and the immobilization percentage of copper by plastic char was 86%. The decrease was uniform for both plastic char doses. The properties of plastic char, such as its high pH (11.27), ash content (36.68 %), and Electrical conductivity-EC (0.03 dS/m), likely contributed to increasing soil pH and facilitating Cu immobilization. Furthermore, the presence of functional groups such as C-H, C=O, OH, N-H, P-H and C-Cl and carboxylic acid-like functional groups on the surface of plastic char, along with its high fixed carbon content (48.14 %), likely supported the immobilization of Cu. In addition, it has 70 $cmol^{+}kg^{-1}$ at 550°C. These findings indicate that plastic char derived from UDD can be effectively utilized to immobilize Cu in contaminated soil. The pyrolysis of UDD represents a promising waste management practice that minimizes environmental pollution.

Keywords: Soil amendment; Disposable baby diapers; Immobilization; Plastic char

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Community resilience and pre-disaster management in cities: A policy analysis brief

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Nations across the globe are confronted with challenges to address climate hazards. Urban inhabitants are more vulnerable to climate change impacts. The demographics of the context associate the potential of prevention and reduction of consequences of disasters towards sustainable communities. However, policy instruments devised by the national governments to enhance community resilience have shown different impacts. The present narrative policy analysis aimed at evaluating the synergies and conflicts between the disaster management policy mixes and community resilience frameworks, stressing participatory management in brownfield redevelopment as a pre-disaster measure in urban settings. A qualitative research design of exploratory nature in the post-positivist paradigm was adopted. Relevant public policy documents and manuals complying with the laws and action principles of Sri Lanka, the United Kingdom, Australia, India and the United States of America representing the Westminster model and federalism were collected from reliable online sources and were comparatively assessed against the policy alternatives reinforced by the empirical evidence in the literature. The policy triangle framework based on Kingdon's Policy Stream Model was employed in the policy analysis. The agenda-setting phase of the policy cycle was focused. Issue characterization was considered the policy evaluation criterion. Results reveal that the state governments of Queensland and Victoria in Australia articulate the most comprehensive policy frameworks equipped with procedural and substantive policy instruments. However, none of the policies explicitly recognize community-led brownfield redevelopment as a pre-disaster measure, despite the land use planning and post-disaster rehabilitation. The included policies are mainly hierarchical; however, public awareness, social equity, and social inclusivity have been promoted. The present policy analysis outlines the potentiality of policy innovation in disaster management empowered by community engagement in urban brownfield regeneration as a pre-disaster measure to ameliorate community resilience. This evaluative summary supports informed decision-making in sustainable urban regeneration.

Keywords: Climate change; Climate hazards; Public participation; Societal resilience; Urban renewal

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Linking intraspecific leaf trait variability to species habitat associations in a diverse tropical rainforest

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Resource variation related to topography plays a major role in shaping local community structure in tropical rainforests. Functional trait differences can reflect the variation in species' responses to topographic associations. Generally, ridge or valley specialists are restricted to upper or lower-elevation habitats while generalists encompass different micro-environmental conditions within a plant community. We investigated if variation in leaf traits within a single species can reflect distinct relationships with landscape features in the lowland rainforest, in southwest Sri Lanka, focusing on locally abundant tree species. We hypothesized that generalists would display a greater degree of intraspecific variability in leaf traits than ridge and valley specialists because they are capable of being more plastic in their responses to the environment. We estimated Intraspecific Trait Variation (ITV) for 19 locally abundant tree species across two topographic habitats: Ridge and Valley, in the Sinharaja Forest Dynamics Plot (FDP). We measured Leaf Area (LA), Specific Leaf Area (SLA), Leaf dry Matter Content (LDMC), and Leaf Thickness (LT) on randomly selected individuals within the 1-5 cm DBH size class. For both specialists and generalists, we sampled 30 individuals from both habitats. We evaluated ITV as the Coefficient of Variation (CV) in leaf traits and performed separate ANOVAs for each trait to explore differences in ITV between habitat generalists, ridge specialists, and valley specialists. Our hypothesis that habitat generalists in Sinharaja would exhibit greater intraspecific variability in leaf traits is not supported, as there was no significant difference (p >0.05) in intraspecific trait variation (ITV) between generalists, ridge specialists, and valley specialists. We conclude that intraspecific variability in leaf traits fails to capture species habitat associations observed in this highly diverse tropical rainforest.

Keywords: Functional traits; Habitat associations; Intraspecific trait variation; Tropical trees

Paper ID: IRCUWU2023-57

Interspecific functional trait responses to environmental gradients in a diverse tropical rainforest in Southwest, Sri Lanka

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Understanding the influence of environmental gradients on the variability of functional traits among plant species is crucial for elucidating ecosystem functioning and species coexistence patterns. This study investigated how interspecific trait variation in key leaf functional traits shaped local plant communities along an elevational gradient in the lowland rainforest in southwest Sri Lanka. We hypothesized that in more resource-limited habitats, dominant species would have leaf trait values associated with conservative resource use. Leaf traits of juvenile trees were assessed across three distinct topographic habitats (ridge, slope, and valley) within the Sinharaja ForestGEO plot. Specific leaf area (SLA), leaf area (LA), leaf thickness (LT), and leaf dry mass content (LDMC) were measured for 35 dominant tree species in each habitat. The community-weighted mean (CWM) of leaf traits was compared among habitats. The results revealed notable variations in the CWM of leaf traits among the different topographic habitats. Specifically, the CWM of LDMC and LT was found to be higher on ridges compared to valleys ($p<0.05$), indicating a more conservative resource-use strategy in resource-limited habitats. The CWM of SLA and LA exhibited the highest values in the ridges and the lowest in the valley habitat ($p<0.05$), likely as a response to higher light availability, enabling species in this habitat to maximize their light-capturing capacity in the ridges. These findings highlight the role of functional trait values in shaping species associations with different topographic habitats at a local scale. However, considering additional factors beyond topography and incorporating intraspecific trait variation could enhance our understanding of trait-habitat associations. By providing insights into how environmental gradients influence interspecific trait variability, our study contributes to a better understanding of community assembly and species coexistence patterns in tropical rainforest ecosystems.

Keywords: Dominant species; Elevational gradient; Leaf traits; Topographic habitats.

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Stress responses and growth rate of *Ceratophyllum* sp. (Hornwort) exposed to different salinity levels

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Due to the highly dynamic nature of aquatic habitats, aquatic plants are extremely susceptible to a variety of pressures. Salinization of freshwater is one of these pressures that is currently having a substantial impact because of climate change and sea level rise. Plants' reactions to salinization are crucial for managing aquatic ecosystems. *Ceratophyllum* sp. was utilized as an experimental plant in this study in order to determine how aquatic macrophytes respond to salinity stress. In a complete random block design, 21 experimental units were randomly assigned to each of the seven treatments (normal water (0), 5, 10, 15, 20, 25, and 30 ppt), each of which had three replicates. A two-week experiment was conducted. Plant growth, pigment levels (total chlorophyll, chlorophyll-a, chlorophyll-b, and carotenoid), H_2O_2 concentration, peroxidase activity (POD), catalase activity (CAT), and microscopic cell observations were compared across treatments at the end of the experiment. Plants in the control (0 ppt) had the longest shoots, whereas the growth of all other plants was limited. With the exception of those exposed to 5 ppt salinity, all plants at the other salinity levels died within two weeks. The pigment content declined with exposure levels, as much as same the plant growth. In *Ceratophyllum* sp., salinity generated oxidative stress was detected as H_2O_2 contents dramatically increased concurrently with exposure to salinity levels, and a similar pattern was observed for POD and CAT activities. The current observations indicate that the plant experiences stress when subjected to salinities higher than those levels. Additionally, *Ceratophyllum* sp. has a limited tolerance, surviving only within salinity levels up to 5 ppt. Beyond 5 ppt of salinity, *Ceratophyllum* sp. cannot thrive. The selection of aquatic plants for aquatic ecosystem management, such as restoration programs, would undoubtedly benefit from these findings.

Keywords: Salinity stress; *Ceratophyllum* Sp.; Peroxidase activity; Catalase activity; H_2O_2 concentration

Paper ID: IRCUWU2023-69

Reflections on household level solid waste management behavior in the Moratuwa Municipal Council area, Sri Lanka

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The Moratuwa Municipal Council (MMC) area generates higher ocean debris in the Western Province of Sri Lanka. Hence, this study aims to analyze the reflections on household-level solid waste behavior in the MMC area, which were identified by the SEVANATHA Urban Resource Center under the baseline research findings of the 3R Action Plan for Zero Plastic Waste project, 2023. The quantitative data were collected through a questionnaire survey and qualitative data were collected through key informant interviews and forced group discussions in identified communities. 92% of the residents in the MMC area have handed over their segregated waste to the MMC's waste collection system and the other 8% of the residents have handed over their segregated waste to Informal Waste Collectors. However, most of the residents used to practice several improper waste disposal methods to manage their non-segregated waste while handing over segregated waste to MMC's collection system. 44% of residents are burning their non-segregated waste, 5% are selling non-segregated waste such as metal, PET bottles and cardboard, 17 % are burying or openly dumping non-segregated waste in their backyards, and 40 % are dumping non-segregated waste to the common grounds and water bodies. Moreover, 89% of the residents are well aware of the impacts of improper waste management on the environment and their health. In conclusion, dumping waste on the common grounds and water bodies in the MMC area is a critical environmental and social issue due to increasing ocean debris. Hence, changing the behaviors of the residents in the MMC area for improving household-level solid waste management practices is an impotent long-term recommendation, which is highlighted by this research. Moreover, strengthening the MMC's waste collection mechanism is a short-term solution for managing improper waste dumping and reducing ocean debris in the MMC area.

Keywords: Waste anagement behavior; Waste management; Waste segregation

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Sol-gel synthesized Fe_3O_4/MgO Nanocomposite: A magnetic sorbent for Cd(II) ions

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In recent years, the toxic nature of Cd(II) ions in aqueous solutions has garnered significant attention. This study investigates the potential of Fe_3O_4/MgO nanocomposites as highly effective adsorbents for Cd(II) removal, presenting a promising solution for environmental remediation. Synthesized nanocomposites by sol-gel method were examined in terms of adsorbing efficiency of Cd(II) ions. X-Ray Diffraction analysis confirmed the formation of well-crystallized Fe_3O_4/MgO nanocomposites with a face-centered cubic structure. Scanning Electron Microscope imaging revealed the presence of rod-like morphology, increasing the surface area and active sites available for effective interaction and Cd(II) ion removal. Furthermore, the spongy spherical morphology representing the magnetic Fe_3O_4 component enhanced overall stability, dispersibility, and magnetic responsiveness. Additionally, Vibrating Sample Magnetometer measurements demonstrated superparamagnetic behavior with a saturation magnetization of 30.19 emu g^{-1}, enabling easy separation via an external magnetic field. Adsorption experiments were conducted by varying the initial Cd(II) concentration, adsorbent dosage, pH, and reaction time. The initial Cd(II) concentration ranged from 200 to 800 mg L^{-1}, while the adsorbent dosage varied from 0.05 to 0.4 g L^{-1}. pH values of the solution were adjusted from 4 to 12, and the reaction time was set from 10 to 150 minutes. Results indicated an increase in adsorption capacity with higher initial Cd(II) concentrations and adsorbent dosages, peaking at 1592.37 mg g^{-1} for an initial Cd(II) concentration of 400 mg L^{-1} and adsorbent dosage of 0.25 g L^{-1}. The pH of the solution played a vital role, with a maximum removal efficiency of 99.5% observed at pH 9. Kinetic studies demonstrated that the pseudo-second-order model provided the best fit, indicating chemisorption as the dominant mechanism. Furthermore, the Langmuir isotherm model accurately described the adsorption behavior, suggesting monolayer coverage of Cd(II) ions on the Fe_3O_4/MgO nanocomposites. In conclusion, Fe_3O_4/MgO nanocomposites exhibited excellent potential for removing Cd(II) ions from aqueous solutions. With high adsorption capacity, efficient removal efficiency, and easy magnetic separation, these nanocomposites are promising for wastewater treatment applications.

Keywords: Chemisorptions; Monolayer coverage; Superparamagnetic behavior; Wastewater treatment

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Effect of organic manure amendments on soil water characteristic curve of topsoil

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Organic manure amendments such as coir dust, cow dung and compost play an important role in improving soil fertility. The objective of this study is to find the effect of organic manure amendments on the driest end of soil water characteristic curve of Agricultural soil. Soil properties were measured such as Texture, Bulk density, Total Organic Carbon (TOC) and Soil Water Content (SWC). Air-dried samples were prepared after keeping sandy clay loam soil samples for about two weeks at room temperature. The air-dried topsoil (0-5 cm depth) was mixed with cow dung, coir dust and compost particles (<2mm sieve) in different percentages (20%, 30%, 40%). The SWC of the manure-amended soil was changed by 2%, 4% and 6% by adding water and keeping it for two weeks for equilibrium in a sealed bag. The field water content of soil samples was measured by oven drying samples at 105 ^{0}C for 24h. Soil water potential for all prepared samples was measured using the WP4C dew point potentiometer which gives the pF values (pF = log |Ψ|, Ψ in cm H_2O). The pF value for air-dried topsoil is 5.72. The pF values for top soils at different SWCs are 5.42 at 0.019, 5.19 at 0.040 and 5.11 at 0.047. The pF values of soil with compost (40%) are 5.45 at 0.015, 5.22 at 0.025 and 5.10 at 0.033. The pF values of soil with coir dust (40%) are 5.19 at 0.064, 5.17 at 0.060 and 5.09 at 0.058. The pF values of soil with cow dung (40%) are 4.45 at 0.214, 4.40 at 0.271 and 4.39 at 0.265. Cow dung amended soil improves soil water retention more than the coir dust and compost. An increase in organic matter content led to an increase in water retention in sandy clay loam soil. Our experiment indicates that cow dung combined with sandy clay loam soil may improve soil water retention in the short-term study.

Keywords: Soil Water Content (SWC); Organic manure amendments; Soil Water retention

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Assessment of toxic trace metal accumulation in water, sediment, and aquatic plants in irrigation tanks, Anuradhapura Sri Lanka

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Heavy metal contamination in tank ecosystems is one of the major environmental concerns in the dry zone of Sri Lanka due to its toxicity and adverse effects on ecological health. Heavy metals dissolved in water or present as contaminants in sediments are directly exposed to the aquatic biota and are easily taken up by aquatic plants. This study was carried out to assess the concentration and correlation patterns of heavy metals in water, sediment, and aquatic plants (Lotus; *Nelumbo nucifera*, Water hyacinth; *Eichhornia crassipes*, Crested floating heart; *Nymphoides cristata*) in Kammalakkulama, Hammillewa, Kirindegama, and Madawalagama freshwater aquatic ecosystems in Anuradhapura district, Sri Lanka. Randomly collected samples were tested for total Cadmium (Cd), Arsenic (As), Lead (Pb), and Mercury (Hg) using inductively coupled plasma mass spectrometry (ICP-MS). The limits of detection (LOD) and quantification (LOQ) were established for Cd, As, Pb, and Hg. The results indicated a significant difference ($p < 0.05$) in the detected concentrations of heavy metal levels in tested samples among the tanks. The heavy metal levels in water samples were recorded below the maximum permissible limit according to the WHO/FAO standards. The highest concentration in water was detected for Pb (23.001 $\mu g L^{-1}$) in the Hammillewa tank. For sediment samples, the highest metal concentration (11.518 mg kg^{-1}) was recorded for Pb in the Madawalagama tank, while the lowest metal concentration (0.006 mg kg^{-1}) was recorded for Hg in the Kirindegama tank. The accumulation levels of these heavy metals were higher in the aquatic plant roots compared to their leaves in most of the samples. According to the Pearson correlation analysis, a significant positive correlation (Correlation coefficient > 0.9) was shown for the sediment with Lotus roots and leaves in the Kammalakkulama and Madawalagama tanks, and further for the sediment with Crested floating heart root samples in the Hammillewa tank. The results indicate that all the study sites were contaminated with at least one of these heavy metals. Therefore, immediate actions are required to mitigate the heavy metal accumulation in aquatic ecosystems to ensure environmental sustainability in the Anuradhapura district.

Keywords: Accumulation; Irrigation Tanks; Toxic trace metals; ICP-MS; Pearson Correlation

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Microplastic accumulation in the sediment of Rekawa lagoon, Sri Lanka

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Currently, microplastics have become a major threat to all ecosystems both aquatic and terrestrial. Those microplastics have been discovered in sediment samples in most areas around the world. The present study is accomplished to understand the microplastic abundance in the Rekawa lagoon area in Sri Lanka as the first such study carried out in this area. The sediment samples were collected from randomly chosen three sites (6° 2'30.25"N, 80°49'19.59"E, 6° 3'8.44"N, 80°49'37.61"E, 6° 3'16.09"N, 80°50'15.84"E) in Rekawa lagoon. At each site, four replicants' samples were collected from three different places within a 1m distance. Organic parts in samples were digested with 40ml of 30% H_2O_2 at room temperature. The density separation method was used to allocate microplastic from the sediment sample by using 110ml of saturated NaCl solution (1.2g/ml) and filtered using a membrane flirtation unit through whatman filter paper (11um pore size). Filter papers were stained using Nile red solution. After drying, filter papers were observed using blue light under the microscope at 10×4.5 magnification. The concentration of microplastics in these three sites was significantly different (5.12 items/ gram in site 01, 1.41 items/ gram in site 02, and 0.91 items/gram in site 03) including Fibers, fragments, and films. According to the Kruskal Walis test, the mean abundance of microplastics was significantly different in all three sites, where the lowest was observed at site 03 (0.91 item /gram) and the highest was observed at site 01 (5.12 item/ gram). The blue color (44%) was dominant in all three locations and the fragment shape was mostly abundant in all samples. Microplastic was distributed throughout the lagoon due to anthropogenic and hydrologic activities. Microplastics in lagoon sediments' ability to modify sediment composition, alter physical structures, and act as carriers of toxic pollutants underscores the potential harm they can inflict upon benthic organisms, aquatic life, and even human health through the food chain.

Keywords: Microplastics; Rekawa Lagoon; Sediment; Sri Lanka

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Exploring the life cycles of two natural enemies of water hyacinth in Sri Lanka

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Eichhornia crassipes (Mart.) Solms (Water hyacinth), has become a highly invasive weed in many inland water reservoirs in Sri Lanka. The use of natural predators, such as *Neochetina eichhorniae* and *Neochetina bruchi* weevils, may help control the growth of water hyacinths. However, no or few studies have been conducted to explore the life cycles of *Neochetina eichhorniae* and *Neochetina bruchi* on water hyacinth under local conditions. Hence, this study was aimed at exploring the lifecycles of *Neochetina eichhorniae* and *Neochetina bruchi* under laboratory conditions while determining an effective method for obtaining higher hatchability of eggs for successful mass rearing. Accordingly, egg development was investigated under four treatments, namely eggs mounted inside the leaf petioles, eggs mounted on the outer surface of leaf petioles, eggs mounted on leaf discs, and eggs mounted on wet tissues. The experiment was laid out in a Complete Randomized Design, including three replications where one day old 10 eggs were introduced randomly to each replicate. Morphological characterization was performed for the egg, larval, and adult stages. Durations for egg, larval, pupal, and adult stages of development were investigated. Results revealed that eggs mounted inside leaf petioles yielded the highest hatchability for *Neochetina bruchi*, whereas eggs mounted on leaf discs were most effective for *Neochetina eichhorniae*. In morphological characterization, distinct features were identified, including geniculate antennae type, chewing mouthparts, and legs with small claws, which may be helpful to get approximations of their evolutionary relationships. Overall, the knowledge gained from this study will help maximize the output of mass rearing methods which would assure the periodical release of these natural enemies in water hyacinth-invaded reservoirs.

Keywords: Water hyacinth; *Neochetina eichhorniae*; *Neochetina bruchi*; hatchability; morphological characterization

Paper ID: IRCUWU2023-241

Farmer survey and analysis of pesticide residue levels in 'Gotukola' (*Centella asiatica)* and 'Mukunuwenna' (*Alternanthera sessilis*) exported to the European Union

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The level of pesticide residues is one of the important parameters that determine the safety of food. In the year 2023, with respect to the maximum pesticide residue limits (MRL), several non-compliances were reported with the consignments of 'Gotukola' (*Centella asiatica)* and Mukunuwenna' (*Alternanthera sessilis*) exported from Sri Lanka to the European Union (EU). Therefore, this study was conducted to gather information about pesticide usage in 'Gotukola' and 'Mukunuwenna' cultivations in Sri Lanka and to determine the residual levels of widely used pesticides. Information on pesticide usage and practices were collected using a pre-tested questionnaire from all 15 farmers registered at the National Plant Quarantine Service (NPQS). Samples were collected from 18 farmer fields which are located in Puttalam and Kaluthara Districts, Sri Lanka. Samples were extracted according to the quick, easy, cheap, efficient, rugged, safe (QuEChERS) method (AOAC official method 2007.01) and pesticide residues were quantified by LC/MS/MS method. Eight insecticides (Abamectin, Sulfoxaflor, Diafenthiuron, Imidacloprid, Chlorantranipol+ Thiamethoxam, Emamectin Benzoate, Tebufenozide and Pymetrozine) and five fungicides (Mancozeb Chlorothalonil, Pyraclostrobin+Metiram, Mancozeb+Metalaxyl and Azoxyxtrobin) were found to be widely used by the growers. Lack of awareness about pesticide recommendations and non-adherence to pesticide recommendations, pre-harvest intervals, integrated pest management strategies, and pesticide usage instructions were identified as malpractices at the farmer level. According to the results, Fipronil, Imidacloprid, Profenofos and Tebuconazole were the mostly detected active ingredients in the tested samples. Further, 42.9% of the tested 'Gotukola' samples and 16.7% of the tested 'Mukunuwenna' samples contained at least one of the tested pesticides. Fipronil and Metalaxyl contents in 8.3%of tested 'Mukunuwenna' samples exceeded the EU MRL (5ppb for both pesticides). Whereas Fipronil, Profenofos and Tebuconazole contents in 21.4%, 14.3% and 14.3% of tested 'Gotukola' samples exceeded the EU MRL (5ppb, 5ppb and 50ppb respectively). Farmer awareness of pesticide usage and good agricultural practices will be useful to maintain the pesticide residue levels in 'Gotukola' and Mukunuwenna' cultivated for export purposes. Further, it is suggested that policymakers scrutinize the farmer registration and surveillance procedures.

Keywords: *Alternanthera sessilis; Centella asiatica;* maximum residue limits; pesticide residues

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Alternatives for plastic to achieve zero plastic framework in Uva Wellassa University of Sri Lanka

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This research focuses on the Uva Wellassa University (UWU) community's perspective toward the awareness of a zero-plastic university concept and participation in sustainable biodegradable alternatives. Data from cafeterias, the Biosystems technology laboratory and the outlet of the UWU were used to determine the main plastic items influencing the university environment. Data was collected using a questionnaire survey method and it was analyzed using Minitab 17 and identified that polyethylene sheets cause the most environmental damage (30.310±4.51/ day) on the university premises. Due to rapid UWU community growth in recent years, monthly or annual plastic waste generation is expected to increase by 33.33 %, making waste collection and solid waste management harder. The study identifies the need for both re-usage practices and alternative usage approaches for moving towards a zero-plastic community. At the same time, biodegradable and cost-effective alternatives were developed based on sustainable materials such as bagasse (B), bagasse dust (DB), white corn flour (WC), yellow corn flour (YC), kurakkan flour (K) and banana peel (BP) waste. Samples of alternative options were labeled as B-WC, DB-WC, DB-YC, DB-K and BP and analyzed for water absorption, solubility, moisture content, tensile test and biodegradability. Samples of B-WC reported significantly the lowest moisture content (9.110±0.01%) and water absorption rate (38.370±0.00%), highest tensile strength surpassing all others. DB-K had the highest degradation rate and BP was found to be insoluble in water by the solubility test. Based on the study B-WC is identified as a more effective intervention and less cost. Moreover, the usage, acceptability, advantages and disadvantages of alternatives to plastic in the UWU community will be further studied.

Keywords: Plastic waste; University community; Biodegradable; Zero-plastic concept; Bagasse; Banana peel

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Investigating climatic change by analysing rainfall data in Badulla district

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Although Sri Lanka has a tropical climate significant characteristic changes have been observed both during dry and wet seasons. Badulla district is an administrative area of Sri Lanka and it is an agricultural district where vegetables, tea, fruits and paddy are cultivated. The main city of Badulla district is Badulla and its geographical coordinates are 6.98472°N, 81.05639°E. The aim of this study was to investigate the climatic change in Badulla district by studying the monthly, seasonal and annual rainfall trends over Badulla district based on daily rainfall data for a period of thirty years from 1990 to 2020. Because Badulla district in Sri Lanka faces climate change, which impacts rainfall patterns and traditional water resource management techniques, requiring predictable rainfall. The analysis of the climatic change in Badulla district the baseline data were prepared by using the daily rainfall data of 11 rainfall gauge stations and were collected from the Meteorological Department of Sri Lanka. The data were analyzed by using nonparametric statistical tests such as Mann-Kendall and Sen's slope tests and interpreted by using the graphical method from R Studio. According to the results of the graphical method in December 2017 Debadda Estate and in July 2015 Ledgerwatte were shown as the maximum and minimum values respectively. The values are 2700 mm and 25.6 mm. In statistical methods, Ella, Kirklees Estate, and Ledgerwatte showed significant trends. According to the annual results in 2017 Debadda Estate and in 1998 Welimada Estate showed maximum and minimum rainfall values, respectively. The values are 2698.5 mm and 50.7 mm. Under the statistical method, Kirklees Estate and Ledgerwatte showed significant trends. In seasonal analysis, NEM and SIM showed the highest trends for both methods. The results of the statistical method were taken based on the *p* and *z* values. If the *p* value is less than 0.05 the results show a significant trend. Therefore, according to the results, it can be concluded that there is a climatic change in Badulla district over the period from 1990 to 2020.

Keywords: Climate change; Rainfall data analysis; Non parametric statistical tests; Mann-Kendall test; Sen's slope method.

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Assessment of hydrological characteristics of Amban ganga sub-basin of Mahaweli river basin using morphometric analysis of spatially derived data

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Amban Ganga is one of the major tributaries of the Mahaweli River which is the longest river in Sri Lanka. It originates in Matale District and travels for about 81 km before joining the Mahaweli River at Tunmodara in the Manampitiya Flood Plains National Park. Despite its hydrological and ecological significance, a detailed morphometric analysis of the Amban Ganga Basin has so far not been performed. This study analyzes morphometric parameters of Amban Ganga using Geographic Information Systems in order to estimate its soil erosion and flood characteristics. The spatial data for the study were gathered using the DEM derived from a 20 m contour map and various linear, areal and relief aspects of morphometric parameters were determined. The results of the study revealed that the stream network of Amban Ganga extends up to Strahler's 7th order showing a dendritic drainage pattern. The total number of streams in the Amban Ganga river network was 8581 spreading over 3947 km^2. The mean bifurcation ratio was 4.34, which indicated that the sub-basin generates a longer and flatter direct runoff with a low risk for flooding. Drainage density was 2.54 km/km^2 confirming the availability of highly permeable subsurface materials under dense vegetative cover. The stream frequency value was 5.51 indicating a low relief and high infiltration capacity of the bedrock generating less runoff within the basin. The form factor and circularity ratio of the sub-basin were 0.27 and 0.31 respectively, indicating that the drainage basin is more elongated in nature. The elongation ratio was 0.59 which also confirms that the basin is more towards an elongated shape. Basin relief was 1.8 km and the relief ratio was 0.02 reflecting a somewhat lower relief in the study area, indicating less susceptibility for soil erosion. Hence the results of this study provide valuable information about the hydrological characteristics and the soil erosion potential of the Amban Ganga sub-basin and such details elucidate the decision-making and implementation of sustainable watershed management strategies in the Mahaweli River Basin of Sri Lanka.

Keywords: Geographic Information Systems; Morphometric analysis; Runoff characteristics; Soil erosion susceptibility; Spatial data

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Sri Lankan low quality tourmaline as a novel adsorbent for the removal of lead and copper in aqueous media

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Industrial processes produce metal and chemical wastes with toxic heavy metals, polluting water resources. Adsorption techniques are widely used in purification processes. This preliminary study centers on the adsorption of lead (Pb) and copper (Cu) onto low-grade black tourmaline, a complex borosilicate mineral, in batch and column experiments. The tourmaline particles were characterized using X-ray Diffraction Spectroscopy, Fourier Transform Infrared Spectroscopy, X-Ray Fluorescence Spectroscopy and Particle Size Analysis. In batch adsorption, variables such as adsorbent dose, pH, and initial concentration were examined. Both Pb and Cu adsorption well behaved in the pseudo-second-order kinetic model derived from correlation coefficient values of kinetic studies. The column study employed tourmaline particles below 75 µm, with a 1 cm diameter and 20 cm length column. Breakthrough curves were analyzed for different bed heights (3.5 cm, 5.0 cm, and 7.5 cm) and initial concentrations (25 mg/L, 50 mg/L and 100 mg/L) at a constant flow rate of 0.5 mL/min. Results suggested optimal conditions emerged with lower initial concentrations (25 mg/L) and higher bed heights (7.5 cm) at a pH of 4. Comparing column and batch studies via isotherm analysis favored the column approach. The breakthrough curves were analyzed at different conditions using Thomas and Yoon-Nelson models to estimate the column adsorption behaviors. The maximum Thomas adsorption capacity was achieved up to 9.13 mg/g for Pb and 6.03 mg/g for Cu. The Yoon-Nelson model indicated that the time required for 50% retention (τ) was decreased with higher initial inlet concentrations, potentially due to quicker column saturation. Meanwhile, τ values were increased with elevated bed heights, indicating slower column saturation. Since the low-grade Sri Lankan tourmaline is still not employed in heavy metal removal, this finding would provide valuable insights into developing new material for removing heavy metals from the environment.

Keywords: Tourmaline; Breakthrough curves; Thomas; Yoon-Nelson; Adsorption

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Floristic features of plant associations harbouring S*temonoporu*s species in the peak wilderness conservation area

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The genus *Stemonoporus* of the Family Dipterocarpaceae is the most speciose endemic genus in Sri Lanka, and its species are mainly confined to the wet zone of Sri Lanka. Knowing the floristic features of the vegetation with different *Stemonoporus* species is crucial in determining conservation measures for these threatened species. The present study aims to determine the floristic features of plant associations with *Stemonoporus* species in the Peak Wilderness Conservation Area (PWCA) and investigate the threat of invasion by alien exotic plant species on the site. Twenty two 10 x 15 m^2 experimental plots were established over a 72 km^2 area of PWCA at randomly chosen locations where *Stemonoporus* species were present. Vegetation taller than 1 m was recorded and enumerated if the diameter at breast height (dbh) of plants was ≥ 10 cm. Seedlings of *Stemonoporus* species (≤1 m tall) were recorded in 2 x 2 m^2 quadrats in each plot. Results of the Detrended Correspondence analysis of 133 plant species in 22 experimental plots revealed three major clusters. *Agrostistachys borneensis* and *S. rigidus* were among the most dominant species in both clusters 1 and 2, but other secondary forest species such as *Kendrickia walkeri* and *Pothos hookeri* were also abundant in the latter, indicating rather mild disturbances occurred in the same vegetation. Two *Stemonoporus* species, namely *S. oblongifolius* and *S. rigidus* were found to be grown in plots in Clusters 1 and 2. *Actinodaphne elegans*, *Lasianthus gardneri* and *Ardisia solanacea* were the dominant species in cluster 3, and *S. gardneri* and *S. rigidus* were found to be grown in this plant association. The stem density (≥ 5cm) (p=0.799) and species richness (p= 0.561) in the vegetation of these three clusters were not significantly different. Further, alien exotic *Clidemia hirta*, a plant species with weak invasive potential was reported in more than 50% of the established plots. Seedlings of all recorded *Stemonoporus* species except *S. gardneri* were found in the area. The distorted population structure of *S. gardneri* could be due to prevailing threats to its natural regeneration or to the seedling bank, and therefore, it is essential to implement appropriate conservation measures to protect this *Stemonoporus* species.

Keywords: Dominant species; Endemic plants; Invasive plants; Plant diversity; Stem Density; Threatened Species

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Investigate physicochemical and mechanical properties of potential native tree species for manufacturing toothpicks

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Toothpicks have been used for centuries as a tool for oral hygiene and are still widely utilized in various cultures worldwide. However, in recent decades, Sri Lanka has been heavily dependent on imported toothpicks despite having the potential for local manufacturing. Addressing this dependence on imports and promoting the utilization of local resources is of utmost importance. Therefore, it is crucial to understand the physicochemical and mechanical properties of native tree species in Sri Lanka, which are relevant to toothpick production. This study aims to investigate such properties in *Gmelina arborea* (Athdemata), *Symplocos cochinchinensis* (Boombu), *Acronychia pedunculata* (Ankenda), *Neolitsea cassia* (Dawul Kurundu), and *Cinnamomum verum* (Cinnamon). Wood samples from the selected species were prepared as toothpick specimens. A market requirement analysis was conducted using a Google survey to gather information on toothpick usage and consumer experiences. The wood specimens underwent various tests, including color comparison, stress and strain measurements, break tests, modulus of elasticity tests, density measurements, and moisture content percentage calculations. Additionally, sensory evaluation tests, such as hedonic rating tests, paired difference/comparison tests, and consumer preference tests were conducted. Statistical methods and Minitab software were employed for data analysis. The results of this study revealed a preference for locally produced toothpicks over imported ones, highlighting potential market opportunities for domestic manufacturers. Mechanical testing of different wood samples demonstrated variations in breaking strength, flexural modulus, wood density, and moisture content. *A. pedunculata*, *S. cochinchinensis*, and *N cassia* woods exhibited higher breaking strengths, making them suitable for toothpick production. In terms of sensory evaluation, *A. pedunculata* toothpicks were favored for color, appearance, and overall acceptance. A majority of participants also preferred cinnamon-scented toothpicks in aroma preference tests. These findings provide valuable insights for toothpick manufacturers and marketers, enabling them to understand consumer preferences and mechanical properties crucial for successful product development. Furthermore, future research could explore other wood species or eco-friendly materials for toothpick production, investigating their mechanical properties, consumer preferences, and sustainability. This knowledge can potentially diversify toothpick options in the market, enhancing consumer satisfaction and promoting market success.

Keywords: Toothpicks; Native wood species; Mechanical properties; Wood

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Evaluation of Phosphate solubilizing ability of *Aspergillus* spp.

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Phosphorous (P) is an essential plant nutrient, which is second only to Nitrogen and Potassium. However, it shows low bioavailability and leading P scarcity of plants. Utilizing conventional chemical phosphate fertilizers causes adverse environmental issues. Phosphate-solubilizing fungi (PSF) play an important role in increasing the bioavailability of phosphorus in soils for plants. Two *Aspergillus* strains were isolated from the soil by using National Botanical Research Institute's Phosphate (NBRIP) media. High Graded Eppawala Rock Phosphate (HERP) solubilizing ability of these two *Aspergillus* strains was quantified by UV visible spectrophotometer according to molybdenum blue method in a previously published study. The effect of the combination of two fungi on phosphate solubilization was evaluated by conducting a solubility assay with the fungal inocula as 1:1, 1:2 and 2:1 of *Aspergillus* species 1: *Aspergillus* species 2. Fungal spore solution (1×10^8 spores per mL) was added to NBRIP broth (inoculum: broth =1:9) containing HERP as the sole P source. The fluctuation of the pH of the medium was also measured. The absorbance and pH readings were obtained after every 24 hours from the inoculation. Data analysis was done by a two-way ANOVA using R software. There is a significant difference ($p<0.05$) in phosphate solubilization of inocula 1:2 and 1:1 and 2:1 and 1:1 of *Aspergillus* species 1: *Aspergillus* species 2. Combinations 2:1 and 1:2 did not show a significant difference. HERP solubilization was significantly different between 2 subsets of incubation periods; day 0-2, and day 3-8 ($p<0.05$), although there was no significant difference in HERP solubilization within those subsets. According to the results, it can be concluded that *Aspergillus* spp. has the potential to solubilize HERP for sustainable utilization of the Eppawala P deposit. According to the results of this study and previously published studies, the effect of a single *Aspergillus* sp. is more efficient than the effect of a combination of *Aspergillus* spp. on the solubilization of HERP.

Keywords: Phosphate; Solubilization; Fungi; *Aspergillus*; HERP

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Infaunal abundance of Polhena reef lagoon, Matara, Sri Lanka

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Invertebrates living within the matrix of marine sediments are known as benthic infauna. This consortium of infaunal groups plays a major role in the production, accumulation, and transfer of organic matter within coral reefs. They often include Polychaetes, Nemerteans, Cnidarians, Oligochaetes, Echiurans, Sipunculids, and Bivalves. Additionally, there are crustaceans such as Isopods and Amphipods. Polhena fringing reef lagoon is a tourist beach in Southern Sri Lanka that is constantly subjected to anthropogenic activities, yet no studies on benthic infauna have been conducted there. Infauna samples were collected from the Polhena fringing reef lagoon (latitude 5.9363° N and longitude 80.5263° E) from October 21, 2022, to January 6, 2023, using a Poly Vinyl Chloride tube corer with a sampling depth of 20 cm. The collected samples were analyzed to identify the major infauna species and determine their abundance. After removing the infauna, soil samples were analyzed for particulate organic matter (POM). The identification of preserved infauna was performed using microscopic digital photography and taxonomic guides. A total of 71 infauna species were recognized from 16 samples. The results showed that the majority of the species belonged to the phylum Annelida (53%), with the Family Neriididae (39.47%) dominating. Other reported phyla included Cnidaria (18%), Mollusca (11%), Arthropoda (7%), Chordata (1%), and the remaining species were unidentified (9%). Other recognized annelid families included Glyceridae, Sipunculidae, and Terebellidae. The particulate organic matter content of the samples ranged between 4.5% and 6.5% w/w, indicating healthy levels that can support infaunal communities as a food supply and provide nutrients for reef-building corals and marine plants. Further studies are essential to describe the trophic dynamics associated with the coral reef food web in the Polhena reef and compare them with existing literature.

Keywords: Benthic Infauna; Organic Matter Content; Fringing Reef; Annelida

Paper ID: IRCUWU2023-438

Investigating the effect of Mg(II) on electrolysis removal of hexavalent Chromium in wastewater

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Hexavalent chromium (Cr (VI)) is a significant environmental hazard due to its non-biodegradable nature, extremely poisonous, and carcinogenic properties. The tannery industry, electroplating, metal finishing, dying industry, and many more industries are discharging chromium in wastewater. In this study, an electrolysis system (stainless steel cathode and pt anode) was used to remove Cr(VI) from synthetically produced wastewater concentrations ranging from 5, 10, and 20mg/L while sodium chloride was utilized as a supporting electrolyte (1 g/L). A square-shaped reactor with a 600 mL capacity, was electrolyzed with 0.25A of constant current, for 30 minutes duration (Charge loading 1500 C/L). The effect of initial ion concentration on the removal of Cr(VI) was investigated with different levels of Mg(II) (ranging from 5-100mg/L). The maximum Cr(VI) removal (67%), was achieved with an initial Mg(II) concentration of 100mg/L for 5 mg/L, Cr(VI) contaminated wastewater. When the Cr(VI) concentration was 10mg/L, the maximum removal efficiency was found 48.14%. At a Cr(VI) concentration of 20 mg/L, the highest removal efficiency was 31.56%. In the electrolysis system, metallic hydroxide like $Mg(OH)_2$ was created when Mg(II) reacted with OH^-, and this hydroxide was able to remove Cr(VI) from water and Cr(VI) removed by both co-precipitation and by Coulomb forces. Accordingly, the Cr(VI) removal efficiency was decreased as the initial Cr(VI) concentration was increased at particular Mg(II) concentrations. This is because an inadequate amount of coagulant formed ($Mg(OH)_2$) and, with the increase of Cr(VI) concentration.

Keywords: Co-precipitation; Electrolysis; Hexavalent Chromium; Mg(II)

Paper ID: IRCUWU2023-453

Qualitative assessment of phytoremediation potential for textile waste sludge to remove microplastics from textile sludge using floating aquatic macrophytes

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Microplastics (MPs) (less than 5 mm in length) are minuscule fragments of any type of plastic that originate from various types of larger plastic materials. Due to their small particle size, these particles disperse throughout ecosystems and persist for a long period of time, posing a significant threat to the environment. The Sri Lankan textile industry is a major contributor to the release of MP fibers into the environment. Therefore, there is a growing concern for sustainable methods to treat MPs in wastewater generated from the textile industry. This study primarily aimed to evaluate the efficiency of the phytoremediation process using *Eichhornia crassipes* as a potential solution for treating MPs. Firstly, The MPs in the textile sludge were initially identified using optical microscopic studies before plants were grown. In this preliminary analysis, polarized light optical microscopy was employed to ascertain the birefringence characteristics of the MPs present in the textile sludge. Following the density separation process, the MPs within the textile sludge were readily identified through a thorough examination of the Whatman filter paper (with an 11µm pore size) using an optical microscope. Then, the macrophytes were grown in a pot with textile waste sludge and kept for 45 days. Then, they were harvested and subjected to further analysis. The accumulation of MPs in different plant parts, including the roots, stems, and leaves was determined using optical microscopy. To understand the nature of the chemical bonds and the composition of the adsorbed MPs, FTIR spectroscopic techniques were also carried out. After 45 days, the microscopic results of *E. crassipes* indicated that the majority of particle-type MPs were accumulated in the leaves, while a significant number of fibrous-type MPs were identified in the root area. Therefore, *E. crassipes* showed potential for being a suitable accumulator plant for effectively treating MPs in sludge. With these insights, further studies are recommended to quantitatively assess the MP hyperaccumulator potential of these floating aquatic macrophytes and optimize their hyperaccumulation.

Keywords: Floating aquatic macrophytes; *Eichhornia crassipes*; Microplastic hyperaccumulation; Textile industry

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Morphological characterization of wild macrofungi from Passara Tea Research Institute and surroundings in the mid-country intermediate zone IM3B of Sri Lanka

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The term macrofungi includes fungi that exhibit identifiable fruiting bodies and they are evolutionarily divided into two branches known as Ascomycetes and Basidiomycetes. A plethora of research has been conducted worldwide on various aspects of macrofungi to uncover their ecological and economic values and benefits. However, in Sri Lanka, studies conducted on macrofungi remain limited, and their diversity in different climatic zones is inadequately known to science. Thus, the present study aims to characterize macrofungi in the Passara TRI located in the mid-country intermediate zone IM3b of Sri Lanka. Thirteen different macrofungi specimens were collected from an undisturbed forest area (0.4 ha) within the Passara TRI and subjected to detailed characterization using macromorphological (e.g., characteristics of pileus, lamellae, lamellulae, stipe, and volva) and micromorphological (e.g., characteristics of basidia, hyphal details, presence and nature of cystidia, presence of clamp connections, basidiospores, number of sterigmata, mean spore length, mean spore width) features. Furthermore, they were morphologically identified up to the genus level using the aforementioned characteristics, as well as spore-print characteristics, ecological factors, edaphic factors, and habitat characteristics. Accordingly, three specimens belonging to the genus *Marasmius*, three specimens belonging to the genus *Coprinopsis*, two specimens belonging to the genus *Conocybe*, and one specimen each representing the genera *Condolleomyces*, *Coprinellus*, *Cyptotrama*, *Filoboletus*, *Gyrodontium*, *Oudemansiella*, *Pluteus*, and *Psathryrella*, were identified. The specimen belonging to the genus *Filoboletus* was found to exhibit bioluminescent properties. *Marasmius* spp. were found in association with decaying leaves, rotting branches, and twigs, while *Coprinopsis* spp. were detected in habitats of leaf litter mixed with humus soil. And the majority of the specimens were identified as saprotrophs. Thus, our results indicate a rich diversity of macrofungi in the selected area. Despite the broad diversity of macrofungi in the country, cryptic speciation, misidentifications, misconceptions, and myths have limited the accurate estimation of macrofungal diversity in Sri Lanka. Furthermore, scattered data from different sources and locations, along with a lack of technology, have made the situation more complicated. Hence, extended studies strengthened with molecular phylogenetic analysis are currently underway to draw accurate conclusions regarding identifying the above specimens.

Keywords: Macrofungi diversity; Macrofungi habitat; Macrofungi identification

Paper ID: IRCUWU2023-484

Tourism and marine chemical pollution: A global analysis

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Coastal and marine areas are popular tourist destinations across the globe. The environmental impacts of tourist activities increase when visitors exceed the environment's capacity to handle their presence, despite the economic benefits they bring. The marine environment receives chemical contaminants from the sources including tourism activities (i.e. boating, beach showers, cruise shipping) and effluents and wastes from tourist hotels and recreational establishments. Most studies conducted on marine pollution caused by tourism are based on field monitoring of a limited area or region, which may not accurately represent the global scale of the issue. Chemical contaminant concentration data were gathered from global literature (110 studies) for chemical pollution in coastal and marine tourist destinations in the environmental matrices including seawater, marine sediment and marine biota. Articles were screened through Google Scholar and Web of Science databases. The field studies' quality assurance and quality control procedures were thoroughly assessed for article inclusion. Studies published over the past 22 years were considered, and the data were analyzed using a meta-analytic approach. As the results indicated, the most frequently detected chemical classes were pharmaceuticals, UV filters, toxic trace metals, nutrient pollutants, polycyclic aromatic hydrocarbons and synthetic musks. Most predominantly reported compounds were benzophenone-3, 4 methyl benzylidene camphor, octocrylene, nitrate, phosphate, cadmium and iron among 71 chemical contaminants. Ranges of chemical concentrations in surface water, sediment and biota were 0.09 ng/L-51000µg/L,0.02 ng/g-37990 µg/g and 0.11ng/g-240 µg/g, respectively. A negligible correlation between tourist arrival and chemical water pollution(r=-0.087) was identified. There was a significant difference between tourism activities (cruise shipping, boating, water sports and tourist-hotel stay) with reference to chemical pollution (p<0.05). The highest chemical concentration was sourced from cruise shipping compared to the other tourism activities in seawater and sediment. Boating is the highest significant contributor of chemical contaminants in biota compared to other activities. There was a significant difference between regions (Atlantic Ocean, Indian Ocean and Pacific Ocean) and chemical contaminant concentrations (p<0.05). This study provides information on possible sources of chemical pollution by coastal and marine tourism activities which will be useful for developing chemical pollution mitigation strategies in coastal and marine tourism destinations.

Keywords: Aqua ecotourism; Chemical contaminants; Marine pollution; Recreational activities

Food Science & Bioprocesses

Paper ID: IRCUWU2023-40

Assessment of functional properties of Jackfruit (*Artocarpus heterophyllus* L.) seed flour: A comparison of hot-air-drying and freeze-drying methods

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Jackfruit seeds are a readily available, but underutilized rich source of flour with a significant nutritional profile. The functional properties of flour are crucial in its performance in formulating bakery products and can be varied with the drying technique. This study investigated the effects of hot-air-drying and freeze-drying methods on the functional properties of jackfruit seed flour (JSF). Jackfruit seeds from fully mature fruits were collected, cleaned, lye-peeled, sliced, and dried using two different drying techniques, ground, and sieved to acquire the JSF. Bulk density, water absorption index, oil absorption index, least gelation concentration, swelling power, water solubility index, emulsifying capacity, emulsifying stability, foaming capacity, and forming stability of the JSF obtained from the two drying methods were determined and compared. A significant difference (p<0.05) between bulk density, water absorption index, oil absorption index, swelling power, water solubility index, emulsifying activity, emulsifying stability, foaming capacity, and foaming stability between hot-air-dried and freeze-dried flours was observed while no significant difference (p>0.05) was observed in the least gelation concentration. The bulk density (0.94±0.03 gmL^{-1}), water solubility index (22.68±4.04%), emulsifying activity (1.49±0.01%), emulsifying stability (1.9±0.1%), forming capacity (20.3±2.0%), and forming stability (20.2±2.0%) of hot-air-dried JSF sample were significantly higher than the freeze-dried sample. However, the water absorption index (2.52±0.13%), oil absorption index (2.51±0.13 mLg^{-1}), and swelling power (6.37±0.34) of freeze-dried JSF were significantly higher (p<0.05) than hot-air-dried JSF. The moisture content of freeze-dried JSF (5.18±0.2%) was significantly lower (p<0.05) than that of hot-air-dried JSF (8.77±0.1%). The present study reveals that the drying method can significantly affect the functional properties of JSF, thus the applications in the food industry.

Keywords: Freeze-drying; Functional properties; Hot-air-drying; Jackfruit seed flour

Paper ID: IRCUWU2023-157

Development of ready-to-cook rohu (*Labeo rohita*) products using traditional methods

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Fish and fish products, known for their high-quality protein and essential nutrients, have witnessed increased demand for Ready-to-cook (RTC) food market. Fish consumption is vital for protein intake, but limited availability, taste preferences, and preparation inconvenience hinder the consumption of inland fish. This study aims to identify a suitable traditional fish recipe to produce a ready-to-cook fish product using rohu (*Labeo rohita*). Sixty traditional freshwater fish recipes were collected from the Tamil community in central, eastern, and northern provinces in Sri Lanka. Based on ingredient and cooking method similarities, eight recipes were prepared for the trial cooking process. Fresh rohu fish was sourced from the Handapanagala reservoir in Monoragala and day one fish muscle nutrient analysis was done. Sensory evaluation carried out using a 9-point hedonic scale with 30 untrained panel members to assess the appearance, texture, color, aroma, taste, and overall acceptability led to the selection of mango-incorporated, tamarind-incorporated, and fried-rohu-tomato. These products were then chosen for further analysis, including Keeping quality tests (pH, 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, thiobarbituric acid reactive substances (TBARS) assay), Physical properties analysis (water holding capacity, cooking loss, texture profile analysis), and to confirm the protein hydrolysis, SDS page was performed in the weekly interval. A significant difference ($p<0.05$) was observed in pH values between day 01 vs Day 07 for all treatments. pH consistently remained below 7.00, indicating a favorable shelf life of up to day 28. Mango & tamarind incorporated exhibited the lowest lipid oxidation values throughout the storage period (<3 mg MDA/kg). Mango-incorporated had the highest DPPH values (46.05± 3.47) on Day 01, suggesting potentially higher initial antioxidant activity. Cooking loss significantly ($p<0.05$) varied over time for each treatment. Mango-incorporated had the highest and fried-rohu-tomato had the lowest, overall cooking loss. Mango-incorporated exhibited highest water-holding capacity, there were no significant differences ($p>0.05$) observed up to day 14. For Fried-rohu-tomato, no significant differences ($p>0.05$) were found in the texture properties over time, suggesting that the texture of the product remains consistent, and is perceived similarly by consumers throughout the storage period. Lower hydrolysis was observed in mango and tamarind incorporated (SDS-PAGE). This study successfully developed ready-to-cook rohu products using traditional recipes, enhancing consumer acceptance.

Keywords: Traditional methods; Mango-incorporated product; Tamarind-incorporated product; Fried-rohu-tomato-Incorporated product; Ready-to-cook

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Elucidating the role of phytocompounds from *Brassica oleracea* var. italica (Broccoli) on hyperthyroidism – An *in-silico* approach

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Thyroid hormone (TH) plays a crucial role in regulating the metabolism in every cell and all organs in the human body. TH also controls the rate of calorie burning, body weight, and function of the heartbeat. Therefore, the aim of the present study was to investigate the role of phytocompounds from *Brassica oleracea* var. italica (Broccoli) against irregularities of TH biosynthesis (hyperthyroidism) through *in silico* molecular modeling. Initially, the genetic network was built with graph theoretical network analysis to find the right target to control excessive TH production. Based on the network analysis, the three-dimensional crystal structure of the mammalian enzyme lactoperoxidase (PDB id: 5ff1) was retrieved from the protein data bank (PDB), and the active site was predicted using BIOVIA Discovery studio. Sixty-three phytocompounds were selected from the IMPPAT database and other literature. Selected sixty-six phytocompounds were docked against lactoperoxidase enzyme and compared with the standard drug methimazole. Based on the docking scores and binding energies, the top three compounds, namely brassicoside (-10.00 kcal/mol), 24-methylene-25-methylcholesterol (-9.50 kcal/mol), 5-dehydroavenasterol (-9.40 kcal/mol) along with standard drug methimazole (-4.10 kcal/mol) were selected for further ADMET and molecular dynamics simulation analysis. The top-scored compounds were for their properties such as ADMET, physicochemical and drug-likeness. The molecular dynamics simulation analyses proved the stability of lactoperoxidase-ligand complexes. The intermolecular interaction assessed by the dynamic conditions paved the way to discover the bioactive compounds brassicoside, 24-methylene-25-methylcholesterol, and 5-dehydroavenasterol to prevent the excessive production of thyroid hormones.

Keywords: Hyperthyroidism; Broccoli; Lactoperoxidase; Molecular docking; Molecular dynamics simulation

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Comparison of bioactive peptides produced from selected egg white proteins by using enzymatic hydrolysis and High Temperature and Mild Pressure conditions

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Egg white proteins are an excellent source of animal protein for producing bioactive peptides. While enzymatic hydrolysis is commonly employed to enhance bioactivities, the potential of physical methods for protein hydrolysis is often overlooked. This study aimed to investigate the hydrolysis of selected egg white proteins (ovalbumin, ovotransferrin, and ovomucin) under enzymatic and physical conditions to compare their functional properties. The objectives were to determine the optimal pH and duration for hydrolyzing egg white proteins using high-temperature and mild-pressure (HTMP) conditions (121°C and 0.14 MPa), and to compare the bioactivities of the best HTMP hydrolysates with those from enzymatic hydrolysis. For enzymatic hydrolysis, ovalbumin was hydrolyzed using 1% protease and trypsin, ovotransferrin with 1% papain and protease at 37°C, and ovomucin by heating at 100°C for 15 minutes under alkaline conditions. Regarding the physical method, egg white proteins were adjusted to three pH levels (6, 7, 8) and treated at HTMP conditions for 15, 30, 45, and 60 minutes. The best conditions were selected based on 15% SDS-PAGE analysis. Hydrolysates under the best HTMP conditions were compared with controls for antioxidant and metal chelating activities. Although the physical method effectively hydrolyzed the three egg white proteins, resulting hydrolysates showed considerably lower bioactivities compared to enzymatic hydrolysates ($P < 0.05$). The antioxidant ability of all 3 hydrolysates was higher in enzymatic hydrolysate compared with the HTMP hydrolysates. Enzymatic hydrolysates of ovomucin demonstrated 63.8% antioxidant ability, while HTMP hydrolysates provided only 0.83% antioxidant ability in the DPPH assay. Similarly, enzymatic hydrolysates of ovotransferrin showed 22.17% iron chelating activity, whereas HTMP hydrolysates provided only 2.33% chelation. Ovomucin controls exhibited over four times more Cu^{2+} chelation than its HTMP hydrolysates. In conclusion, the physical method of hydrolysis proved less effective in generating bioactive peptides from selected egg white proteins under the examined conditions compared to enzymatic hydrolysis. While this study offers valuable insights into egg white protein hydrolysis and compares two methods, further considerations are necessary to determine the practicality and suitability of optimizing an industrial process based on these findings.

Keywords: Egg white proteins; Bioactive peptides; HTMP; Enzymatic hydrolysis; Functional properties

Paper ID: IRCUWU2023-196

Development of a snack bar using Green Gram, Chickpea, and Black-Eyed Pea

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Green gram (*Vigna radiata*), chickpea (*Cicer arietinum*), and black-eyed pea (*Vigna unguiculata*) are nutrient-rich legumes widely recognized for their contribution to healthy diets. However, they are not readily consumable due to their tough texture and the presence of anti-nutrients. Soaking, cooking, or sprouting is necessary to improve digestion and unlock its nutritional benefits. Thus, this study aims to develop an innovative approach that focuses on creating a convenient snack bar using green gram, chickpea, and black-eyed pea which offers a practical and portable way for individuals to consume these grains without the need for extensive preparation or cooking. The snack bar formulation included roasted grains and other ingredients such as egg white, brown sugar, milk, and margarine. Four formulations were developed by varying the ratios of green gram, chickpea, and black-eyed pea flours, with 26.7:26.7:26.7, 40:20:20, 20:40:20, and 20:20:40 %, respectively. Throughout the formulation process, the proportions of the remaining ingredients were kept constant at 5%. The formulation with 40% green gram, 20% chickpea, and 20% black-eyed peas exhibited the best sensory attributes in preliminary trials. To optimize baking conditions, different time-temperature combinations were tested, and the snack bar baked at 165°C for 15 minutes was selected based on sensory evaluation. The selected snack bar had 57.03±0.15% carbohydrate content, 17.43±0.00% crude protein content, 9.72 ± 0.07% crude fat content, 6.87 ± 0.06% moisture content, 4.54±0.32% crude fiber, and 4.41±0.00% ash content. The texture analysis of the developed bar indicated a significantly higher hardness compared to commercial grain bars, with values of 1405.80 g and 663.20 g, respectively. This finding highlights the need for further analysis and exploration of potential solutions to improve the texture and enhance the overall consumer experience of the developed bar. In conclusion, this study highlights that green gram, chickpea, and black-eyed peas could be used in creating convenient and nutritious snack bars, emphasizing the need for texture improvement through further research.

Keywords: Black eyed pea; Chickpea; Green gram; Nutritious; Snack

Paper ID: IRCUWU2023-260

In vitro antidiabetic and antioxidant activities of different phytochemical extractions from *Gynura procumbens* leaves

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The incidence and prevalence of diabetes in recent decades have experienced a sharp increase worldwide. The *Gynura procumbens* has been used to treat diabetes and other ailments in traditional medicine in South Asia. However, there were no *in vitro* studies to support the claim. Therefore, this study aims to investigate the *in vitro* antidiabetic and antioxidant activities of different extractions of *G. procumbens* and assess their phytochemical profiles. The ethanolic extraction (EE), hot water extraction (HWE), and hot water infusion (HWI) were prepared using *G. procumbens* leaves. Phytochemical profiles of extracts were assessed using total phenolic content (TPC), total flavonoid content (TFC), and Fourier Transform Infrared (FTIR) spectroscopy. Then, the *in vitro* antidiabetic activity of different extracts was measured by α-amylase inhibitory activity assay, and the antioxidant potential of extracts was assessed using 2,2-diphenyl-1-picrylhdrayl (DPPH) scavenging activity. Every experiment was carried out three times independently in triplicates. Data were analyzed according to the Completely Randomized Design (CRD) using MINITAB 19 by One Way Analysis of Variance with a 95% confidence level. All three extractions had significant differences, with EE having the significantly highest antioxidant activity (64.17±1.41%), followed by HWE (53.38±1.61%) and HWI (47.047±0.929%). The inhibitory effects on α-amylase enzymes involved in carbohydrate metabolism were measured to evaluate their antidiabetic activity. The EE had the strongest α-amylase inhibitory effects of the three extracts (93.969±0.460%) (p<0.05), followed by the HWE (86.434±0.764%) and HWI (75.47±1.18%). The FTIR analysis revealed different phytochemical compounds in different extracts and the results were compatible with their TPC's. The extracts spectra showed distinctive absorption peaks for various functional groups, such as alcohol (HWI), ester (HWI) and ketone (EE) were mainly findings. Signifying differences in the phytochemical composition of the different extracts, the spectral profiles of the extracts varied according to the extraction techniques. The EE showed significantly higher antidiabetic and antioxidant activities than all other extractions. In conclusion, the findings emphasize the potential of *G. procumbens* while providing scientific proof in favour of the valuable therapeutic resource for controlling diabetes.

Keywords: *Gynura procumbens*; FTIR; Antidiabetic; Antioxidant

Paper ID: IRCUWU2023-279

Characterization of potential phyloplane fungal antagonists against common foliar pathogens of pole beans (*Phaseolus vulgaris*) grown in Bandarawela region of Sri Lanka

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The pole bean (*Phaseolus vulgaris* L.) is a widely cultivated vegetable crop in Sri Lanka. However, it is susceptible to various fungal diseases such as anthracnose, bean rust, fungal wilt, and angular leaf spot, which result in significant yield losses of 80-100%. Traditional control methods often rely on the use of chemical fungicides, which pose serious health and environmental issues due to their excessive use. In recent years, the utilization of endophytic fungi with antagonistic properties has emerged as bio-control agents. Therefore, our aim was to isolate both pathogenic and endophytic fungi from *P. vulgaris* and evaluate the antagonistic activity of endophytes against the pathogens. Healthy and diseased leaf samples showing symptoms of anthracnose and angular leaf spot diseases were collected from the Bandarawela area. Three potentially pathogenic and 12 endophytic fungi were isolated from leaf samples and serial sub-culturing was done until pure cultures were obtained. The antagonistic activity of endophytic fungi against pathogenic fungi was tested using the dual culture technique. Among the isolated fungi, seven endophytes demonstrated significant antagonistic activity against the pathogenic fungal strains. PCR amplification and sequencing were performed on the pathogenic fungi, using ITS, ACT, CAL, GAPDH and TEF gene regions. Successful sequencing was achieved for two samples and detailed morphological characterization is in progress. Nucleotide BLAST search analysis of each gene region revealed that PFB 02 exhibited 100% similarity to *Colletotrichum gigasporum*, while PFB 03 displayed 100% similarity to *C. plurivorum*. These two species have been reported as causal agents of anthracnose disease in various fruit crops and chillies worldwide while *C. lindemuthianum* has been identified as the causative agent of bean anthracnose in Sri Lanka. This study presents the occurrences of two new fungal pathogens associated with bean anthracnose disease in Sri Lanka. To the best of our knowledge, this is the first report of *C. gigasporum* and the second report of *C. plurivorum* from *P. vulgaris* worldwide. This study successfully identified two previously unknown pathogens and seven endophytes that exhibited antagonistic activity against them. These findings have the potential to enhance the control of bean anthracnose disease through the implementation of sustainable crop protection strategies.

Keywords: Antagonistic activity; Bio-control; *Colletotrichum*; Endophytes; Molecular Characterization; *Phaseolus vulgaris*

Paper ID: IRCUWU2023-308

Effect of power ultrasound on soy protein isolate as wall material in microencapsulation of *Streptococcus thermophilus* STI - 15

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The potential health benefits of probiotic bacteria may not be realized because of the substantial reduction in their viability during storage and gastrointestinal transit. Microencapsulation can be used to protect the probiotics during exposure to harsh environmental conditions. Employing power ultrasound (Hz/W) on soy protein isolate (SPI) may modify their properties to enhance the microencapsulation ability. In this study, two different wall materials namely soy protein isolate (SPI) and ultrasound-treated soy protein isolate (USPI) were used for microencapsulation of *Streptococcus thermophilus* STI – 15 using a freeze-drying technique. Final moisture content, water activity, and particle morphology of resulting microcapsules were analyzed. Then, the viability of microcapsules containing ST was assessed under simulated gastrointestinal tract conditions and different pH ranges. It was observed that the moisture content of USPI was higher (p<0.05) than that of SPI treatment. The water activity of unencapsulated bacteria (0.620±0.006) was higher (p<0.05) than the encapsulated bacteria. In simulated gastric and intestinal conditions USPI encapsulated cells show better stability than SPI encapsulated cells. The reduction of survivability of encapsulated cells under simulated intestinal tract conditions (87.67%) was less than the gastric conditions (96.23%). A higher survivability (p<0.05) was observed at pH 5.5 compared to the other pH values. The highest viability was observed under pH 5.5, 7.21±0.01 log CFU/g (p<0.05) in USPI-encapsulated cells. It can be concluded that both SPI and USPI treatments promoted the survival rate of *Streptococcus thermophilus* STI-15 during gastrointestinal tract conditions and different pH ranges.

Keywords: Microencapsulation; Soy protein isolate; *Streptococcus thermophilus*; Ultrasound

Paper ID: IRCUWU2023-327

Formulation of freeze-dried instant guava (*Psidium guajava*) powder mix and evaluation of its sensory and nutritional properties

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Guava (*Psidium guajava*) is an underutilized, widely abundant, rich source of nutrients that limited uses acquired. Postharvest losses of guava are considerably high throughout the supply chain due to various reasons. Freeze drying is one of the most suitable preservation techniques to preserve fresh fruits and their heat sensitive nutrients. Freeze-dried guava pulp has a high potential for use in formulated beverages and can be identified as a source of instant powder for instant juice mixtures. The study was conducted to develop a freeze-dried instant guava powder mix using a locally available guava variety known as Bangkok Giant and to evaluate its sensory and nutritional properties. Three instant formulations were prepared from freeze-dried guava powder by changing the ratios while maintaining the other minor ingredients, including sugar, citric acid and Carboxy Methyl Cellulose (CMC) at constant levels. Color, aroma, flavor and overall acceptability of the juice samples were evaluated by 30 untrained panelists under 0.05 level of significance. The most acceptable formula contained 5 g of freeze-dried guava powder per 100 mL serving. The selected instant guava powder was analyzed for proximate composition: moisture (3.1±0.07%), crude ash (0.7±0.10%), crude protein (0.8±0.01%), crude fat (1.2±0.10%), crude fiber (16.47±0.07%), digestible carbohydrates (77.76±0.12%) and energy (324.8±0.27 kcal per 100 g). DPPH radical scavenging activity was also found to be significantly higher in formulated instant guava powder mix and it was 20.91±0.42%. Instant guava powder mix contained 16.73±1.76 mg/g vitamin C content. By considering the sensory and nutritional points of view freeze-dried instant guava powder mix can be introduced as a convenient and healthy preserved product with acceptable sensory properties.

Keywords: Instant guava juice powder; Freeze drying; Formulation; Proximate composition; Radical scavenging activity

Paper ID: IRCUWU2023-328

Effect of the processing procedures on black pepper (*Piper nigrum* L.) oil content

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Black Pepper (*Piper nigrum* L. Family Piperaceae) is the most widely used spice in the world and is known as the "King of the Spices". It is valued for its pungency contributed by the alkaloid piperine and flavor contributed by the volatile oil. There was a literature gap to investigate the effect of processing procedures on black pepper oil content. Therefore, in the current study, the effect of the processing procedures was examined on black pepper oil content. Three types of threshing methods (Hand threshing, Trampling the spikes underfoot and Threshing machine) were used blanching (with blanching/without blanching) and drying (sun drying/ mechanical drying). Black pepper samples were collected at different stages after threshing, blanching, and drying. Determination of the black pepper oil content was done by using the hydro distillation method. According to the descriptive analysis, there is no significant difference in threshing method on oil content but all the machine-dried samples contained the highest oil (3.08%) content than sun-dried samples (2.6%). The lowest oil content (2%) resulted in a hand-picked- without blanched-sun dried sample and the highest oil content (3.75%) resulted in machine threshed-blanched- machine dried sample. According to the statistical analysis, two variables (threshing by hand and blanching) were found to be statistically significant when associated with the oil content. It implies that if increased the hand threshing, decreased the oil content of the black pepper. The regression coefficient for the blanching was 0.4252. It was positively associated with the oil content. This means that if blanching is increased by 1%, the volume of the oil will increase by 0.42. Finally, the data suggested that machine drying and blanching were positively affected by the black pepper oil content, and threshing by hand and sun drying were negatively associated with the black pepper oil content.

Keywords: Black pepper; Processing procedures; Black pepper oil content

Paper ID: IRCUWU2023-360

Effect of microencapsulation of *Streptococcus thermophilus* STI – 15 in soy protein isolate – inulin matrix on their viability

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The viability of probiotics in foods and human bodies is critical because a certain minimum count of bacteria is required to exert health-promoting effects. However, the number of viable probiotic bacteria capable of delivering their targeted beneficial effect is frequently insufficient due to many factors such as acidity, oxygen content, storage temperature *etc*. Microencapsulation, as one of the most recent methods, has a significant impact on probiotic bacteria survival. In this study, the viability of *Streptococcus thermophilus* STI – 15 in three microencapsulated forms, namely, Inulin (IN), Soy protein isolate + Inulin (SPI + IN), Ultrasound treated soy protein isolate + Inulin (US-SPI + IN) and as free cells (Unencapsulated) were evaluated in simulated gastrointestinal conditions. Activated STI – 15 cells were grown in MRS agar at 37°C for 24 h, cells were harvested and mixed with either IN, SPI + IN, US-SPI + IN in 300 mL separately and freeze-dried to microencapsulate. Simulated gastric juice (pH 2.5) was prepared by incorporating saline solution (0.9%), 1 N HCl, and pepsin while simulated intestinal juice (pH 7.5) was prepared by incorporating NaCl, KCl, $CaCl_2$, $NaHCO_3$, and bile salt. Different microencapsulated cells: gastric juice/intestinal juice (0.5: 5 mL) were incubated at 37°C for 30 min, 60 min, and 120 min, and survivability was evaluated by enumeration on MRS agar. All the matrixes showed better survivability of probiotics than free cells. Among that results, US-SPI + IN matrix resulted in higher survivability in simulated gastric juice conditions (p<0.05) with the lowest loss (1.87 log CFU/mL) over 2 h, and other matrixes also showed better survivability while the highest was loss showed in free cells (5.35 log CFU/mL). Inulin matrix resulted in higher survivability in simulated intestinal juice conditions (p<0.05) with the lowest loss (2.50 log CFU/mL) over 2 h. Encapsulation efficiency between the various encapsulating materials ranged between 94.54% and 95.66%. Scanning Electron Microscopy was performed to investigate the surface morphology of the encapsulated freeze-dried capsules. The study revealed that microencapsulated *Streptococcus thermophilus* STI – 15 can show better survivability than that of free cells when exposed to simulated gastrointestinal conditions.

Keywords: Microencapsulation; Probiotics; Freeze drying; Soy Protein Isolate; Inulin; Power Ultrasound.

Paper ID: IRCUWU2023-374

Variation of organoleptic properties and probiotic viability of inulin added set-type yoghurt made from cattle and buffalo milk

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Set-yoghurt is a probiotic carrier dairy food that is popular around the country. However, the viability of the probiotic microorganisms seems to be less at the time of consumption. Therefore, it is important to identify the factors' effects on the survival of the probiotic bacteria. This study aimed to evaluate the organoleptic properties and probiotic viability of two set yoghurt types prepared using cow milk (CM) and buffalo milk (BM). Three different levels of inulin (1%, 2% and 3% w/v) and two types of starter cultures *Bifidobacterium bifidum* and *Streptococcus thermophilus*, *Lactobacillus bulgaricus* were used as probiotic sources. An authenticated control sample was prepared without adding inulin. Sensorial properties including colour, aroma, texture, taste, and overall acceptability were measured using 40 untrained panelists. Probiotic viability was measured over the storage period of 21 days at a refrigerated temperature of 4±1°C. Compared to the control sample, inulin-incorporated CM and BM set yoghurts had higher (~8.0 log cfu/mL) probiotic count at the end of the enumeration period. The highest probiotic count was recorded in 3% inulin-incorporated CM and BM yoghurts from each category. *S. thermophilus*, *B. bifidum* and *L. bulgaricus* count in CM yoghurts were 9.11 log cfu/mL, 8.90 log cfu/mL and 8.96 log cfu/mL, respectively and in BM yoghurts those were 8.72 log cfu/mL, 8.67 log cfu/mL and 8.73 log cfu/mL respectively. Cow milk set yoghurt of 2% inulin-added samples had the highest preference for all the tested sensorial properties. In buffalo milk set yoghurts of 3% inulin-added samples had the highest preference for odour and taste while 2% inulin-added sample were best for colour, texture and overall acceptability. The findings of this study concluded that, 2% inulin could enhance the probiotic viability while improving the sensorial properties in set yoghurt made from both cow milk and buffalo milk.

Keywords: Microorganisms; Overall acceptability; Probiotic; Sensorial Properties

Paper ID: IRCUWU2023-384

Development of mangrove apple (*Sonneratia caseolaris*) incorporated coconut (*Cocos nucifera*) cream mixed dairy ice cream

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Mangrove apple (*Sonneratia caseolaris*), is an underutilized fruit which has a good potential to develop new food products. Additionally, coconut cream is a distinct tropical ingredient that offers a unique flavor. Thus, this study aimed to explore the feasibility of incorporating mangrove apple into coconut cream-mixed dairy ice cream to create a novel and indulgent frozen dessert and to assess the antioxidant capacity of Mangrove apple. Initially, coconut cream mixed dairy ice cream was developed by substituting 30% of total dairy cream in regular dairy ice cream with coconut cream. Coconut cream mixed with dairy ice cream was incorporated with mangrove apple pulp at three different percentages of 6%, 12%, and 18% on a weight basis. The amounts of skimmed milk and skimmed milk powder were adjusted based on the quantity of mangrove apple pulp used. The sample consisted of without mangrove apple pulp was used as the control. Samples were analyzed for sensory attributes (taste, texture, aroma, creaminess, flavor, color, mouthfeel, and overall acceptability) with 30 untrained panelists. Ice cream made with 12% mangrove apple pulp was significantly different (p<0.05) from other samples with respect to all tested sensory attributes. Thus, ice cream made with 12% mangrove apple were used to evaluate, nutritional composition, including crude protein, crude fat, ash content and other parameters such as melting rate, DPPH radical scavenging activity, moisture content, pH and total plate count. There was no significant difference between the control sample and the 12% mangrove apple added sample for crude protein, crude fat and ash contents. Microbial counts were taken weekly and, in both samples microbial counts were increased with time up to 28 days, but remained within acceptable levels. DPPH Radical scavenging activity is high in the 12% mangrove apple pulp incorporated ice cream sample. The incorporation of mangrove apple helps to prevent oxidation of ice cream due to its antioxidant activity. Other than that, as a result of light acidic pH in 12% mangrove apple pulp incorporated with coconut cream mixed with dairy ice cream, microbial growth was reduced. With the multifaceted potential of mangrove apple, this endeavor paves the way for novel culinary creations and product diversification.

Keywords: Mangrove apple; Coconut cream; Sensory evaluation; Dairy ice cream

Paper ID: IRCUWU2023-396

Physicochemical, microbiological, and sensory properties of chicken sausages incorporated with *Hibiscus rosa-sinensis* flower powder

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The meat industry is actively seeking natural alternatives to substitute synthetic nitrite in processed meat products due to the possible health risks associated with nitrite. This pursuit addresses health implications and sustains the desirable qualities conventionally provided by synthetic nitrite in meats. This study investigated the potential of *Hibiscus rosa-sinensis* flowers to replace synthetic nitrite and its effects on the physicochemical, microbiological, and sensory properties of chicken sausages. The oven-dried *Hibiscus rosa-sinensis* flower powder (HSP) was utilized to develop chicken sausages following standard procedures. Six experimental groups were included: positive control (C1: 125 ppm sodium nitrite and 0% HSP), negative control (C2: 0 ppm sodium nitrite and 0% HSP), treatment 1 (T1: 125 ppm sodium nitrite and 8% HSP), treatment 2 (T2: 125 ppm sodium nitrite and 10% HSP), treatment 3 (T3: 0 ppm sodium nitrite and 8% HSP), treatment 4 (T4: 0 ppm sodium nitrite and 10% HSP). The pH, color (L*, a*, b* values), water holding capacity (WHC), cooking yield, Thiobarbituric acid reactive substance (TBARS) value, and total plate count (TPC) of different sausage samples were analyzed during a 28-d frozen storage (-18±5°C). Significantly lower pH value, L* value, b* value, and TPC values were recorded in T4, whereas it recorded significantly higher WHC, a* value, and cooking yield compared to other groups. The TBARS values of C1 and C2 were significantly higher than the other experimental groups. The overall sensory score of the T3 sample was significantly higher than that of the control group. The inclusion of HSP significantly influenced the physicochemical, microbiological, and sensory properties of chicken sausages. Thus, the results of this study indicate that HSP has the potential to replace synthetic nitrite in naturally cured meat products, appealing to consumers seeking clean-label products.

Keywords: *Hibiscus rosa-sinensis*; Chicken sausages; Nitrite; Sensory; Microbiological properties; Physicochemical properties

Paper ID: IRCUWU2023-402

Identifying the impact of leaf miner (*Acrocercops* spp) infestation on quantity of essential leaf oils of cinnamon *(Cinnamomum zeylanicum* blume)

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Cinnamon (*Cinnamomum zeylanicum* Blume) is highly prized for its essential leaf oils, widely used in industries such as food, cosmetics, and pharmaceuticals. However, the quantity of these oils is threatened by leaf miner (*Acrocercops* spp) infestations. This study investigates the impact of leaf miner infestation on cinnamon's essential leaf oils, focusing on oil percentage. The research was conducted at the National Cinnamon Research and Training Center in Sri Lanka. Harvested from consistent plant variety, leaves sorted: small, medium, and large. Segregated into 3 categories: No damage, minor damage, and severe damage. Standardized methods were used to assess oil yield. The results revealed a direct negative correlation between leaf miner infestation severity and oil percentage. Samples with severe damage exhibited significantly lower oil percentages, underscoring the need for effective management strategies to mitigate the negative impact of leaf miner infestation and uphold cinnamon oil integrity. The analysis demonstrates a significant difference in oil content between undamaged and damaged leaves. Leaves with no damage exhibited a higher (p<0.05) oil content of 3.04±0.61 than damaged leaves. The severe leaf damage did not (p>0.05) affect on the oil content. Leaves with severe damage had an oil content of 2.47±0.24, while leaves with minor damage had an oil content of 2.68±0.76. In conclusion, this study emphasizes the detrimental consequences of leaf miner infestation on cinnamon's essential leaf oils, particularly oil percentage. These research findings serve as a valuable resource for growers, researchers, and industries involved in producing and utilizing high-quality cinnamon oils.

Keywords: *Acrocercops* spp*; Cinnamomum zeylanicum* Blume; Oil yield; Essential leaf oils

Paper ID: IRCUWU2023-403

Analysis, characterization and comparison of *Terminalia catappa* (Kottan) and *Terminalia bellirica* (Bulu) seed oils for their potential applications in cosmetic and dietary supplements

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Sri Lanka possesses a rich diversity of oil-bearing seeds, including *Terminalia catappa* and *Terminalia bellirica*, both belonging to the Combretaceae family. These are already being used in Ayurvedic and indigenous medicine. Although previous studies have investigated the chemical composition of these two seed oils separately, no comprehensive and comparative study has been conducted to date for Sri Lankan-grown species. This study aims to address this gap by performing a comparative study by characterizing the seed oils of *Terminalia catappa* and *Terminalia bellirica*, based on the fatty acids composition, constituents in the unsaponifiable matter, and other physical properties. The oil was extracted using soxhlet extraction and the acid value, iodine value, and smoke point of the oils were determined. Additionally, the ash content and moisture content of the seeds were determined. Gas chromatography-mass spectrometry was employed to identify fatty acid methyl esters and constituents in the unsaponifiable matter. Thermogravimetric analysis was performed to assess the thermal behavior of seed oils. The following values were obtained for *Terminalia catappa* and *Terminalia bellirica* respectively: crude oil yields 85.63±0.01% and 40.94±0.01%, moisture contents 7.87±0.01% and 5.00±0.16%, ash contents 3.85±0.45% and 4.11±0.48%, acid values 13.30±3.26 and 4.26±0.61 mg KOH g^{-1}, iodine values 10.56±1.83 and 14.02±1.78 g I_2 $100g^{-1}$, decomposition temperatures 411.60°C and 402.63°C, smoke point values 277.3±10.6°C and 227.7±5.5°C and yields of unsaponifiable matter 1.92±0.01% and 0.61±0.01%. Gamma-sitosterol was identified as the primary constituent in both oils. Campesterol, stigmasterol and gamma-tocopherol were also identified in both oils at lesser levels. Major fatty acids identified in both oils include Oleic, Linoleic, Stearic and Palmitic acids. The findings of this study suggest that the seed oils of *Terminalia catappa* and *Terminalia bellirica* grown in Sri Lanka exhibit similar chemical compositions to those of previous overseas studies. The reported deviations are possible due to geographical and climatic disparities. In conclusion, both of these seed oils possess significant potential for utilization in dietary supplements and cosmetic industry.

Keywords: *Terminalia catappa; Terminalia bellirica;* Fatty acids; Unsaponifiable matter; Cosmetic; Dietary Supplements

Paper ID: IRCUWU2023-412

Oxidative stability of mechanically separated chicken meat incorporated with seaweed (*Sargassum cristaefolium*) powder during frozen storage

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Mechanically separated chicken meat (MSCM) is a widely used low-cost protein source in meat processing industry. MSCM is highly susceptible to lipid oxidation due to its high fat and heme contents leading to consumer rejection due to unfavorable changes in quality attributes. Currently, industries use synthetic antioxidants to prevent lipid oxidation in MSCM. However, outcomes of carcinogenic and neurotoxic effects of synthetic antioxidants encourage further research toward alternative antioxidants such as natural antioxidants. *Sargassum cristaefolium* is an edible, but underutilized brown seaweed with an excellent potential as a natural antioxidant rich in many bioactive compounds including polyphenols. Therefore, the present study investigated the effect of adding seaweed (*S. cristaefolium*) powder into MSCM on lipid oxidation and quality attributes. Five different MSCM formulations were prepared incorporating different levels of seaweed powder (0 [negative control], 1, 2, and 3%), and ascorbic acid (0.1%). The samples were then vacuum packed and analyzed for pH, color, thiobarbituric acid reactive substances (TBARS) value, and DPPH free radical scavenging activity during a 28-d frozen storage (-20°C). Results showed that addition of seaweed powder decreased the pH of MSCM, irrespective of the storage period (p<0.05). However, the addition of seaweed powder made MSCM darker with lower L* values, irrespective of the level added (p<0.05). Furthermore, seaweed powder incorporated MSCM had lower lipid oxidation levels in terms of TBARS value as opposed to negative control (p<0.05). A significantly higher antioxidant activity was reported in MSCM added with 3% seaweed powder at 28-d compared to the negative control. In conclusion, *Sargassum cristaefolium* effectively improved the oxidative stability of MSCM over a 28-d frozen storage.

Keywords: Antioxidants; DPPH; Quality attributes; *Sargassum cristaefolium*; TBARS

Paper ID: IRCUWU2023-419

Investigation of antibacterial activity of wild macro-fungi collected from the Badulla area

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Antibiotics play a significant role in modern medicine. However, due to the misuse and overuse of antibiotics worldwide, antibiotic resistance in Badulla area. The ethyl acetate crude extracts of 11 mycelia samples and methanol crude extracts of 12 fruiting body samples, were tested against two Gram-positive (*Staphylococcus aureus* and *Bacillus cereus*) and two Gram-negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*) using agar disk diffusion method. All studied macrofungi were tentatively identified up to the genus level using macroscopic and microscopic characteristics. The mycelial crude extracts of *Daldinia* sp., *Cyptotrama* sp., and a *Phellinus* sp. showed inhibition zones against *S. aureus* and *B. cereus* with diameters ranging from 13-21 mm at a concentration of 400 µg/disc and 12-18 mm diameter at a concentration of 200 µg/disc. Crude extract of NG.UWU.02 exhibited a weak inhibition zone of 12.5 mm against *E. coli* at a concentration of 400 µg/disc. The antibacterial activity of the crude extracts was further assessed using the bioautography technique with a 5% methanol: 95% ethyl acetate solvent system, and the inhibition zones were visualized using p-iodonitrotetrazolium violet stain. In the bioautography, extracts from the mycelia of *Daldinia* sp., *Cyptotrama* sp. and *Phellinus* sp. (BD.PTRI.21) exhibited bioactive compounds in the range of Rf 0 to 0.81 while the extracts from fruiting bodies of *Xeromphalina* sp., *Trametes* sp., *Marasmius* sp., and *Ganoderma* sp. (YM.UWU.06) exhibited bioactive compounds at Rf values ranging from 0.5 to 0.85 against Gram-positive bacteria used in the test. The crude extract of *Phellinus* sp. (BD.PTRI.24) showed an inhibition zone with Rf values ranging from 0 to 0.627. The antibacterial activity can be attributed to the presence of polar and moderately polar compounds in the crude extracts, as indicated by the Rf values. The results indicate that the macrofungi studied are potential sources for discovering antibacterial drug leads.

Keywords: Agar disk diffusion assay; Antibacterial activity; Crude extract; Wild macrofungi

Paper ID: IRCUWU2023-437

Isolation and identification of yeast strains with high attenuation rate from *Caryota urens* (L.) phloem sap for optimization of the "Kithul" toddy production in Badulla district

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Caryota urens (L.) is an underutilized palm which grows in Sri Lanka and other South Asian countries, where the sap is tapped to produce syrup and toddy is produced after rigorous fermentation. This study was aimed to screen *Caryota urens* (L.) toddy samples to isolate yeast strains with a higher attenuation rate and then to optimize "Kithul" sap fermentation process. Kithul toddy samples were collected from *Soranathota* area in Badulla district, Sri Lanka. Samples were initially analyzed for ethyl alcohol content, pH, and acidity. The samples showed 5.5-6.1 % (v/v) ethyl alcohol, 3.42-3.59 pH and 0.54-0.65% acidity levels. For the isolation of yeast, 1 mL of each toddy sample was streak plated on YEPD (yeast extract, peptone, dextrose, and chloramphenicol) media and incubated at 30°C for 48 h. Single colonies with different morphological characteristics were isolated. Carbon fermentation of the isolated strains was performed using basal yeast fermentation broth (yeast extract, peptone, 1% (w/v) phenol red containing 2% (w/v) of the specific carbon source. Five yeast colonies were identified based on their distinct morphological and biochemical properties and named Y_1, Y_2, Y_3, Y_4, Y_5. Isolated colonies were screened for *in vitro* ethanol production in glucose enriched medium (180 g/L). Results revealed that all the isolated strains produce relatively high alcohol concentrations and Y_2 strain produced higher alcohol concentrations (6%) than the reference strain (3%) did. Sensory evaluation using a seven-point hedonic scale of the "Kithul" inflorescence sap fermented by five selected yeast strains showed no significant differences in color and clarity, flavor, aroma and overall acceptability. Therefore, this study demonstrated the potential use of Y_2 strain as a commercial level starter culture to optimize the "Kithul" toddy production process. However, the isolated strains should be genetically identified to ensure further identification and classification.

Keywords: *Caryota urens*; Toddy; Yeast strains; High attenuation; Fermentation

Paper ID: IRCUWU2023-440

Development of water soluble and edible sachet packages for 'Matcha' tea powder using canistel (*Pouteria campechiana*) starch

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This study was conducted to evaluate the potential of developing water soluble and edible sachet packages for 'Matcha' tea powder using canistel (Lavulu) (*Pouteria campechiana*) pulp-starch and seed-starch. Separate canistel pulp-starch-based and seed-starch-based films were developed using different levels of canistel pulp-starch (0.4, 0.8, 1.2, and 1.6% w/v) and seed-starch (0.4, 0.8, 1.2, and 1.6% w/v) and constant levels of carrageenan powder (0.4 w/v) and food grade glycerol (0.1% w/v). Physical properties; film thickness, tensile strength, elongation at break, water solubility and color of the films were evaluated using standard methods and sensory properties of the films were evaluated by 10 trained panelists using 7-point hedonic scale. The most suitable levels of canistel pulp-starch and seed-starch were selected based on the physical and sensory properties of the films. Further, using the selected starch levels, pulp-starch-based and seed-starch-based films with different flavors (peppermint, mango, chocolate, lime) were prepared and the most suitable flavors were selected by conducting a sensory evaluation. Having considered the water solubility and sensory properties of films more important, incorporation of starch at 0.4% (w/v) was selected as optimum for developing both pulp-starch-based and seed-starch-based edible and water-soluble sachets for packing 'Matcha' tea. The best flavor for seed-starch-based film and pulp-starch-based film was found to be peppermint (0.2% w/v) and chocolate (0.2% w/v), respectively. Further, based on the physicochemical and sensory properties, canistel pulp-starch-based film was found to be the best for the packaging application of 'Matcha' tea. It can be concluded that there is a potential for utilizing canistel pulp-starch for developing edible and water-soluble sachet for packing 'Matcha' tea.

Keywords: Canistel; Edible film; 'Matcha' tea; Pulp-starch; Seed-starch

Paper ID: IRCUWU2023-455

Development of an instant fruit juice mixture from freeze-dried watermelon (*Citrullus lanatus*) powder and evaluation of its quality parameters

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The non-availability of fruit juice alternatives like instant fruit drinks that are free from synthetic colorants and flavorants is very much visible in the Sri Lankan market. Also, the non-availability of an instant watermelon juice mixture in the market creates a strong demand for a healthy fruit drink that is free from synthetic colorants and flavorants. Therefore, this study was conducted to develop a natural fruit juice mixture from freeze-dried watermelon powder and to evaluate its physicochemical, functional, sensory and microbial properties. Rocky 475 watermelon variety was used for powder extraction via freeze-drying whereas maltodextrin (15% w/w) was incorporated as a drying agent. Physicochemical properties of the instant powder mix including moisture content, titratable acidity, water activity, colour and bulk density along with pH, total soluble solids and solubility of the reconstituted product were evaluated. For the functional property analysis, lycopene and ascorbic acid contents were recorded at 25.30±0.22 mg/kg and 2.16±0.01 mg/g respectively along with the antioxidant activity at 75.56±4.46%. The proximate analysis for the 15 g instant watermelon powder mix showed 3.59±0.01% moisture content, crude ash 3.72±0.41%, crude protein 0.97±0.01%, crude fat 0.17±0.02%, crude fiber 10.94±0.13% and digestible carbohydrates at 80.60± 0.53%. The instant powder mixture contains 327.77 kcal per 100 g of energy. The microbial counts were less than the SLSI standards and the shelf-life evaluation was conducted for one month. Hence, the formulated instant watermelon powder mix can be introduced as a natural instant fruit juice mixture to the local market.

Keywords: Freeze-drying; Instant fruit drinks; Physicochemical properties; Watermelon powder

Paper ID: IRCUWU2023-463

Assessment of selected microbial quality parameters in Ceylon black tea FBOP grade as affected by Ceylon natural cinnamon flavor

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Camellia sinensis is known to possess many nutritive and health benefits and helps to lose weight, promote oral health, reduce cardiovascular diseases, have antioxidant properties and combat cancer cells. In the process of black tea manufacturing, from the plucking of tea buds to the final consumption of tea every stage allows microbial contamination of the product. This occurs mainly due to improper hygiene practices and improper handling practices of the product by employees. Tea factories with good hygienic practices use artificial humidifiers to control the external environment effect (relative humidity and temperature) to reduce microbial contamination. Yeast and molds are the main contaminants that contaminate the tea in the fermentation process. However, in the drying process, the microbial count may be reduced due to the excess temperature and reduction in the moisture level. Here, we report the natural cinnamon that can be added as a flavor to the tea contains cinnamaldehyde which showed antimicrobial properties. Hence, in this study, the microbial quality of Ceylon black tea FBOP flavored with Ceylon cinnamon was compared with non-flavored tea to find out whether there is an effect of natural Ceylon cinnamon on the growth of yeast and mold in tea. The total plate count (TPC) was conducted referring to the method described in SLS 516: Part 1: Section 1: 2013 (ISO 4833-1:2013). And total yeast and mold count (TYMC) was done according to SLS 516: Part 2: Section 2: 2013 (ISO 21527-2:2008). According to the results obtained, it was noted that both cinnamon flavor and cinnamon quills reduced TPC in tea during storage in all 3 elevations tested. Furthermore, TYMC showed a declining trend during storage in both flavored and non- flavored tea Final count of yeast and mold in flavored tea was less than (p <0.05) that of non-flavored tea. It can be concluded that cinnamon flavor with quills can affect TPC and TYMC in made tea (FBOP) and suppress microbial growth.

Keywords: Total Plate Count; Total Yeast and Mold Count; Ceylon Tea; Cinnamon

Paper ID: IRCUWU2023-467

Development of fruit jelly using freeze dried watermelon (*Citrullus lanatus*) powder and evaluation of its quality parameters

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Watermelon (*Citrullus lanatus*) is a widely cultivated fruit in Sri Lanka but it is currently not being properly utilized and processed for its full potential. Its high level of antioxidants such as lycopene gives its attractive color and functional properties. By employing freeze-drying, watermelon powder can be made to retain the fruit's natural characteristics and incorporate it into food products to enhance color, flavor, and nutrients. In contrast, commercial jelly powders in the local markets of Sri Lanka are made with artificial flavors and colorants, which pose potential health risks. The present study is focused on the development of a watermelon-flavored fruit jelly powder and the evaluation of its physicochemical, proximate and functional properties. The freeze-dried watermelon powder (FDWP) was made by incorporating 15% maltodextrin on a wet-weight basis. Four formulations of jelly powder were made by incorporating 1.5 g (T1), 3 g (T2), 4.5 g (T3) and 6 g (T4) of FDWP along with gelatin, sugar, citric acid, sodium citrate and potassium sorbate in 50 mL boiling water. The best formulation 6 g (T4) was chosen by a 9-point hedonic scale test by 30 untrained panelists as the final product. It exhibited a solubility of 90.91±0.02% and positive functional properties including 74.35±0.03% antioxidant activity, 3.96±0.01 mg GAE/g total phenolics content, 34.3±0.607 mg/kg lycopene content and 3.18±0.01 mg/g ascorbic acid content. The proximate analysis result showed 3.34±0.45% moisture, 12.45±0.02% crude protein, 0.91±0.03% crude ash, 0.21±0.01% crude fat, 9.43±0.04% crude fiber and 73.66±0.50% digestible carbohydrates. It contained 346.33 kcal per 100 g. The microbial analysis showed that total plate count and yeast and mold counts had remained less than the standard maximum limits over a month of the study period. Therefore, FDWP can be used as a potential raw material to produce jelly powder without artificial fruit flavors and colorants and expand the range of healthy food options.

Keywords: Watermelon; Freeze dried fruit powder; Proximate composition; Antioxidants

Paper ID: IRCUWU2023-487

Effect of pineapple peel powder and papaya peel powder on textural quality traits of marinated spent hen breast meat

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Spent hen meat is considered a by-product of the egg industry. It is tougher than broiler meat due to high collagen content and higher number of cross linkages leading to limited usage in the meat industry. Ginger is effectively used to tenderize the spent hen meat. Papaya and pineapple peels are considered waste in the fruit processing industry. Therefore, the objective of this study was to detect the efficacies of papaya peel powder and pineapple peel powder on textural quality traits of marinated spent hen breast meat. Spent hen breast meat was separately marinated at 4°C for 24 h using three different marination pastes containing 2% 1) ginger powder (control), 2) pineapple peel powder, and 3) papaya peel powder. The texture profile analysis, characteristics via scanning electron microscopy, and myofibrillar fragmentation index of marinated meat samples were determined weekly during a 21-d refrigerated storage. Both papaya peel powder and pineapple peel powder reduced the extural properties of spent hen breast meat including adhesiveness, chewiness, and gumminess values as opposed to ginger powder (p<0.05). In addition, the lowest hardness value throughout the storage period was reported in spent hen breast meat marinated with papaya peel powder followed by those marinated with pineapple peel powder and ginger powder, respectively (p<0.05). Similarly, spent hen breast meat marinated with papaya peel powder showed the highest myofibrillar fragmentation index value followed by those marinated with pineapple peel powder and ginger powder, respectively (p<0.05). In addition, myofibrillar fragmentation index values of breast meat samples were increased significantly with increasing storage period (p<0.05). The scanning electron microscopy images indicated that paste marination caused significant breakdown in muscle fibres irrespective of the marination ingredient used when compared to the microstructure of raw spent hen breast meat. In conclusion, papaya peel powder and pineapple peel powder at an inclusion level of 2% can be effectively used to tenderize spent hen breast meat and improve textural quality traits compared to ginger powder at the same inclusion level.

Keywords: Ginger powder; Hardness; Myofibrillar fragmentation index; Paste marination; Scanning electron microscopy

Hospitality & Tourism

Paper ID: IRCUWU2023-98

The impact of YouTube travel vlogs on E-WOM

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YouTube is the most popular online video platform and travel vlogs have become one of the most popular types of content on YouTube with a large number of travel channels. Today most tourists use YouTube as a platform for sharing information about destinations such as images, videos, and content in the form of vlogs. This also promotes E-WOM among tourists. This research was aimed at understanding whether watching these travel vlogs is helpful for domestic tourists to make travel decisions. Accordingly, the main objective of this research was to investigate the influence of features of YouTube Travel vlogs on E-WOM. The result proved that entertainment, information seeking, social interactivity, emotions, and social presence are independent variables and E-WOM a dependent variable. A sample of 312 active YouTube travel vlog viewers responded and purposive sampling techniques were employed to collect primary data. Data were collected through a self-administrative questionnaire distributed via Google form as a reply to people who commented on selected YouTube travel channels with more than 50K subscribers. A Statistical Package for Social Sciences (SPSS) was used for the data analysis process. The results of the research show that YouTube travel vlogs can help tourists make their travel decisions and also show that women pay more attention to travelling and this confirms the trend seen in the society. The findings of this research are useful for travel vloggers, educational institutions, academics, travel agents or agencies, social media users, destination/ tourism marketing companies and students who have studied tourism. The study found that the 20-30-year-old youth generation, particularly women, were the main viewers of YouTube travel vlogs. It suggested that this demographic group's intense exposure to travel-related content on social media platforms like YouTube could increase their interest in traveling and use travel vlogs as a guide. The study indicated that most people spent three hours or less per day watching YouTube travel vlogs due to busy schedules. In conclusion, correlation results supported all hypotheses positively and significantly. But the regression results supported only three hypotheses and partially supported two. Finally, the findings of the study show that all independent variables positively affects the E-WOM.

Keywords: E-WOM; YouTube; Sri Lanka tourism

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Wellness tourism as a strategy for sustainable development in Sri Lanka

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Wellness tourism is gaining momentum as a niche market segment within the tourism industry, driven by the increasing desire among travelers to enhance their overall well-being. This study investigates the potential of wellness tourism as a paradigm for sustainable development in Sri Lanka, a country known for its rich cultural heritage and emphasis on traditional medicine. The main objective is to analyze the motivations, expectations and experiences of wellness tourists in Sri Lanka and examine the potential for sustainable development by identifying strengths, weaknesses, opportunities and threats. In addition, it suggests practical strategies for developing a wellness tourism industry across the country. A qualitative research approach was adopted, utilizing semi-structured interviews with 5-7 wellness tourists and engaging 10-15 supply-side stakeholders. Thematic, SWOT and content analyses were employed to analyze the collected data, providing valuable insights into the topic. The findings reveal that wellness tourists visiting Sri Lanka drive by a holistic pursuit of well-being across various dimensions, encompassing physical, spiritual, emotional, social, and intellectual aspects. Their expectations vary, including destination choices, wellness services, price sensitivity, and health and safety considerations. The perceived experiences of wellness tourists are influenced by engaging wellness activities, quality wellness facilities, service excellence, and opportunities for relaxation and rejuvenation. The study identifies several challenges and opportunities for sustainable development in Sri Lanka's wellness tourism sector. Challenges include the underutilization of Ayurveda resources, inadequate infrastructure, service quality control, shortage of skilled employees, and low awareness. However, opportunities exist for leveraging Sri Lanka's rich heritage and natural resources to position the country as a unique wellness destination. The study recommends strategic investments in infrastructure, facilities, and staff training while emphasizing the significance of effective promotion and marketing of wellness tourism services. In conclusion, this study emphasizes the potential of wellness tourism as a catalyst for sustainable and inclusive development in Sri Lanka. Moreover, this research offers policymakers and industry stakeholders' insightful information and valuable recommendations for boosting sustainable wellness tourism in Sri Lanka.

Keywords: Wellness tourism; Sustainable development; Travel motives; Expectations; Perceived experiences

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Impact of leadership styles on organizational citizenship behavior: Empirical evidence from non-managerial employees in five-star hotels

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Human resources play a major and critical role in the hotel industry. Because human resource provides uniqueness and a competitive advantage to achieve the overall organization's mission and vision. This research focuses on the hotel sector's leadership styles and organizational citizenship behavior. The organization's citizenship is most important to enhance the employee's efficiency level, reduce the employee's costs and manage the employee's stress and employee retention. If we consider the hotel industry, there is a very limited number of publications on this topic. Hence leadership styles highly influence employees' behavior and their tasks. This study used transformational, transactional, and laissez-faire leadership styles as independent variables. Employee motivation and job stress are the mediator variables and organizational citizenship behavior is the dependent variable of this study. This research attempted to identify the impact of leadership styles on the organizational citizenship behavior of five-star hotels in Colombo. This was done based on the quantitative research approach and both primary and secondary data were collected. Primary data were collected through the self-administrated questionnaires and this questionnaire was shared with 220 non-managerial employees. And the convenience sampling technique was used to collect data from the sample. Collected data were analyzed by using SPSS and Smart PLS. Smart PLS software was used to run the Structural Equation Modeling (SEM) analysis. Based on the research results and findings, this study highlights the positive impact of transformational and transactional leadership styles on organizational citizenship behavior (OCB). Conversely, the laissez-faire leadership style has been found to have a negative impact on OCB. The mediator's analysis clearly highlights the positive mediation effect of employee motivation on the relationship between leadership styles and OCB while employee job stress was found to have a negative mediating effect on the same relationship. And the researcher recommended taking actionable steps to convert transactional and laissez-faire leaders into transformational leaders. Consequently, managers should take action to encourage and implement a transformational leadership style in their hotel operations. It is highly important to enhance the overall organization's efficiency and OCB.

Keywords: Human resources; Hotel industry; Leadership styles; Organizational citizenship behavior

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Dark mansions in Sri Lanka as a potential of promoting dark tourism; with special reference to Western Province

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In contemporary times, there has been a discernible shift in the preferences of tourists, marked by their inclination towards novel and distinctive forms of tourism experiences. This evolving demand has given rise to emerging trends in the tourism sector, including the phenomenon of dark tourism. This research investigates the influence of dark mansions in Sri Lanka as a potential of promoting dark tourism, with special reference to the Western province in Sri Lanka. The research objectives include identifying the profile of the tourists who involve in dark tourism activities in dark mansions, the factors that influence to engage in dark tourism activities in dark mansions, and the challenges and opportunities to promote dark mansions as a dark tourism destination. To achieve this, the researcher employed mixed-methods, combining quantitative and qualitative approaches. The quantitative phase comprised 150 surveyed tourists in the Western Province, facilitated by a questionnaire. Simultaneously, the qualitative facet involved structured interviews with 12 travel industry stakeholders. Data underwent meticulous analysis, including descriptive and exploratory factor analyses via IBM SPSS Statistics 25, and content analysis. Findings reveal significant interest among respondents to explore dark mansions and showing willingness for activities like exploration, photography, videography, and storytelling. The factors under investigation encompassed the status of these mansions, social factors, geographical factors, promotional factors, and their overall potential. This comprehensive analysis aims to understand intricate aspects contributing to positioning dark mansions as compelling dark tourism destinations in Sri Lanka. The research also highlights noteworthy elements current tourism strategic plan, nightlife tourism, availability of unutilized and archaeological valuable dark mansions, dark historic stories related to dark mansions in the community, infrastructure facilities as opportunities and legal requirements, negative ethical and emotional challenges, ownership and preservation, lack of accessibility facilities, lack of awareness as challenges of dark mansions as promoting dark tourism. Based on the study's findings, utilizing Dark Mansions, exploring the impact of promotion, policy's role in sustainable mansion development, and their contribution to Sri Lanka's overall sustainable development could effectively catalyze dark tourism promotion.

Key Words: Dark Tourism; Dark Mansions; Dark Activities; Challenges

Paper ID: IRCUWU2023-120

Impact of government monetary and non-monetary assistance on rejuvenating the performance of tourism MSMEs in Badulla district, Sri Lanka: A perspective of resource advantage theory

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The tourism industry plays a significant role in developed and developing economies by mitigating common issues such as unemployment, poverty, social inequalities etc. Similarly, MSMEs (Micro, Small & Medium Enterprises) recognized as a tool for the growth of an economy. Sri Lanka is a developing country, tourism industry supports the economy by generating foreign income and elevating socio-economic standards in the country. A big proportion of the tourism service providers represent by MSMEs who are witnessing insufficient resources to boost their performance, especially during market fluctuations. The availability of tangible and intangible resources such as financial, human, physical, informational, and legal support determines the superior performance of the firm. The Resource Advantage theory (R-A theory) has explained the government as an external factor that can provide the necessary resources to rejuvenate the performance of MSMEs. The government initiates monetary and non- monetary assistance to support MSMEs in different industries. This study was conducted in Badulla district which was identified as one of the highest poverty witnessed areas which demands the necessity of government support. Hence, this study investigates the impact of Government Monetary (GMA) and Non- Monetary Assistance (GNMA) on rejuvenating the Financial and Environmental performance of Tourism MSMEs (TMSMEs) in tourism DS divisions of Badulla District. A self-administered structured questionnaire was fielded to collect data from 140 TMSMEs in tourism district secretariat divisions declared by the Uva tourism ministry through a snowball sampling technique. Statistical Package for Social Sciences (SPSS) was employed to analyze collected data. The results revealed GMA, and GNMA such as Tax concessions, grants, credit loans, interest-free loans, training programs, trade fairs, and Business Development Supports (BDS) positively impact the financial and environmental performance of TMSMEs at 1% significant level. Outcomes of the study revealed that government assistance as an external factor supports on reinvigorate the performance of service-oriented MSMEs in perspective of the availability of resources. Moreover, this study provides insights for government institutions to make sound decisions by evaluating and improving the existing assistance for further development of MSMEs as well as to empower novel tourism entrepreneurs to cater to potential tourism demand.

Keywords: Government; Monetary Assistance; Financial Performance; Environmental Performance; Resource Advantage

Paper ID: IRCUWU2023-122

Development of nightlife activities in Colombo City: The resident community perspective

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Nightlife activities are economic activities that take place from 6. p.m. to 6. a.m. Nightlife development creates economic benefits and also negative impacts on society. Sri Lankan economy relies on the tourism industry however nightlife activities are not a primary strategy. Though several projects were initiated to develop nightlife activities within Colombo they were not successful. Colombo City is usually asleep after midnight. Nightlife is a foreign concept to Sri Lanka and people are hesitant towards such activities. This negative mindset comes from the cultural, social and religious background of Sri Lanka. It is imperative to identify the community perspective on nightlife activity development in Colombo City as residents are the first group to face the consequences of these activities. Objectives of this study are to identify the community perspective on nightlife activities, its effects on residents' life with nightlife activities and their preferred nightlife activities. The study used both quantitative and qualitative approaches. Using convenience sampling method for both qualitative and quantitative approaches 384 respondents were selected from Colombo city residents as the sample. Data was collected through a questionnaire for achieving the quantitative objective (effects on residents' life) of the study. Qualitative research objectives (community perspective and preferred nightlife activities) were assessed by conducting interviews with selected 22 respondents from Colombo City. Kaiser- Meyer- Olkin (KMO) test and Bartlett's test was performed to measure the reliability and sampling adequacy and tests were significant for the data set. Exploratory factor analysis and content analysis were conducted to assess research objectives. Residents were most concerned about safety, conducting daily activities, noise and occupying private and public areas. Further, the study indicates that the community has a positive view on implementing nightlife activities in Colombo city. Food festivals, night cinemas, night markets, live performances, beach parties and DJ shows are preferred nightlife activities from the community perspective. Non-residential areas like Galle-Face Green, the Floating Market, the Lotus Tower, Royal Arcade, Port City and coastal areas are recognized as preferred locations to develop nightlife activities in Colombo.

Keywords: Nightlife activities; Night economy; Community perception; Colombo

Paper ID: IRCUWU2023-164

Impact of workplace bullying on operational-level employees' job performance; empirical evidence from star hotels in Colombo district

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Workplace bullying is a pervasive issue that can have detrimental effects on both individuals and organizations. This study aims to investigate the impact of workplace bullying on operational-level employees' job performance in the context of star hotels in Colombo, Sri Lanka. The affective events theory serves as the theoretical framework, and the study explores the mediating role of employees' psychological well-being. Data were collected from 131 employees working in 3, 4 and 5-star hotels distributing a self-administered questionnaire and the sampling technique was purposive sampling. The questionnaire consisted of several measures to assess demographic information, workplace bullying, employees' psychological well-being, and employees' job performance. The data were analyzed using SPSS 17.0 and SmartPLS 4 software. The findings of this study suggest that workplace bullying has a negative impact on employees' job performance. Furthermore, psychological well-being was found to mediate the relationship between workplace bullying and job performance. Moreover, the application of confirmatory factor analysis assisted in the identification of key determinants impacting workplace bullying in the hotel industry. Therefore, it is recommended that organizations implement clear policies and procedures to prevent workplace bullying, provide support for employees who experience it, and promote employees' psychological well-being. Managers and supervisors should receive training on how to recognize and address workplace bullying, and employees should be encouraged to report any incidents they experience or witness. Additionally, efforts should be made to promote employees' psychological well-being, such as offering mental health resources, promoting work-life balance, and providing opportunities for professional development. To further explore the relationship between workplace bullying and job performance, future studies could use longitudinal designs to examine how workplace bullying affects employees over time. Moreover, researchers could investigate the specific strategies that organizations can use to prevent workplace bullying and promote employees' well-being. In essence, this research not only sheds light on the impact of workplace bullying on job performance but also emphasizes the significance of nurturing employees' psychological well-being for a more resilient and productive work atmosphere in the hotel industry.

Keywords: Workplace bullying; Job performance; Psychological well-being; Affective events theory

Paper ID: IRCUWU2023-182

Analyzing the impact of rural tourism development on standard of living in rural community; with special reference to Dambulla

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Rural tourism is a form of a niche market that has a high potential to interact with the rural lifestyle. The primary objective of "rural tourism" is to afford total benefits to the community in the rural regions, and enhance their contribution to tourism product development. As a country, Sri Lanka has great potential to develop rural tourism because of its range of natural and cultural resources. The research study mainly centred around the areas of Dambulla in Sri Lanka, where rural tourism implements as the main livelihood of the host community. According to the Dambulla municipal council, Dambulla is still characterized by rural communities and poverty. The research objectives of this study were to measure the economic, socio-cultural and environmental impacts of rural tourism development on the standard of living and identify the existing level of awareness and perception of the rural community on rural tourism development in the Dambulla area. The study included both quantitative and qualitative analysis (mixed method) methodologies. The sample was determined using a convenience sampling technique and the sample size consist of 286 rural residents in rural regions of Dambulla. From this sample, 12 residents were selected for qualitative analysis. The researcher collected data through questionnaires and structured interviews. The study employed descriptive analysis, thematic analysis and multiple linear regression analysis to generate meaningful information. The analysis discovered that there were positive economic, social-cultural and environmental impacts of rural tourism development on the standard of living in Dambulla. Further, the researcher discovered "Karatta Safari" is the most popular cultural activity in Dambulla. Through this study, handicrafts, water-based activities and bicycle riding were recognized as valuable hidden activities in research sites. Therefore, this study revealed that rural communities consist of sufficient awareness and perception of rural tourism development in Dambulla. According to the findings, the researcher has recommended practicing yoga in this rural environment, providing needed facilities to develop a better market for unique handicrafts, allocating facilities for a rural community to enhance their language skill, and developing several activities including water-based activities, agro-based activities and bird watching to provide amazing experience through rural tourism in Dambulla.

Keywords: Rural tourism; Standard of living; Rural community; Rural tourism development

Paper ID: IRCUWU2023-193

The impact of sticky floor on women's career advancement in hotel industry; with special reference to the Central Province

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Sticky Floor refers to the hurdles that prevent women from climbing to executive positions. As the sticky floor exists, studies endlessly demonstrate that there is an extreme degree of gender inequality in the world of work in spite of women encompassing half of the entire population. Over the last few decades, gender issues have grown into one of the most urgent problems of concern. Considering the above circumstances, the study attempted to explore whether there is an impact of sticky floors on women's career advancement in the hotel industry in Central Province. Furthermore, it was expected to identify the determinants of sticky floors that have a major impact on women's career advancement among non-executive women employees in the hotel industry. To achieve the research objectives, a quantitative research framework was adopted, and the data were collected from a randomly selected sample of 159 non-executive women employees in 4 and 5-star hotels in Central Province with a structured questionnaire. To present and analyze the data, descriptive and inferential statistics were used, and the results were yielded. The findings of the study indicated a strong negative relationship between sticky floors and women's career advancement. According to the multiple regression analysis, family factors could be identified as the most influential factor that impacts women's career advancement. Based on the findings of the study, it is recommended for the management of the hotels implement special HR policies such as a flexible working hours arrangement, implementing a diversity and inclusion policy, skills training, and childcare support to reduce career advancement barriers and promote women's employment. The results of this study will be advantageous for the hospitality industry, government, academics, and policymakers to have a clear understanding of how to solve sticky floor-related issues and attain organizational success.

Keywords: Sticky Floor; Women; Career Advancement; Hotel Industry; Gender Inequality

Paper ID: IRCUWU2023-216

Unleashing the potential: Affecting factors, barriers and opportunities in community-based tourism; with special reference to Jaffna district

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Community-Based Tourism (CBT) is a dynamic concept that is increasingly being promoted as a strategy to promote sustainable tourism and is one of Sri Lanka's most rapidly evolving tourism segments. CBT aims to conserve socio-cultural values while simultaneously supporting host communities that function as service providers at tourism destinations. The Northern Province of Sri Lanka has a tremendous potential to attract visitors due to its eco-environmental features which are under-developed throughout the civil war period. Existing research has focused on the influence of attitudes and perceptions of CBT in rural locations from the perspectives of visitors and community members. Yet, analyzing the affecting factors, barriers and opportunities from the perspective of tourists and the community is lacking the existing literature and, this study was carried out in order to fulfil this research gap. The quantitative objective of this study is to identify the impact of affecting factors on CBT development and the qualitative objective of this study is to identify the barriers and opportunities to develop CBT in Jaffna. The mixed method was utilized for this study whereas 385 tourists who visited Jaffna were selected to gather primary data using a questionnaire under quantitative research design and 14 tourism stakeholders were interviewed using a semi-structured interview method under qualitative research design. Regression and thematic analysis methods were used to analyze the primary data and the major findings of the study reveal that social, environmental and economic factors have a significant impact on CBT development in Jaffna and the regression analysis indicates that there is a significant positive impact between social, environment and economic factors on CBT development in Jaffna. Moreover, findings identify operational barriers, economic barriers, socio-cultural barriers as some barriers and legal and political support, social and environmental support, and current and future innovation technologies as opportunities associated with Jaffna CBT development. Furthermore, the study identifies the importance of having a specific CBT strategy for Jaffna. The outcome of this study will be very useful to the government and policymakers, tourism stakeholders, and local residents who are involved in the tourism industry.

Keywords: Affecting factors; Barriers; CBT development; Jaffna; Opportunities

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Identify the mediation impact of destination image to the relationship between brand personality of cultural dancing and destination attractiveness in Southern Province, Sri Lanka

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Cultural dancing is a centuries-old art form practiced worldwide, rooted in the traditions and customs of communities. In the Southern Province, cultural dancing holds a significant place in the region's rich cultural heritage and is celebrated during cultural events. This research aims to identify the mediation impact of destination image on the relationship between the brand personality of cultural dance and destination attractiveness in Southern Province, Sri Lanka. The research objectives are respectively to identify the role of cultural dancing as a tourism product in the Southern province, to examine the factors affecting the brand personality of cultural dance as a tourism product in the region, and to determine the impact of the brand personality of cultural dance on destination attractiveness through the destination image in the Southern province. A mixed-method approach was used to achieve the objectives. The quantitative analysis utilized confirmatory factor analysis and Smart PLS-SEM with 140 foreign inbound tourists who visited the Southern province. Data were collected through self-administered questionnaires using a convenience sampling technique and were processed via Smart-PLS software. Qualitative analysis was conducted using content analysis with a sample size of 10 tourism stakeholders engaged in cultural dance and tourism activities in the Southern province. Data was collected through structured interviews using the snowball sampling technique. This research contributed to understanding the role of cultural dancing as a tourism product, factors that influenced the brand personality of cultural dance, and the impact of destination image on destination attractiveness in the Southern province. The qualitative data analysis findings from this study indicate that factors such as cultural authenticity, uniqueness, and perceived value influence the brand personality of cultural dance as a tourism product in the Southern province. These factors contribute to the overall attractiveness of the cultural dance product as a tourism offering in the Southern province. This research concluded that Destination Image partially mediates the relationship between the brand personality of cultural dance and destination attractiveness. Both data analysis findings were useful for tourism stakeholders, policymakers, and researchers in developing strategies to promote cultural dancing as a unique tourism product in the region.

Keywords: Cultural dance; Brand personality; Destination attractiveness; Destination image; Tourism product

Paper ID: IRCUWU2023-243

Impact of green human resource management practices on employee engagement: The role of personality traits in hotel industry

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The world is developing day by day, and as a result, businesses and human activities negatively influence the environment largely due to endless manufacturing and consumption. Some decades ago, people identified these negative impacts, while paying more attention to protecting and saving the natural environment for future generations. According to statistical reports, hotels are the largest energy user in the business world and the highest Green House Gas releaser to the surface. Green Human Resource Management (GHRM) is considered a key source of competitive advantage to the hotel industry. This study aims to identify the mostly used GHRM Practices, the impact between GHRM practices and EE and the moderator impact of personality traits between GHRM Practices and EE. Moreover, this research will be adapted the quantitative analysis method and Researcher used self-administrated questionnaires to collect primary data from the sample of 145 employees in the above three star hotels in the Colombo district using a purposive sampling technique and the collected data was analyzed by adapting PLS-SEM by using SmartPLS statistical software. The researcher used descriptive statistics for analysis of the profile of the hotel by adapting IBM SPSS software. By using PLS path modeling researcher measured two hypotheses in this research and the researcher identified the significant positive impact of the Green Human Resource Management practices on employee engagement. Also, the moderating effect of personality Traits in the hotel industry. Further, the study suggests, personality Traits as a key consideration between GHRM Practices and EE. The researcher recommends to future researchers expand the industry and investigate customer preference, staff engagement and staff awareness impact on the Going Green Concept, and the researcher proposed multiple mediation or moderation analysis for the same research.

Keywords: Hotel industry; Green Human Resource Management; Employee engagement; Personality traits

Paper ID: IRCUWU2023-264

Impact of tourism gentrification on community life; with special reference to Southern coastal tourism zone, Sri Lanka

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The tourism industry is one of the most rapidly booming industries in the world and it is a major contributor to global economic development. Tourism gentrification is known as the process of transforming a traditional neighborhood's characteristics due to a massive influx of tourists and tourism-related businesses. Particularly, foreign companies and other local companies are investing to purchase lands belonging to the people who are living in coastal destinations in Sri Lanka. However, a significant assessment has not been done on how this gentrification behavior affects the community living in such areas. This research aimed to examine the impact of tourism gentrification on community life in the southern coastal tourism zone. The objectives of the study were to identify the current situation of tourism gentrification in the Southern coastal tourism zone and to identify the impact of tourism gentrification on community life in the Southern coastal tourism zone. This study was conducted using a qualitative approach. Using the purposive sampling method, samples of 15 community members were selected. Data was collected occupying semi-structured interviews and the interview transcriptions were analyzed through content analysis. The findings of the study revealed four aspects of tourism gentrification in the Southern coastal tourism zone including commercial gentrification, residential gentrification, sociocultural gentrification, and physical gentrification. Moreover, the research findings show there are economic impacts and sociocultural impacts that impact the community life in the Southern coastal tourism zone. Rising land prices and house rents, raising the cost of living, loss of small businesses, job creation, increase in income level, and infrastructure development are economic impacts of tourism gentrification in the southern coastal tourism zone. Loss of harmony and relationship with each other, loss of culture, disturbances, and drug addiction are socio-economic impacts of tourism gentrification in the southern coastal tourism zone. The recommendations of this study included directions to avoid negative economic and socio-cultural impacts in the southern coastal tourism zone.

Keywords: Tourism; Gentrification; Community; Southern coast; Sri Lanka

Paper ID: IRCUWU2023-267

Cognitive and affective image formation in domestic urban tourism: Investigating the influence of overall destination image on behavioral intentions: A case study of Mirissa, Sri Lanka

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Tourism brings forth numerous social, cultural, and economic advantages for destinations, emphasizing the need for a positive destination image. The image of a destination comprises two essential components: cognitive and affective. Due to inconsistencies in the existing literature and a lack of comprehensive studies in the Sri Lankan context, the impact of the cognitive image (CI) and affective images (AI) on overall image formation and subsequent behavioral intentions remains unclear. To address this research gap, this study investigates the influence of CI and AI on Mirissa on the formation of the overall destination image and its impact on behavioral intentions. This research was conducted in Mirissa, Sri Lanka, utilizing primary data collected from a sample of 200 tourists, including both past visitors and non-visitors of the destination which were selected employing a convenient sampling technique. Incorporating both past visitors and non-visitors in the study ensures a more comprehensive analysis of the relationship between CI and AI, overall destination image, and behavioral intentions. The data analysis was conducted through SPSS software and it confirmed the significant role played by both CI and AI in shaping the overall destination image among both past visitors and non-visitors. The analysis indicated a strong positive correlation between CI and overall image (0.778) and a moderate positive correlation between AI and overall image (0.406). Similarly, the overall image showed a moderate positive correlation with the intention to revisit (0.674) and a strong positive correlation with the intention to recommend the destination (0.762). The computed r^2 value of 0.454 clarifies that approximately 45.4% of the variability in the intention to revisit can be attributed to the overall image, whereas a more significant 58.1% of the variability in the intention to recommend can be understood through the overall image. The findings of this study support the notion that cognitive and affective images play influential roles in the formation of the overall destination image in the context of domestic urban tourism.

Keywords: Domestic urban tourism; Cognitive image; Affective image; Overall image; Behavioral intentions

Paper ID: IRCUWU2023-269

Impact of personality traits on travel motivation of religious tourists

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Religious tourism has grown into a much larger and more fragmented market. Sri Lanka is a country with great potential for religious tourism along with cultural heritage. But according to the tourism statistics in Sri Lanka, the number of tourists who visit Sri Lanka for religious purposes is at a very lower level (0.01%%). When a person chooses their destination, their personality traits affect to decide where they go and through that it affects their motivation. Accordingly in this study, the objectives were to identify the level of personality traits and level of motivation factors of religious tourists and to identify the impact of personality traits on travel motivations of religious tourists. A conceptual framework developed based on the big five personality traits. Data was collected through a questionnaire distributed among 340 religious tourists who visit Kandy, Sri Maha Bhodhi, Duwa church and the Munneswaram Kovil. A convenience sampling technique was used to collect data. To achieve the objectives researcher used the quantitative method and SPSS software used to analyse the collected data. To identify the level of personality traits and level of motivational factors of religious tourists used descriptive analysis and multiple linear regression analysis used to identify the impact of personality traits on travel motivations of religious tourists. According to the results, most of the tourists consist of Extraversion personality traits and Extraversion, Emotional Stability, Agreeableness, Conscientiousness, and Openness to Experience highly impact on the travel motivation. Diversification of religious tourism products such as visiting monuments, religious cultural experiences, religious tourism for peace, and religious festivals has become a new trend in tourism and it simply breaks the monotony of praying and worshipping in one place. In order to attract religious tourists to religious places and to develop religious tourism in Sri Lanka it is essential to consider tourists' personality traits and motivations.

Keywords: Religious tourism; Religious tourist; Big five personality traits; Travel motivation

Paper ID: IRCUWU2023-298

Impact of perceived supervisor's leadership styles on organizational commitment of employees in small scale restaurants: with special reference to Colombo district

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Organizational commitment is vital for leveraging human resources effectively and achieving organizational goals. Effective leadership plays a crucial role in harnessing employees' skills and knowledge, as human capital is a valuable resource that provides a competitive advantage to organizations. Leaders play a pivotal role in managing employees and aligning their attitudes with the organization's vision. However, there is a dearth of empirical research examining the impact of perceived supervisor's leadership styles on organizational commitment in small-scale restaurants within the Colombo District. This study examines the influence of perceived supervisor's leadership styles on the organizational commitment of employees in small-scale restaurants in the Colombo district. By employing a quantitative research paradigm, the research aims to address the gap in empirical knowledge regarding the impact of leadership styles on organizational commitment in the Sri Lankan context, particularly in the hotel industry based on a sample of 200 employees selected through convenience sampling, data was collected using a questionnaire comprising sections on background information, the level of agreement with path-goal leadership, and organizational commitment. Regression analysis and Pearson's Product Movement Correlation analysis were employed to analyze the data. The findings reveal significant positive relationships between leadership styles (directive, supportive, participative, and achievement-oriented) and organizational commitment. Specifically, directive, supportive, participative, and achievement-oriented leadership styles were identified as predictors of organizational commitment. The results suggest that supervisors in small-scale restaurants can enhance organizational commitment by adopting these leadership styles. This research contributes to the literature by demonstrating the positive impact of different leadership styles on organizational commitment in the restaurant industry. The study recommends the adoption of all leadership styles to enhance employees' organizational commitment, leading to a more engaged workforce and organizational success.

Keywords: Supervisor; Leadership styles; Organizational commitment; Small-scale restaurants; Colombo district

Paper ID: IRCUWU2023-302

Prospects and challenges of tea tourism in Sri Lanka: A way forward to a high-yielding tourism segment

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Tea tourism is a striking segment around the world due to the widespread number of tea lovers. Most of tea planters have already recognized the value of tea tourism as a diversified concept in addition to their primary sources of income generated from bulk tea and value-added tea. Even though there is a huge potential to attract tourists for tea tourism while generating economic benefits for the host community, it has not developed properly as a tourism product in Sri Lanka. Hence, the objectives of this study were to identify the travel motives of tea tourists, to identify the impact of tourists' perception of tea tourism on the perceived experience at tea tourism establishments in Sri Lanka, and finally to identify the prospects and challenges to develop tea tourism as a high-yielding emerging market sector. The mixed methodology was adopted as the research design and conveniently selected a sample of 350 (of local and foreign tourists) and 10 service providers involved in tourism businesses to collect primary data. Descriptive statistics, regression analysis, and content analysis were used to meet the study objectives. The data was processed and analyzed using SPSS software. The findings highlighted that push motive factors are more influencing tourists to visit tea tourism establishments than pull motive factors. Moreover, tea tourists' overall perception has a significant positive impact on their perceived experience of tea tourism. Further, the researcher has identified attractions towards the tea industry, demand for Ceylon tea, available activities and resources, and future plans of the service providers as prospects in the tea tourism industry in Sri Lanka and challenges have been identified under political, economic, environmental, operational and technological challenges. Developing a proper information base, introducing an international marketing plan to popularize tea tourism destinations, proper packaging, and implementing more activities are recommended to develop the tea tourism sector in Sri Lanka. For future researchers can carry out a SWOT analysis or value chain analysis on the tea tourism industry in Sri Lanka.

Keywords: Tea tourism; Motivations; Perceived experience; Perception; Prospects; Challenges

Paper ID: IRCUWU2023-333

Investigating the impact of perceived value of luxury rail tourists on their intention to recommend: Mediating effect of tourist experience

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The tourism sector is anticipated to play a big role in the nation's economic resurgence. Luxury tourism is the most profitable market in the tourism sector. Sri Lanka's rail sector has a great deal of untapped potential and the Ministry of Transport states that if rail tourism is properly promoted, it might contribute to the growth and prosperity of Sri Lanka's tourism industry. This research aims to identify the impact of the perceived value of luxury rail tourists on their intention to recommend which is mediated by tourist experience. The study employs a quantitative research approach, and data is collected from 125 luxury rail tourists who traveled using the 1041-Ella Odyssey Special Train (Colombo-Badulla) and the 4021-AC Intercity Train (Mount Lavinia-Kankasanthurei). The collected data were analyzed using descriptive statistics and Structural Equation Modeling. The findings of the study proved that there is no relationship between luxury rail perceived value and luxury rail tourists' intention to recommend, and tourist experience fully mediates the relationship between luxury rail tourists' perceived value and luxury rail tourists' intention to recommend. The study also contributes to the body of knowledge on mediation analysis by looking into the role of the tourist experience in mediating the relationship between perceived value and intention to recommend. In this research, the researcher recommends developing the infrastructure and ancillary services, effective branding and marketing strategies, and leveraging partnerships. This research adds value to understanding the railway tourism industry in Sri Lanka, helps to study more knowledge about identifying perceived value and enhancing the tourist experience, and will contribute to the development of strategies to improve the perceived value and the tourist experience, which can lead to an increase in the intention to recommend. Furthermore, this study will guide future researchers who are interested in this field.

Keywords: Luxury railway tourism; Perceived value; Tourist experience; Intention to recommend

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The role of tour operators in the development of sustainable mountain tourism in Sri Lanka

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Mountain tourism is a special interest type of tourism that could be elaborated as any sort of tourism activity that is done in mountainous areas. As such areas are high in sensitivity and biodiversity, the involvement of a third party such as tour operators is essential. Despite research on specialized tourism and stakeholder participation, tour operators' contribution to mountain tourism development has been frequently neglected in prior studies. In light of the research gap highlighted by the SLTDA tourism strategic report, which indicates a lack of investigation into alternative, niche, and emerging tourism market segments in Sri Lanka, this study seeks to address this research void. Specifically, the study aims to examine the antecedents and challenges faced by tour operators in the development of mountain tourism in Sri Lanka and the role played by tour operators in this context. Through a qualitative approach involving the analysis of data obtained from purposively sampled fifteen tour operators via semi-structured interviews, this study contributes to the existing literature on mountain tourism development and provides practical implications for tour operators and other stakeholders involved in the industry. The findings suggest that the antecedents to mountain tourism mainly arose under two segments, which we can elaborate on as pull and push factors. Where pull antecedents consist of Unique Selling propositions and Destination's Diversity and push antecedents arose from traveler's personal and external factors. Despite the challenges tour operators face, including the lack of government support and overshadowing by other countries, tour operators play a critical role in mountain tourism development. They act as intermediaries between tourists and the destination, creating tourism packages that cater to the specific needs and preferences of tourists. Moreover, the findings indicate that tour operators have adopted many economically, socially, and environmentally favorable practices, which lead to sustainability. However, the study suggests that partnerships and collaborations with public authorities in the tourism industry and combined tourism products could further develop mountain tourism's potential, which has not been addressed yet.

Keywords: Mountain tourism; Sustainable; Tour operators; Alternative tourism; Special interest tourism

Paper ID: IRCUWU2023-405

Tourists' expectations on willingness to visit Agri-Tourism destination (Special reference to Nuwara Eliya Agro-Ecological Zone)

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Agri-tourism combines agriculture and tourism, giving visitors the chance to participate in agricultural activities, connect with nature, learn about sustainable farming practices, and experience local cultures. It provides immersive experiences, generates economic opportunities, and contributes to the development of the agricultural and tourism sectors. To fully capitalize on the potential benefits of Agri-tourism, it is crucial to identify and understand the expectations of tourists. By recognizing what visitors seek in their Agri-tourism experiences, destinations can tailor their offerings to effectively meet these expectations. The study targets the Nuwara Eliya agroecological zone and employs a quantitative research approach that incorporates questionnaires as data collection methods. Through the implementation of stratified sampling methods, a total of 160 tourists have been selected as respondents. The study is based on the "Evolving Tourists Expectation Model" (ETEM), which aims to identify the changing expectations of tourists regarding their concerns about Environmental-friendly Sustainable Operation (ESO) in the tourism products and offerings they choose to purchase. The findings revealed that more than 76% of tourists expressed their willingness to visit destinations focused on Agri-tourism. Through the exploratory factor analysis, the study identified five factors that influenced tourists' decision-making: flexible pricing, entertainment options for tourists, opportunities for tourists to participate actively, availability of high-quality products, and the overall environmental condition. Further analysis using Structural Equation Modeling (SEM) indicated that among these factors, the basic environment, quality of products, and flexibility in pricing had a statistically significant impact on tourists' expectations and their willingness to engage in Agri-tourism activities. However, it was noted that tourists also emphasized the need for improvements in farm entertainment activities, including a wider variety of options, in order to enhance the overall environmental experience. Additionally, upgrading the quality of farm products and ensuring proper hygiene and sanitation facilities were identified as crucial factors for enhancing tourists' willingness to visit Agri-tourism destinations.

Keywords: Agri-tourism; Willingness; Tourist expectations; Nuwara Eliya; Ecological zone

Paper ID: IRCUWU2023-426

Impact of travel motivations on destination choice of backpackers in Sri Lanka

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Over recent years 'Backpacker Tourism' has been reported as the fastest-growing niche tourism market worldwide in the tourism industry. Since the beginning of the 21st century, backpacker tourism has grown significantly as a lifestyle, travel preference, and industry. In contrast to the global situation, Sri Lanka's backpacking sector is in a different state. In Sri Lanka, there is less attention to backpackers. Backpackers are not properly identified and located. Sri Lanka has not paid attention to why backpackers come to the destinations and the reasons for choosing destinations. Sri Lanka is a stunning island nation in South Asia, known as the Pearl of the Indian Ocean. With rich cultural heritage, stunning natural beauty, and friendly people, Sri Lanka has recently become a popular backpacker destination. Therefore researcher tries to find out the impact and current level of travel motivations on the destination choice of backpackers in Sri Lanka. By choosing Ella as the selected sample location, this study was completed with a quantitative data analysis of 200 backpackers by using the convenience sampling method. The research conceptualized core, middle, and outer layer motivations (Travel Career Pattern Theory) and the destination choice of backpackers. A structured questionnaire was used to collect data from the backpackers. Descriptive statistics, Pearson correlation analysis, and simple linear regression analysis were used to analyze the data. The results revealed that core layer motivations are the key motivational factors in destination choice and the most influencing core layer motivations are escape/relaxation, novelty, and kinship. The research's conclusions suggest that Sri Lanka should work to promote backpackers as a potentially valuable niche market with distinct and complementary advantages over another, the more general form of tourism.

Keywords: Backpackers; Motivations; Destination choice; Travel

Paper ID: IRCUWU2023-486

The effect of employee relation on employee performance in food and beverage operations (with special reference to five-star hotels in Colombo district)

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The hospitality industry has become turbulent and dynamic exposed to externalities whereas human resources in hospitality organizations have emerged as a significant area to achieve corporate goals and objectives. Among all sectors in hospitality, the food and beverage sector demands high labor directly to fulfil the guest's requirements. Hence, ensuring high employee performance is vital to sustain the businesses. They have the responsibility to satisfy the guests to bring them back to the hotel. Therefore, this study drew attention to study the effect of employee relations on employee performance in food and beverage operations in five-star hotels in the Colombo district. Adopting mix research approach to the study a sample of 150 employees in the food and beverage department was selected using the convenience-sampling method. The primary data were collected through a structured questionnaire and structured interview method. Analyzed using descriptive analysis, Pearson's correlation and regression analysis through SPSS software. Qualitative analysis was done through content analysis with the objective to identify the employer's strategies for better employee performance. For the qualitative analysis sample of 10 employees was selected using convenience-sampling method. The results revealed that employee relation has a significant positive relationship with employee performance. Hence, a significant positive effect was shown between these two variables. Qualitative analysis findings showed that, in addition to formal communication, informal communication also happens and revealed that their reward system is at a moderate level. Under multiple regression analysis, the coefficient value for motivation at the lowest value indicates a factor for employee performance. Therefore, the researcher can recommend managers have to be more concerned about employees' motivational factors. The working conditions, administrative policies and structure may differ between these hotels. Hence, the findings of this research cannot be applied to all. Therefore, future researchers can be focused on the whole country to conduct this research.

Keywords: Employee relation; Employee performance; Food & beverage operations; Hotel industry

Humanities, Social & Library Sciences

Paper ID: IRCUWU2023-4

An evaluation of the critical functions in English language classrooms in a university

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Marginalized mostly due to political reasons in the late 50s up to the 1980s, English is again given prominence in the secondary and tertiary education systems thus, significant steps have been taken by consecutive governments within the last two decades to improve English as a Second Language in the country. When students enter universities, the lack of competence in the English language thwarts their academic progress, as many subjects are now taught in the English medium. As such, English language classrooms contribute significantly to improving the English language abilities of students, but the problems encountered are many. Therefore, the study intended to diagnose critical functions of the English language classroom system to improve the pedagogic discourse within. Critical functions are the factors that are identified as vital for a properly operative system. Then, solutions to treat the dysfunction of language teaching and learning in English as a second language classrooms in the university were looked at. This study was conducted in the Faculty of Arts at a local university. The objectives here were to identify critical functions and reasons for the dysfunction of English as a Second Language in that pedagogy and to look at suitable recommendations for the improvement of the classroom praxis. Hence, problematic analysis was used to identify the problem situations in the classrooms. The critical functions, when not functioning, will prevent the classroom discourses from operating effectively and efficiently. Data were collected from questionnaire surveys of English instructors and students, interviews with professionals, and a literature survey were also conducted to substantiate the findings. Then a framework to overcome the dysfunction of critical functions was proposed thereafter.

Keywords: English as a second language; Critical functions; Dysfunction; Problematique Analysis; System; University

Paper ID: IRCUWU2023-15

The impact of graduates' job fit on organizational citizenship behaviour with the mediating effect of organizational commitments of the public sector organizations in Jaffna district

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The paper is a systematic study based on hypothetical deductive, correlational, and cross-sectional methods that were carried out to glean empirical evidence of perceived Person – Organization fit and Person – Job fit on Organizational Citizenship behaviour with the mediation effect of the Organisational Commitment. The Development Officers from Jaffna District were a population (N=675), and the stratified random sample was 251. The data collected through Google Form 198(79%) was analysed by SPSS-26. Internal consistency for 12 items Cronbach's alpha ranged from 0.789 to 0.833. The independent variables are Person – Organization Fit and Person – Job Fit, the dependent variable is Organizational Citizenship Behaviour and the mediating variable is Organizational Commitments. The Person– Organization Fit and Person – Job Fit were significantly high. (M=3.86, SD=0.41, and M=3.81, SD=0.79). Organizational Commitments were significantly moderate level (M=3.28, SD=0.62) and Organizational Citizenship Behaviour was moderate level (M=2.83, SD=0.49). Five hypotheses are postulated based on a literature survey; one is that perceived Person-Organization fit has a positive influence on Organisational commitments, which showed a weak positive correlation (r=0.203, p<0.001). Second is Perceived Person – Job fit has a positive influence on Organizational Commitments which showed a moderately positive correlation (r=0.405, p<0.001) and accepted the above alternative hypotheses. Third, Organizational Commitment has a positive influence on Organizational Citizenship Behaviour showing a strong positive correlation (r=0.811, p<0.001) accepted alternative hypothesis. The fourth and Fifth hypotheses are that through the mediating effect of the Organizational Commitments, the perceived Person – Organization Fit (Sobel test; z=2.86, p<0.001), and the Perceived Person – Job fit (Sobel test; z=5.93 p<0.001), enhanced the Organizational Citizenship Behaviour. Organizational Commitments mediated between Perceived Person -Organization fit, perceived Person-Job fit, and Organizational Citizenship Behaviour, with both alternative hypotheses accepted. Recommending both employers and officers encourage them to arrange and attend training to enhance their work attitudes, pro-socialization behaviour, and Job fit.

Keywords: Person–Organization fit; Person–Job fit; Organizational Citizenship behaviour; Organizational Commitment.

Paper ID: IRCUWU2023-19

Factors affecting inequality in education in Sri Lanka: A multinomial logistic regression approach

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This empirical analysis aimed to examine the factors affecting educational inequality in Sri Lanka. Data for this research was collected from a sample of 378 randomly selected households, which included 536 school-aged children. A structured questionnaire was used to gather information, and the sample was selected through a combination of purposive and random sampling techniques. Specifically, the districts of Colombo, Nuwara-Eliya, Batticaloa, Puttalam, Anuradhapura, and Rathnapura, along with their Divisional Secretariat divisions and Grama Niladhari divisions, were purposively selected based on two criteria: poverty ratio and percentage of informal sector workers. Within these selected areas, households were chosen randomly. The empirical analysis utilized a Multinomial Logistic Regression model (MLR) to identify the determinants of educational inequality in Sri Lanka. The key findings of the study indicate that several factors significantly influence educational inequality in Sri Lanka at a significance level of 0.05. These factors include monthly educational expenditure, household size, residential area, and the receipt of social protection programs. The findings underscore the importance of addressing factors like household financial constraints, household size, and disparities in residential areas to enhance educational opportunities for all students. Financial constraints, such as the inability to afford educational expenses, contribute to disparities in access to quality education. Additionally, larger household sizes may limit the resources available for education, leading to unequal opportunities among children. Moreover, discrepancies in residential areas, with some areas having better educational infrastructure and resources than others, contribute to educational inequality. To address these issues and promote educational equality, the study recommends the development of an inclusive online education platform accessible to all students. This platform would provide equal access to educational resources and opportunities, regardless of geographical location or economic background. Additionally, the study suggests to the introduction of a school-funded scholarship program to support low-income households. This program would help alleviate financial burdens and enable students from disadvantaged backgrounds to pursue their education without hindrance.

Keywords: Affecting factors; Disparities; Educational inequality; Sri Lanka

Paper ID: IRCUWU2023-32

Hindi-English pronoun system: A contrastive analysis

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All languages have pronouns, at the very least first-person and non-first-person. A pronoun is a word that can function by itself as a noun phrase, and that refers either to the participants in the discourse or to someone or something mentioned elsewhere in the discourse. As Hindi is an Indo-European language, to which English also belongs, the pronoun in Hindi closely resembles their equivalents in English. Therefore, the objective of the present study was to provide a clear understanding of the pronouns that function in Hindi and English languages as several translations take place between Hindi and English, as well as native speakers of Hindi and English learn respectively English and Hindi as a foreign language. This study focuses on the similarities and differences between Hindi and English. And primary data were gathered using library surveys and the Internet. Secondary data were collected through discussions with academicians of the University of Kelaniya. Data analysis was performed as a comparative study based on contrastive analysis techniques. The key research findings of this paper are based on identifying several extraordinary features of Hindi and English pronouns compared to both languages. This paper emphasized the clarification of pronouns. Always Hindi and English pronouns cannot be fitted, and Hindi-English pronouns may play concerning the action or state described by a governing verb.

Keywords: Contrastive Analysis; English; Hindi; Morphology; Pronouns

Paper ID: IRCUWU2023-35

Factors affecting to the development of school-level badminton players in Central Province

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Badminton holds a significant position among racket sports globally, known for its short duration and high-intensity gameplay involving two or four players. The sport's progress is influenced by various factors, which ultimately shape a player's maximum performance. There is limited research on Badminton in Sri Lanka. Hence, the primary objective of this study was to explore the physical, human, economic, and sports development factors impacting school Badminton in Sri Lanka's Central Province. The study included a sample of eighty-two participants, consisting of forty-two physical education teachers and forty-two school students (n=84, PE Teachers = 42, Students = 42). Data was collected using the multi-state sample method in Central Province, utilizing separate questionnaires with twenty questions for both physical education teachers and students. The questionnaires utilized a five Likert Scale (Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree). The data was analyzed using Minitab 19, and the findings were presented using tables and graphs. The results indicated a negative relationship (-) between the physical factors, economic factors, and sports development factors concerning Badminton development, suggesting that these aspects require improvement to foster the sport's growth. The human factors of school students and physical education teachers exhibited a neutral (0) relationship with Badminton development, implying that there is neither a positive nor a negative association. The finding also proved that a depth study of the current situation of school badminton games in Central Province, and better focus on the development of school-level badminton. To develop school Badminton in Sri Lanka's Central Province, following a long-term training plan, conducting training programs, providing adequate facilities, and employing new technology is generally preferable

Keywords: Badminton; Economic factors; Human factors; Physical factors; Sports development factor

Paper ID: IRCUWU2023-63

Mapping of e-waste based on research publications: A scientometric study

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The study is to focus on overall keyword e-waste research publications in countries. This study tried to examine the research performance of the e-waste field as a major performance area. The investigation on e-waste, published from 2018 to 2022, was conducted by collecting data from the Web of Science database, utilizing the search string title. Through the course of this, a total of 2,283 records were successfully obtained. Furthermore, data analysis was undertaken, with the help of MS Excel, Bibexcel, and Biblioshiny, along with mathematical and statistical formulas. It found that the single authors published 86 articles with a percentage of 3.76, and more than two authors published 2197 articles with a percentage of 96.23. The maximum Degree of Collaboration was in the year 2020 which was 0.9641, followed by 0.9632 in the year 2019. The findings provide insight into the current state of e-waste, contributing to further understanding of this research.

Keywords: E- waste; Hazardous waste; Scientometric; Zipf's law; Collaboration index

Paper ID: IRCUWU2023-110

Identify the women's contribution with respect to food and nutrition security: A case study from Palugaswewa tank cascade system, Sri Lanka

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In the Palugaswewa Tank Cascade System of Sri Lanka, women play a vital role in ensuring food and nutrition security. However, they face challenges in accessing resources and decision-making power. Despite this, women are actively involved in crop cultivation, livestock management, and food processing, which are crucial for household food security. Gender equality in agriculture can lead to poverty reduction, increased agricultural productivity, and improved food security. A study conducted with 120 women farmers from the area reveals that most of them are married and have completed formal education. About half of the women are engaged in crop farming and dedicate significant time to agricultural activities. However, there is a significant disparity in land ownership, with the majority not owning agricultural lands. Regarding food processing, the majority of women spend less than an hour per day, while some spend 1-5 hours. In terms of food searching, a significant portion currently spends no time, while the majority dedicates less than an hour. Awareness about food and nutrition security is relatively high, with many women possessing broad knowledge through awareness programs. Local traditional practices play a role in food production for about half of the respondents, indicating the potential for enhancing household food and nutrition security. However, there is room for promoting the adoption of traditional knowledge among the remaining women. In conclusion, despite facing challenges, women's contributions to food and nutrition security in the Palugaswewa Tank Cascade System are significant. Empowering women through equal access to resources, education, and decision-making can lead to increased food production, improved nutrition, and enhanced food security. Harnessing local traditional knowledge and understanding the unique factors influencing food security are crucial for developing effective strategies. By addressing these issues, Sri Lanka can make progress towards achieving sustainable food security and improving community well-being.

Keywords: Tank cascade system; Food and nutrition security; Women's contribution; Agriculture production

Paper ID: IRCUWU2023-119

Evaluating the awareness of Artificial Intelligence among academic librarians at the University of Kelaniya, Sri Lanka

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Artificial Intelligence's burgeoning prominence across various sectors calls for its effective implementation in library science. Nevertheless, the integration of AI in academic libraries appears to be hampered by a significant lacuna: a discernible deficiency in AI knowledge and practical application among library professionals. Hence, the critical research problem centers around determining the AI awareness level among the librarians at the University of Kelaniya. This study explores the level of awareness of Artificial Intelligence (AI) among academic librarians at the University of Kelaniya, Sri Lanka. The key objective was to investigate the librarians' comprehension of AI, the perceived benefits, potential challenges, and the influence of AI literacy on library service optimization. The methodology for this qualitative study incorporated semi-structured interviews with 11 academic library staff members concerning their AI cognizance, attitudes, and perceived barriers. The resulting data was subsequently analyzed via thematic analysis, extracting key patterns and insights. Results evince a relatively moderate level of AI awareness amongst participants, although a strong appreciation for AI's potential role in enhancing library services is apparent. The chief impediments identified include a lack of structured training, resource scarcity, and technological hurdles. Conclusively, the study underscores the compelling need for targeted interventions to bolster AI literacy among academic librarians. The outcomes also emphasize the urgency to bridge the identified gaps in knowledge, facilitating the effective incorporation of AI within library operations.

Keywords: Artificial intelligence; Academic libraries; AI Awareness; Library services; University of Kelaniya

Paper ID: IRCUWU2023-121

Developing a conceptual framework for digital transformation of readers services in Sabaragamuwa University library of Sri Lanka

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Integration of digital technologies into reader's services in Sri Lankan university libraries remains notably deficient, despite the rapid growth of digital technologies. The key objective, therefore, is to establish a conceptual framework for the Digital Transformation (DT) of readers services in the Sabaragamuwa university library of Sri Lanka. Recognizing the surge in digital information technologies and their pervasive influence, the study strives to facilitate the transition from traditional services to digital platforms, enhancing accessibility and user experience as the outcome of the research. This study identifies the pivotal question: how can a conceptual framework be constructed to guide the DT of reader's services? By addressing this concern, the research endeavors to promote effective digital services, ensuring that the libraries meet contemporary user expectations and remain relevant in the digital era. In-depth interviews are used to collect data from a focus group of 04 librarians and 20 library users across Sabaragamuwa University of Sri Lanka. To formulate the proposed framework, an interpretative phenomenological analysis (IPA) is employed as the principal methodology. This qualitative approach allows the investigation of librarians' and users' transformative charged-lived experiences with the transformative environment of a library. The study reveals that a digital divide exists within the current reader's services, hindering users from optimally exploiting the available resources. The proposed conceptual framework encapsulates several aspects including digital infrastructure, user-friendly interfaces, digital literacy training, and continuous evaluation processes, amongst others. In conclusion, this research emphasizes the urgency for university libraries in Sri Lanka to undergo a systematic DT of reader services. The proposed framework serves as a comprehensive guide, addressing the unique challenges of this transition, thereby enhancing user satisfaction and increasing library usage.

Keywords: Digital transformation; Readers services; University libraries; Conceptual framework

Paper ID: IRCUWU2023-131

Microsoft Power BI Desktop: An open-source software tool for data visualization in libraries

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Microsoft Power BI Desktop is a powerful open-source software tool that offers significant potential for data visualization in libraries. Power BI Desktop is a valuable tool for librarians looking to improve their data analysis and visualization capabilities and make more informed decisions based on their data. This paper discusses the application of Microsoft Power BI Desktop as an open-source software tool for data visualization in libraries. In the current data-driven economy, effective data management and analysis have become crucial for driving growth and making informed decisions. Microsoft Power BI desktop offers a powerful and user-friendly solution for connecting, transforming, and visualizing data in real time. This paper highlights the key features of the Power BI desktop, including its data sources, data transformation capabilities, visualization tools, and collaboration features. It also explores the advantages and limitations of using Power BI Desktop as a data visualization tool and provides best practices for its utilization. The application of Power BI desktop in an academic library setting is explored, focusing on collection analysis, user engagement, space planning, and assessment and evaluation.

Keywords: Microsoft Open-source software, Data visualization, Real-time visualization, Real-time visualization

Paper ID: IRCUWU2023-136

Language and social media: Exploring the impact of digital platforms on linguistic variation and discourse styles in Sri Lanka

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This research aims to critically investigate the impact of social media on language use and communication patterns in Sri Lanka, focusing on popular digital platforms such as Facebook and Instagram. In an era dominated by the rapid evolution of digital communication, social media platforms have become central spaces for interaction, information dissemination, and self-expression, significantly influencing the ways individuals communicate and engage with language. By delving into the intricate interplay between social media and linguistic practices, this study seeks to shed light on the dynamics of language variation, discourse styles, and language change in the context of Sri Lanka's diverse sociolinguistic landscape. This study employs a mixed-methods approach including qualitative and quantitative data-gathering techniques. The language usage patterns, discourse patterns, and linguistic characteristics of user-generated material on social media platforms will be investigated by qualitative content analysis. One of the noteworthy trends identified as a consequence of this research is the rise of "Sinhala-English Code-Mixing" in online communication. The study discovered that Sri Lankan users commonly combine Sinhala and English in their posts and comments, a practice known as code-mixing. Due to the multilingual character of Sri Lanka's digital domain, the adoption of this hybrid language practice is frequently driven by a desire to appeal to a wider audience. Furthermore, the research revealed a significant increase in the use of "Emoji-Based Discourse" across various social media platforms. Emojis, as visual representations of emotions and ideas, are employed to complement or even replace textual communication, leading to the development of innovative discourse styles. The integration of Emojis into linguistic exchanges on social media has prompted discussions on the potential impact on language comprehension and the evolution of non-verbal communication patterns among Sri Lankan users. Through critical analysis and interpretation of the collected data, this research provides valuable insights into the ever-changing landscape of language use on social media in Sri Lanka. The findings may have implications for language policy, education, and digital communication practices, offering opportunities for fostering inclusive and effective language use in online settings.

Keywords: Language; Linguistic; Discourse analysis; Social media; Variation

Paper ID: IRCUWU2023-202

The path to e-judiciary: Where does Sri Lanka stand?

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The Supreme Court of Sri Lanka

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The judiciary renders justice to the people of the country and timely justice is one of the hallmarks of a democratic society. The notion of the E-Judiciary is rooted in this necessity to deliver prompt justice through adapting to the digitalization of the legal arena. The task of strengthening the E-Judiciary in Sri Lanka is a sub-target in Sri Lanka's wider goal of adopting e-governance. The objective of the e-governance strategy of Sri Lanka is to harness ICTs towards achieving socio-economic development in the country. As a part of this strategy, e-judiciary is aimed at increasing proficiency, productivity, and transparency while reducing red tape and corruption within the judicial system. The process of digitization within the judiciary includes digitization of court records, e-filing of cases, virtual hearings, and live streaming of court proceedings. The Sri Lankan judiciary started using technology in their daily proceedings mainly during the Covid-19 pandemic era. Although the country has been progressive in some of the above tasks, several key areas require further action and attention. Moreover, many other socio-economic obstacles hinder the establishment of e-judiciary in Sri Lanka including, low IT literacy, language barriers, lack of public trust, lack of finance, lack of information, and resistance to change. This paper is aimed at discussing the current status of e-judiciary in Sri Lanka. The methodology used in the paper is a qualitative approach based on doctrinal research and journal articles, research publications, e-books, online reports, and websites have been used and analyzed to complete the research. The paper at its beginning discusses the concept of e-judiciary and what the country has done so far to adopt e-judiciary. The paper then analyzes the potential of strengthening the e-judiciary in Sri Lanka by making references to the system of e-judiciary in India. The paper examines the challenges in adopting e-judiciary in Sri Lanka and gives recommendations to overcome such. In conclusion, this paper suggests that Sri Lanka can adopt a more progressive and productive e-judiciary by investing additional time, resources, and research on this aspect.

Keywords: E-Judiciary; E-governance; Digitalization; Technology; Justice system

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Ranking of academic social networking websites: A webometric analysis

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This research article presents a webometric analysis aimed at ranking and evaluating academic social networking (ASN) websites. The proliferation of ASN platforms has provided researchers with new opportunities for collaboration, knowledge exchange, and visibility within the academic community. However, the abundance of choices makes it challenging for researchers to identify the most suitable platforms for their specific needs. This study addresses this gap by utilizing webometric analysis techniques to assess and rank ASN websites based on various indicators such as web presence, user engagement, publication citations, and user feedback. This study investigates and explores the websites of 12 academic social networking websites based on their backlinks, Country Rank, Category Rank, Google page rank, global Rank, and desktop and mobile website loading time. This study collected data from Check page rank, Similarweb, and other SEO-analyzer search engines. The following methodology has been adopted in this study. The data were analyzed by using the MS- excel sheet used to visualize the network mapping of the websites. The result shows that LinkedIn (16) occupies the first place out of 12 academic social networking websites with a Global Rank. Followed by LinkedIn (17) secure first place in academic social networking websites with a Country rank. Followed by Research Gate (2) secured first place in academic social networking websites with a Category Rank. Followed by LinkedIn (10) secured first place (out of 10) in 12 academic social networking websites with a Google page rank. Followed by LinkedIn (2,14,74,83,647) occupied first place in academic social networking websites with Backlinks. Followed by LinkedIn (1.7 B) occupied first place in academic social networking websites with Total visits in users. Followed by Science Daily, Mendeley, LinkedIn, Google Scholar, Academia.edu, Research Gate, Scholastica, Proquest, Zetoro, and Zenodo have secured Suggestion as a Great academic social networking website with website Desktop Loading speed. Followed by Science Daily, Google Scholar, LinkedIn, Academia.edu, and Research Gate have secured Suggestion as a Great academic social networking with a website mobile loading speed. This ranking can assist administrators of academic social networking in assessing the strengths and weaknesses of their online presence and developing strategies to improve their web presence.

Keywords: Webometrics; Global rank; Academic social networking; Google page rank

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Preservation of traditional folk music in Sri Lanka: Conservation practices and key challenges

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Folk music holds a significant place in the cultural heritage of Sri Lanka (SL), serving as a rich tapestry that reflects the traditions, beliefs, and diverse ethnic communities of the country. However, the preservation and conservation of these valuable musical traditions face various challenges in the modern era. The purpose of this research paper is to investigate and analyze the folk music archiving, preserving, and conservation practices in SL. The primary objective is to examine the historical background and current practices related to the preservation and promotion of folk music in SL. A qualitative case study approach was used to investigate the practices and challenges of folk music conservation in SL. Data were gathered using a literature review, semi-structured interviews, and observations. Purposive sampling was used as the sampling method. The collected data were analyzed using content analysis. The study identified conservation practices employed by organizations like the Folk Music Conservation Centre, Research and Archive Centers of Universities, National Library, Sri Lanka Broad Casting Cooperation, and individual practitioners. Notably, Devar Surya Sena, W. B. Makulloluwa, and C. de S. Kulatillake have made significant contributions to the exploration and documentation of Sri Lankan folk music. Their archival work, research initiatives, educational programs, and performances have played a crucial role in safeguarding and perpetuating traditional music forms. No proper policy for safeguarding, no maintaining inventory, no specific attention to identifying endangered musical genres, no suitable resources, lack of awareness, lack of appropriate programs to strengthen and improve the taste of folk music among the community, and poor financial support were identified as challenges.

Keywords: Conservation; Cultural heritage; Folk music; Sri Lanka

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Motivational factors of undergraduates for reading in English: A case study of successful cases

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Reading in English is an essential requirement for the successful academic performance of undergraduates. Achieving English competence has become challenging, especially in contexts where English is used as a second language. Therefore, the research objective was to identify undergraduates' motivational factors for reading in English as a habit. Accordingly, a case study was conducted using inductive reasoning and mixed-method research instruments. The research objective was achieved in two phases. The first phase is a questionnaire survey for 643 undergraduates from three faculties where essay-type writing in English is mandatory. The first phase revealed that 33% of undergraduates do not find English challenging when they enter university. Meanwhile, 24% of them find English a continuous challenge to achieve targeted grades compared to achieving new subject knowledge in the university. In the second phase, the in-depth interview with 15 identified regular readers of English unanimously disclosed that it is difficult to trace one reason to continue reading in English. However, two types of motivational factors were discovered: those evident during the period of university education and before university entrance. The research recognized four factors that motivated them during university education to continue reading in English as a habit: reading in English being voluntary and trouble-free, satisfactory appraisals in academic performances, unique opportunities in extracurricular activities, and the availability of stimulating technological advancements for screen reading. Similarly, three factors motivated them before university entrance. Reading in English as a habit is identified as a mutually beneficial, interdepending avocation for better academic performance and language improvement. However, research is needed to verify the generalizability of the findings to all Sri Lankan universities.

Keywords: Reading in English; English as a second language; Academic performance; Motivation for reading

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'Right to disconnect' in the information society: Lessons from France

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As the European Parliament defines, 'Right to Disconnect' or 'Right to Offline' is considered a worker's right which enables an employee to refrain from working on electronic-related platforms during non-working hours. Two decades ago, contacting an employee during non-working hours or weekends was an exceptional phenomenon except in cases of emergency. However, the present context is different from what we experienced two decades ago. Now, the 'on call' has become a mandatory working norm. The norm has been improperly and excessively used by employers while contravening the employment contracts signed by employees. The objective of the paper is to promote a legal framework to address the issue of online workers and their right to offline. The author has used comparative analysis to convince the necessity of a separate legal framework and the comparative jurisdiction in France. The research is qualitative and involves the content analysis of primary and secondary sources of law. Digitalization and advancements in the Information Technology sector have blurred the line between private and professional life. The covid 19 pandemic compelled the employees to work from home and the mode of working was identified as the online platform. This was a common incident in Sri Lanka as well. Currently, most of the IT companies in Sri Lanka have adopted the 'work online method but still, there is no legislation to prevent the employees from exploitation by the employers. The paper is predominantly focusing on the matter of including the 'Right to Disconnect as a recognized digital right in Sri Lanka. The reason for selecting France is that there exists strong legislation to protect the employees. In conclusion, the author has asserted that the 'Right to Disconnect' is a basic human right and it is necessary to draft a new law to protect online workers to improve the efficacy of companies and to protect the health and personal interests of workers. The author recommends the enactment of a new legal framework to address the digital rights of workers including the right to disconnect.

Keywords: Right to disconnect; Information technology; Law; Digital right; Labour; France

Paper ID: IRCUWU2023-304

Lexical substitution among bilingual children in Sri Lankan context

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The genesis for this study is to analyse the part played by lexical substitution in the linguistic development of a young child. When we look into the child's speech, we find that it has the characteristics of imitation and even at times rote learning. Children around the world seem to start with a single word and go from a one-word stage to a two–word stage. It is common knowledge, however, that children understand more than what they can speak in the beginning. This paper through empirical evidence identifies lexical items from both languages (English and Tamil) as vocabulary items. The child was growing up in a bilingual environment where adult discourse was weighted in favor of English. Usually, children fail in their attempts to imitate adult speech at the beginning of syntactic development. The children are more successful in spontaneously producing sentences. At this stage the child started resorting to lexical substitution, for example, using English words in Tamil sentences and Tamil words in English sentences. It appeared as though the child made no distinction between the two languages. This substitution or switching occurred very smoothly and spontaneously. As the concepts arose in the mind, a child picked out the labels for them and the labels were there in both languages as alternate vocabulary items. This lexical substitution is developed in this study in English and Tamil noun to noun, noun to noun phrase, noun to verb, noun to preposition, and noun phrase to sentence respectively. The study's results show such clear-cut cases of vocabulary substitution that it is impossible to distinguish between the child's Tamil and English lexicon. This could be expected of a child caught between two languages, in whose linguistic environment code-switching is a regular feature. That lexical substitution is a necessary and inevitable stage in the linguistic development of a young child acquiring a second language.

Keywords; Acquisition; Lexical substitution; Vocabulary; Imitation; Empirical; Lexicon

Paper ID: IRCUWU2023-310

An investigation of the spread of the concept of "*Kuvera*" in Asia

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"Kuvera" is an important deity in Indian Hinduism. According to the Vedas, he is one of the *"Ashtadigpala*" deities, the ruler of the eight directions. He is also the lord of all demons. Above all, he is the lord of wealth. His great treasure is guarded by his servants *Sankha* and *Padma. "Vaishravana"* is another name for him. Indians worship him for wealth and its protection. It is clear from the archaeological evidence that the Sri Lankan society of the past also believed in him. Such as *the Kuvera* image is engraved on "*Kahavanu"* coins in Anuradhapura and *Sankha, Padma* image on "*Muragala*". This research examines how this concept has spread and established itself outside of Hinduism and Indian territory. As a result, he was found to be mentioned in other non-Hindu religions. In early Buddhism, he is known as "Vessawana", one of the "*Sathara Waram*" gods who rule the "*Chaturmaharajika"* heavens and is the lord of demons who rules the northern direction. In Mahayana Buddhism, he is known as "*Jambal"*. He has five forms and the yellow and black Jambal forms are similar to Kuvera. The *Kuvera* concept is also found in countries outside India. In China, he is known as "*Pishamentian*" and is the lord of the north direction. In Japan, he is known as "*Bishamonten"* and also is one of the seven Gods of Fortune. According to the above information, *Kuvera* is not a purely Hindu deity but is mentioned in other Indian religions and the spread of this belief probably happened with Buddhism and he is recognized as its protector. Even in different branches of Buddhism, there are different opinions about his form, name, origin, and appearance. In conclusion, the "*Kuwera*" concept has been established in various cultures as the god of wealth, lord of demons, and ruler of the northern direction not only in India but also Asian region.

Keywords: Kuwera concept; God of wealth; Hinduism; Other Religions; the Asian

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Developing the mathematics teachers' pedagogical content knowledge through algebraic thinking

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This study examined the development of pedagogical content knowledge (PCK) in the algebra of twenty mathematics teachers in the case of algebraic thinking in a two-month professional development (PD) program. The purpose of the study was to develop mathematics teachers' PCK in algebraic thinking, teaching basic algebraic concepts, symbols, and variables, and introduce new approaches to teaching basic algebraic concepts, symbols, and variables to the current teacher education curriculum in Sri Lanka. This mixed methods research was conducted as a case study. The program was conducted as a case study for a group of 20 secondary-level mathematics teachers who are following a two-year in-service teacher training course. The participant teachers' existing knowledge and experiences were taken into discussion apart from the programmed activities. The mean and the standard deviation of the post-test and the pre-test were, (65.60, 4.012) and (33.10, 10.252) respectively. The results interpreted considerable progress of the PD program representing a bigger mean and variability of the post-test than the pre-test. Qualitative data were analyzed under two themes. Under the theme, of addressing the students' misconceptions, they gained the awareness of innovative approaches, with the relation of concrete manipulations, functional thinking, the structural sense, and numerical sense, which help to analyze the students' algebraic misconceptions better. In the second theme introducing new algebraic concepts, the mathematics teachers could develop and modify their abilities to introduce symbols and variables with novel points of view and proper background of the concepts. From the interview findings, teacher trainees asserted the importance of algebraic thinking for problem-solving in algebra. The textbook includes uncompleted definitions for variables. That could eliminate the suspicion of introducing variables. The teachers developed their thinking patterns with different views**,** and are aware of problem-solving functional thinking, and structural thinking. The study recommends the need for algebraic thinking to develop the PCK of Mathematics Teachers in the teacher education curriculum with reforms for enhancing the quality of mathematics education in Sri Lanka.

Keywords: Algebraic thinking; Numerical sense; Pedagogical content knowledge; Professional development; Structural sense

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Existence of traditional performing arts as cultural dialogue

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Traditional performing arts play a vital role in the intergenerational transmission of intangible cultural values. Rapid urbanization, large-scale migration, industrialization, globalization, and environmental changes pose threats to the existence of traditional performing arts. Concerns over the extinction of traditional performing arts were discussed in the existing literature. However, no noteworthy research has been carried out yet to find out how the traditional performing arts are preserved and how their existence is upheld. This paper discusses how traditional performing arts are alive in changing times and varying circumstances. The existence of Vasanthan Aattam, which is the traditional performing art, belongs to the people of Kattuvan village, situated in the Jaffna district of Sri Lanka, even after the large-scale migration from the native place has been identified. Analyzing what makes this performing art at varying times alive is research worthy of identifying the aspects that contribute to the existence of age-old traditional performing arts. A qualitative research approach was adopted in this study. Data was collected through interviews with the one who came from the tradition of historically performing "Vasantham Aattam" and with five exiled youths who still occasionally perform this art, documentation studies, and direct observation were analyzed using narrative and discourse analysis for this study. It could be concluded that, though many factors pose a threat to the existence of traditional performing arts, the collective effort of society and people's loyalty towards their society and its cultural values will preserve the existence of traditional performing arts. The existence of two-hundred-year-old Vasanthan Aattam even after the exodus of the people of this performing art is a perfect example of the will of the people to preserve their traditions even in changing times. Though Vasanthan Aattam has survived all the threats, failure to make continuous efforts to take preservation measures will end up with this tradition becoming extinct.

Keywords*:* Intangible cultural heritage; Preservation; Traditional performing arts; Vasanthan Aattam*;* Existence

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Adopting Artificial Intelligence for digital transformation of University libraries: A review

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There's a renewed focus on digital transformation (DT) of university libraries to become an intimate information center among emerging generations. Providing various user needs for different generations is a real challenge for a university library. Artificial Intelligence (AI) is one of the pivotal technological tools with the potential to digitally transform a university library. AI has the potential to enhance library services and operations, ultimately improving user experiences and promoting efficient resource management. The lacuna of having a comprehensive review regarding the use of AI in DT of university libraries will be addressed by this study. Thus, the objective of the research was to investigate how AI can have adopted to perform the DL of university libraries. The study is a literature review that was followed by the systematic literature review method. In achieving the purpose, related current empirical knowledge was searched and reviewed on "the use of AI in DT of university libraries" in the EBSCOhost, Lens.org, and Dimensions databases from 1946 (the age of baby boomers) to 2023 (present GenZ). The article selection criteria were executed using the PRISMA article selection flowchart steps. Bibliometric analysis will be performed using RStudio to achieve the research objectives. Literature reviled that; AI can be adopted for 1. Intelligent search and discovery, 2. Virtual assistants 3. Automated collection management, 4. Library management automation with data-driven decision-making options, and 5. For collaboration and building communities. Literature also suggests that the future university libraries will integrate with emerging technologies such as the Internet of Things (IoT), data analytics, and semantic web and lead towards enabling intelligent library systems, advanced recommendation engines, and personalized learning experiences. However, challenges such as ethical considerations, data privacy, algorithm bias, staff training, implementation cost, and user acceptance are critical factors that require careful attention while implementing AI solutions. Thus, more research and tested framework for the digital transformation of university libraries is highly essential before adopting AI into the university library systems.

Keywords: Library transformation, Artificial intelligence, University library transformation, AI-driven transformation

Material & Mineral Sciences

Paper ID: IRCUWU2023-52

Characterization and differentiation of Chitin and Chitosan extracted from common crustacean species

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The shrimp and prawn local industry's rapid expansion has caused a significant increase in shell waste production, which negatively impacts the economy, social issues, and community health. Producing shellfish waste into chitin and chitosan is a beneficial solution to reduce improper waste disposal. This research aimed to investigate the quality and quantity of the chitin and chitosan extracted from white leg shrimp (*Litopenaeus vannamei*) and giant freshwater prawn (*Macrobrachium rosenbergii*) shell wastes by characterization and differentiation using a novel and improved extraction method which has pretreatment step has not been done in Sri Lankan context. Around 12% chitosan yield was given by usual conventional methods but this method gives a comparatively higher chitosan yield. Yields from shrimp and prawns were 17.76 ± 0.19% and 17.14 ± 1.32% respectively. The moisture content of 6.16 ± 0.72%, ash content of 0.95 ± 0.03%, and degree of deacetylation 80.29 ± 0.08% were observed for shrimp shells samples while those for prawn shells were 8.50 ± 2.58%, 1.05 ± 0.05%, and 80.40 ± 0.58% respectively. The shrimp shells gave a 33.35 ± 1.59% shell protein percentage, 63.24 ± 2.77% inorganic salt content in the shell and antioxidant activity of 60.12 ± 0.45% while prawn shells gave 46.34 ± 1.91% shell protein percentage, 54.13 ± 0.89% inorganic salt content in the shell, and antioxidant activity of 65.23 ± 1.02%. Fourier transform infrared spectroscopy analysis confirmed the structure of chitin obtained from both shrimp and prawn shells is similar to that of standard chitin. X-ray diffraction analysis showed higher crystallinity for extracted chitin and chitosan. In conclusion, this study demonstrated that improved extraction and purification method can be successfully applied to extract chitin and chitosan in higher yields with comparatively high purity without further modifications. These findings will provide a solution for waste accumulation and an alternative income generation strategy from waste and have the potential to inform future interventions of novel chitin derivatives for applications in biomedical, pharmaceutical, and materials science.

Keywords: Chitin extraction; Chitosan; *Litopenaeus vannamei*; *Macrobrachium rosenbergii*

Paper ID: IRCUWU2023-75

Determination of the causes for yellow patch formation in natural rubber-based examination gloves

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Customer satisfaction is the ultimate objective of any production organization. One of the well-reputed glove manufacturing companies in Sri Lanka has been producing natural rubber-based examination gloves for decades. Examination gloves are used in many sectors such as barrier protection, infection control and to provide safety for users. Therefore, gloves should be devoid of defects to enhance protection and reduce occupational hazards. Among the several defects that occur in the factory, the occurrence of yellow colour patches on the examination and surgical gloves is a key issue that results in large economic losses to the company because the cause is unknown. Initially, the cause was assumed as the seasonal changes in latex. The focus of this research was to find the causes of yellow patch formation in natural rubber-based examination gloves. After brainstorming with the industrial experts, several factors were identified as the most possible causes and their affects were analyzed. Characterization was done by Fourier Transform Infrared Spectroscopy to differentiate the defect-free glove and a glove with defects. Secondary data was collected along with some experimented data. General linear model, correlation, and regression analysis were done using Minitab 17. Based on the hypothesis test results, mechanical stability time (p=0.002) and the time taken to tumbler the gloves after stripping (p=0.003) had a significant effect on the formation of yellow patches at the 0.05 significance level. However, factors like compounding ingredients, microbial activity of the polymer (p=0.147), glove moisture content (p=0.818), and latex parameters such as maturity (p=0.051), total solid content (p=0.121), dry rubber content (p=0.391), total alkalinity, volatile fatty acid content (p=0.537), non-rubber percentage (p=0.960), and the discolouration of the formers had no significant effect for yellow patch formation at 0.05 significance level. Hence, maintaining an optimum mechanical stability time and reducing the time gap between stripping and tumbling was proposed to the company to minimize the issue.

Keywords: Correlation; Examination gloves; Polymer tank; Yellow patch

Paper ID: IRCUWU2023-92

Development of biodegradable plastic from the leaf extract of *Dillenia suffruticosa* (Griff. ex Hook. f. & Thomson) Martelli and polyvinyl alcohol

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Plastics are now an existential threat to our ecosystems persisting for decades so need immediate global action to ensure a sustainable future. Recently, biodegradable plastics get more attention since they are environmentally friendly materials to replace regular plastics. Since bioplastics have been produced in the past but not using this plant, the aim of this study was to create a biodegradable plastic with *Dillenia suffruticosa* leaf extract and polyvinyl alcohol. *Dillenia suffruticosa* is currently considered an invasive alien species that warrants consideration in ecological research in Sri Lanka's wet zone. Biopolymers produced using plant leaf extract by treatment with PVA measured properties such as tensile strength, solubility, and biodegradability properties very close to those of commercially produced bioplastics. The maximum tensile strength for a synthetic bioplastic was measured to 1.2 MPa and the maximum load was 17.01 N. Swelling test showed that the synthetic bioplastic components exhibited no appreciable swelling action on the distilled water (Based on measured the dried weight and swelling weight). According to the solubility test, bioplastics were partially soluble in 20% sulfuric acid and completely soluble in 40% sulfuric acid. The color of the solution changed when treated with 20% ammonia. No other physical change (shape or size) was observed. According to the biodegradability test, the synthetic bioplastics from *Dillenia suffruticosa* leaf extract efficiently decomposed within 2 weeks. The Scanning electron Microscope (SEM) images showed that developed biodegradable films contained uniform surfaces. Based on the results, the synthesized bioplastics have properties such as acceptable tensile strength, resistance to many solvents (acetic acid, chloroform, acetone, methanol, orthophosphoric acid and ethanol concentrations of 20% and 40%), and biodegradability. It can be proposed as a good solution to replace synthetic plastic materials for various applications (food, clothing and fabric manufacturing, pharmaceutical and medicinal industries etc.) in the world.

Keywords: Biodegradable plastic; *Dillenia suffruticosa;* Polyvinyl alcohol; Biodegradability; Invasive alien species

Paper ID: IRCUWU2023-103

Development of fire-retardant natural latex foam mattress incorporating expandable graphite

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Foam rubber mattresses made from natural rubber latex (*Hevea brasiliensis*) are a profitable global industry. Fire safety is crucial, and mattresses with combustible materials must meet flame retardancy standards. Traditional flame retardants pose health risks, so researchers are exploring alternatives. Expandable graphite (EG), a carbon-based material, is promising for fire retardancy in various products without compromising quality. EG's stable properties make it advantageous for compounding with different polymer matrices. Demand for eco-friendly, effective flame-retardant materials increases due to increasing flammability reduction. Therefore, enhancing fire resistance properties is crucial for the well-being of individuals using mattresses. The use of traditional flame-retardant chemicals in mattresses has been found to have adverse effects on human health and the environment due to its toxic nature and persistence. The growing demand for flame-retardant materials that reduce flammability and are environmentally friendly is driven by the need for safer natural latex foam mattresses. This study aimed to develop a fire-retardant natural latex foam mattress by incorporating EG, with specific aims to determine the optimum level of EG for achieving fire-retardant properties. Cured foam rubber samples treated with different loading levels (0, 25, 26, 27, 28, 29, and 30 phr) of EG were tested for physio-mechanical properties, such as compression set and hardness. A Cigarette test was conducted to assess flammability. The results showed that the addition of treated EG to an existing NR-based foam rubber compound showed significant changes in their compression sets and hardness (p=0.000, α= 0.05). Increasing the loading of EG tended to increase the mean compression set values, which resulted in a high degree of residual deformation and a low recovery after compression. Higher EG loadings (28, 29, and 30 phr) resulted in lower hardness means and lower stiffness compared to lower EG loadings (0, 25, 26, and 27 phr) resulting in an increase in resistance to indentation. Also, increased EG levels resulted in decreasing mass lost values, showing reduced flammability. Therefore, the incorporation of EG was found to be additive in enhancing the fire-resistance properties of the rubber foam.

Keywords: Expandable graphite (EG); Fire retardancy; Latex foam mattresses; Natural rubber

Paper ID: IRCUWU2023-132

Thermal management of sandwich composites structures with integrated energy storage core

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This study explored thermal management in an energy storage-integrated glass fiber sandwich composite. With escalating energy storage demands, effective heat dissipation during charging and discharging is pivotal for optimal functionality and expanded applications. A unique configuration was proposed, employing graphite, charcoal, and carbon black additives, to establish one composite facet as an insulator and the other as a thermal conductor. The present project involved the fabrication of sandwich composites featuring an integrated energy storage core. The composite material was developed utilizing a manual hand lay-up technique, wherein glass fibers were meticulously arranged and combined. Within this study, three distinct glass fiber composite (GFR) samples were presented, each incorporating unique additions of charcoal, graphite, and carbon black particles. Subsequent assessment of the thermal conductivity of these samples through the utilization of thermal conductivity measurement techniques revealed that the GFR sheet infused with charcoal particles demonstrated the highest recorded value, whereas the neat GFR sheet exhibited the lowest thermal conductivity value. Employing an IR thermal camera, precise temperature data was amassed to meticulously analyze temperature dynamics within the composite sandwich structure and the integrated lithium-ion battery throughout charge and discharge cycles. By employing the power supply and motor, the procedures involving the charging and discharging operations were executed. The distinction in thermal emissions between the charging and discharging phases of a lithium-ion battery was examined. Charging a lithium-ion battery entails the surmounting of overpotential, denoting the supplementary voltage essential to instigate and uphold the electrochemical processes transpiring at the electrode interfaces. This overpotential phenomenon significantly contributed to the augmented generation of heat during the charging process, in direct contrast to the relatively subdued thermal effects observed during battery discharge. The lithium-ion battery peaked at 36.4°C during charging and 33.7°C during discharging. The filler-free GFR region reached 27.4°C and 42.3°C while charging and discharging. The charcoal-infused GFR panel showed highs of 32.5°C during charging and 27.9°C during discharging. This empirical evidence lucidly underscored the efficacy of the devised sandwich composite in proficiently managing thermal conductivity, thereby fortifying the safety margins of energy storage devices. The integration of lithium-ion batteries in the sandwich composite architecture offers efficient thermal regulation by focusing heat dissipation on one side while maintaining ambient conditions on the other.

Keywords: Glass fiber sandwich composite; Embedded energy storage device; Lithium-ion battery; Heat transfer

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Magnetic energy of face-centered cubic structured ferromagnetic ultra-thin films with three spin layers as described by fourth-order perturbed Heisenberg Hamiltonian

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The magnetic energy of face-centered cubic (fcc) structured ferromagnetic ultra-thin films with three spin layers was investigated using the fourth-order perturbed Heisenberg Hamiltonian with all seven magnetic energy parameters. All the magnetic energy parameters such as spin exchange interaction, magnetic dipole interaction, the second-order and the fourth-order magnetic anisotropy constants, in the plane and out of plane applied magnetic fields, demagnetization factor and stress-induced anisotropy were included in the fourth-order perturbed Heisenberg Hamiltonian. 3D plot of total magnetic energy versus angle and stress-induced anisotropy were plotted for different values of second-order magnetic anisotropy constants to determine the energy minimums and maximums. All other magnetic energy parameters were fixed at constant values. By plotting the graphs of energy versus angle at these different stress-induced anisotropy values, the easy and hard directions were determined. All the peaks were closely packed in the graphs plotted using the fourth-order perturbed Heisenberg Hamiltonian compared to peaks in the graphs plotted using the second and third order perturbed Heisenberg Hamiltonian. The order of magnetic energy varied from 10^6 to 10^{22}. The magnetic energy was higher, when the value of the second-order magnetic anisotropy constant in the top spin layer is less than those of the bottom and middle spin layers. The order of magnetic energy was lower, when the value of the second-order magnetic anisotropy constant in the middle spin layer is less than those of the top and bottom spin layers. The order of magnetic energy found using the fourth-order perturbed Heisenberg Hamiltonian was higher in the fcc structure compared to that found using the third-order perturbed Heisenberg Hamiltonian for the same structure. In addition, the angle between consecutive magnetic easy and hard directions was nearly 90 degrees for all the cases.

Keywords: Fourth order perturbed Heisenberg Hamiltonian, Magnetic anisotropy constant, Magnetic thin films, Spin, Stress-induced anisotropy

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Exploring minerals and sediments: A case study of Badulu Oya through stream sediment survey

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The stream sediment survey has been a fast and reliable method for mineral exploration since ancient times and continues to be utilized to this day. Particularly, more dependable, and precise surveys are conducted on second-order tributaries. One significant second-order tributary of the Badulu Oya originates from Kendagolla area, passes through Sirimalgoda and Hidagoda, and merges with the mainstream of Badulu-oya. However, no comparable investigations have been carried out regarding the sedimentary analysis of this area. To address this gap, a stream sediment investigation (Six samples UP01-03, DS01-03 with 100 m intervals from 6.9848108210, 81.0791457170) of the Badulu Oya was undertaken with the aim of identifying transported materials and heavy minerals. Heavy minerals were separated using the panning method and analyzed through magnetic separation. Subsequently, particle size distribution (sieve method) and sand mineralogy (optical microscope) were also analyzed. The sediment samples exhibited a textural composition ranging from Sandy Gravell to Gravelly Sand, with a dominant mean value of 1307 µm, predominantly composed of Verycoarse sand. The sorting characteristics indicated a range from moderately sorted to poorly sorted. The Heavy mineral fraction in the samples contained magnetic minerals, comprising approximately 6.81% of the total fraction, with the highest proportion observed in Sample DS02. The mineralogical composition predominantly consisted of quartz, garnet, zircon, rutile, tourmaline and epidote with weathered garnet being the prevailing rock type within the stream samples. Gravel and pebbles exhibited a semi-rounded shape, while sand particles tended to exhibit an angular to sub-angular shape, possibly attributed to the moderate transportation distance and the elevated origin. The subsequent phase of this study entails the collection of samples from upstream, extending to the tributary's origin, in order to identify potential mineral anomalies for future investigations.

Keywords: Heavy mineral; Stream sediment survey; Badulu Oya; Mineralogy; Particle size distribution

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Study of Nano metal oxide incorporated Zinc phosphate coatings as corrosion inhibitors on mild steel

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The existing corrosion prevention processes and methods are incapable of predicting all environmental conditions. On the other hand, the local metal coating and paint industries continue to suffer from a lack of appropriate advanced phosphating technology as a surface pre-coating technique. The incorporation of ceramic nanoparticles into the phosphate coating has improved the properties such as high corrosion resistance and secondary coating adhesion. As a result, the goal of this research was to create and improve a corrosion prevention method suitable for the metal coating industries by incorporating nano TiO_2 into a phosphate precoating. To facilitate the coating via chemical conversion, the cleaned mild steel specimens were dipped in the prepared phosphating bath containing the nano TiO_2. Under the given conditions, the optimum coating time was determined to be 90 minutes. Significant changes in coating weight, adhesion quality, surface porosity, and corrosion resistance were observed with the addition of nano TiO_2 (average particle size ~ 25 nm). X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and a Gemological microscope were used to investigate the crystal phases and surface morphology of zinc phosphate coatings. XRD data clearly showed that nano TiO_2 was incorporated into the phosphate layer. The addition of nano TiO_2 to the zinc phosphate coating improved its properties, such as coating thickness and surface area, promising an improvement in corrosion resistance. With minor modifications, the findings of this study could be easily implemented in the metal coating industries and extended to other metals such as steel, aluminium, and alloys.

Keywords: Chemical conversion; Nano TiO_2; Mild steel; Phosphating

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Analysis of the novel test method for sodium salt of thiol-mercaptan bleaching agent used in crepe rubber industry

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Sri Lanka exports pale and sole crepe, which are considered the purest raw rubber form. The color of natural rubber is used to determine its quality. Thus, yellowing caused by carotenoid pigments in the latex can degrade its quality. Gravimetric analysis is an alternative that can be used for titration to determine the strength of bleaching agents and to develop a solution that overcomes the challenges such as the presence of silver salt precipitate and the requirements for experienced analysts using titration methods. The study involved comparing the new gravimetric method with the existing titrimetric method, assessing crepe rubber properties, and establishing an optimal weight range. Experimental procedures included the Fourier Transform Infrared (FTIR) analysis, preparation of crepe rubber samples, and determination of properties such as the Lovibond Color Index, Plasticity Retention Index, and Volatile Matter Content. The experiment followed a two-factor factorial design with different bleaching agent concentrations and different methods and mean separation was conducted using the Tukey method. The new gravimetric method calculated the active ingredient concentration of the bleaching agent at 46% w/w, while back titration confirmed it at 36% w/w. The FTIR results confirmed the absorption peaks of the pure bleaching agent and the precipitate formed during gravimetric analysis were similar. Lovibond Color Index decreased as the weight range increased from 0.03 to 0.06 under 46% w/w ratio. The best fit for gravimetric analysis was found at 0.06% weight range under 46% w/w ratio. Increasing the weight range from 0.03 to 0.06 under 46% w/w ratio decreased PRI value to a certain extent. Application of bleaching agent within 0.06% weight range could be done in the gravimetric analysis. The gravimetric analysis method provided a more consistent and odor-free alternative to the titrimetric method for determining the concentration of the sodium para-toluene mercaptan bleaching agent. Further research is recommended to validate the gravimetric procedure using the inductive couple plasma optical emission spectroscopy (ICP-OES) and explore alternative methods for determining the concentration of the bleaching agent.

Keywords: Bleaching agent; Crepe rubber; Gravimetric method; Titration

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Synthesis and characterization of protected Iron nanoparticles

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Iron nanoparticle synthesis shows great potential for creating innovative materials suitable for a range of applications. However, this is accompanied by difficulties stemming from the instability of nanoparticles produced through traditional techniques. Therefore, as a solution, this study suggested a one-step approach to creating oleic acid-capped magnetic iron nanoparticles. In this study, stable ligand-protected iron nanoparticles were synthesized by surface modification with organic ligands oleic acid in an organic solvent, toluene and sodium borohydride as the reducing agent. X-ray diffraction, UV-visible spectrometry, and Fourier transform infrared spectroscopy were used to identify and characterize the produced nanoparticles. The synthesized oleic acid-coated iron nanoparticles (Fe OA-NPs) retained their magnetic property, making them useful in a wide range of technological applications such as controlled drug delivery, and magnetic nano-coating. The synthesized iron-nanoparticles were readily dispersible in organic solvents like toluene and do not dispersible in water or ethanol. Oxidation was a major issue with uncapped iron nanoparticles, but after capping with oleic acid, oxidation was reduced and stability was improved. These Fe OA- NPs showed remarkable shelf life in contrast to uncapped iron nanoparticles. Having oleic acid protects the iron nanoparticles acting as a barrier for environmental factors which catalyze the oxidation process and gives rise to post synthetic functionalization of the Fe OA- NPs due to the inherent advantage of double bonds in the hydrocarbon chain. Fe OA- NPs showed photocatalytic properties and Methylene Blue (MB) dye degradation was investigated. The Fe OA- NPs showed a higher MB removal percentage reaching 94% degradation within three hours under ambient conditions. Due to these properties, Fe OA- NPs will be an interesting novel nanoparticle for among wide array of applications, especially for organic chemists.

Keywords: Oleic acid; Toluene; Stability; Oxidation; Methylene blue

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Smart Nano packaging materials for food industry: A short review

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The food packaging sector is always looking for novel solutions to ensure the quality, safety, and longevity of its products. In recent years, it has become clear that applying nanotechnology to food packaging is a workable solution to these challenges. Improved barrier properties, antibacterial activity, and real-time monitoring capabilities are just a few of the contemporary advantages that smart nanomaterials for packaging offer. The objective of this review was to study smart nano-packaging materials and study their interaction with polymer matrix while developing packaging materials, and the positive and negative impact of these nano-based food packaging. Nanotechnology is an important technology to improve smart nano packaging. Smart packaging has the potential of both intelligent and active packaging. It provides a total packaging solution that on the one hand monitors changes in the product or the environment (intelligent) and on the other hand acts upon these changes (active). The mechanical, antioxidant and antimicrobial properties, thermal stability and barrier properties of the packaging material are improved by the integration of appropriate nanomaterial in the polymer matrix, which extends the shelf life of the food products. In this review, nano-cellulose, nano starch, protein nanoparticles, chitosan nanoparticles, nano clays, and nano additive materials such as carbon nanotubes, silver nanoparticles, zinc oxide nanoparticles, and titanium dioxide nanoparticles impact on packaging structure and properties have been discussed. The most prominent smart nano packaging materials and their enhanced properties, when reinforced with polymer matrix, have also been compared. These include nanosensors that are used to detect specific chemical compounds, infections, and poisons in food when they are integrated into food packaging. There are numerous advantages and disadvantages associated with smart nano packaging. As a developing technology, the knowledge about risk associated with nano packaging is minimum. Nanomaterials for packaging show enormous potential for changing the packaging sector due to their strongly improved properties. To ensure responsible and widespread usage in the future, a comprehensive assessment of their safety and regulatory aspects is necessary.

Keywords: Nanotechnology; Nanomaterials; Food industry; Smart packaging

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Potential synergistic effect of pineapple leaf-mediated Ag-ZnO nanocomposites for enhancing antibacterial activities

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Bacterial infection is a worldwide health problem that has negative effects on both the economy and society. Recently, there is a critical demand for new chemical substances acting as antibiotics or potential antibacterial targets. To address this challenge, the current study focused on the *Murusi* and *Kew* pineapple varieties' leaf-mediated biosynthesis of silver nanoparticles (Ag NPs), zinc oxide nanoparticles (ZnO NPs), and a silver-zinc oxide nanocomposite (Ag-ZnO NCs) as an antibacterial agent and the assessment of their growth inhibition efficacy against pathogenic bacteria. Nanomaterials were synthesized under optimal conditions and characterized using UV-Vis spectroscopy, FTIR, XRD, SEM, and TEM analysis. The antibacterial activity was investigated against *Escherichia coli* and *Staphylococcus aureus*. Nanomaterials synthesis was confirmed through surface plasmon resonance peaks, ranging from 440-445 nm, 355-360 nm, and 440-360 nm for Ag NPs, ZnO NPs, and Ag-ZnO NCs respectively. FTIR analysis revealed the presence of bioactive compounds that serve as reducing and capping agents. XRD analysis indicated the formation of a hexagonal wurtzite structure for ZnO and a face-centered structure for Ag. SEM analysis confirmed the successful synthesis of Ag-ZnO NCs by showing spherical Ag NPs aggregating on the ZnO surface. TEM images showed the coexistence of Ag on ZnO, with an average particle size ranging from 7-125 nm for NCs. The antibacterial activity of nanomaterials exhibited an increasing trend with Ag NPs>Ag-ZnO NCs>ZnO NPs. The largest inhibition zones observed for *Kew* leaf-mediated Ag NPs (2000 ppm: 100 µL) against *E. coli* and *S. aureus* were 20 mm and 21 mm respectively. *Murusi* leaf-mediated Ag-ZnO NCs (2000 ppm: 100 µL) indicated values were 13 mm as the largest inhibition zone for both strains and ZnO NPs (2000 ppm: 100 µL) displayed the greatest inhibition zones, with 12 mm and 14 mm against *E. coli* and *S. aureus*, respectively. There was no significant difference ($p \geq 0.05$) in the growth inhibition against both strains between leaf-mediated ZnO NPs and Ag-ZnO NCs. However, there was a significant difference in growth inhibition between leaf-mediated Ag NPs and ZnO NPs, and between Ag NPs and Ag-ZnO NCs due to NP size variations. The study emphasizes the sustainable synthesis of Ag-ZnO NCs and demonstrates that the combination of ZnO NPs with Ag NPs reduces toxicity and provides synergistic effects, making them suitable for biomedical use, especially as antibacterial agents.

Keywords: Antibacterial activity; Ag-ZnO NCs; Biosynthesis; *Murusi*; *Kew*

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Cost effective recycling approach for the anode materials from discarded Lithium-ion rechargeable batteries

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Rechargeable Li-ion Batteries (LIBs) are still considered as the prominent rechargeable battery type due to the high energy density, long life cyclability and low self-discharge rate. Further, high demand in the fields of automotive, consumer electronics, medical and telecommunication have drastically enhanced the usage of LIBs and hence the disposal rate has increased rapidly. This has caused pessimistic issues to the environment and to the ecosystem. Therefore, it is important to emphasize proper recycling and disposal methods to minimize these negative impacts. LIBs are basically composed of an anode, cathode and electrolyte, and the anode is based on graphite or graphite-related materials. Therefore, the present study was focused on the recycling of the anode materials from discarded LIBs and upgrading them to battery-grade anode materials in a cost-effective approach. Discarded LIBs were collected from the mobile devices and the voltage of each battery was checked prior to the disassembling. Generally, anode materials are casted on a copper foil, hence they were carefully collected from a plastic scrapper. The finely powdered anode material was treated with 20, 30, 40, 50 and 60 v/v% concentration series of nitric acid for 24 hours. Both the used and acid-leached samples were characterized for the carbon content (CC) following ASTM C-561 standard, X-ray diffraction (XRD) and the Fourier Transform Infrared Spectroscopic analysis (FTIR). The CC of the used anode and treated anode materials were recoded as 93.56% and 99.99%, respectively. XRD analysis confirmed the high crystalline nature of the used anode materials with some Li-based minor impurity phases. That implies the applied acid leaching treatment of the present study was able to preserve the crystal structure while removing the impurities. FTIR results confirmed the detachment of functional groups related to impurities after the treatment. Finally, the cost calculation confirmed that the proposed recycling method was more effective than the processing of new anode materials. In addition, recycling of anode materials minimizes the environmental issues arising from discarded LIBs as well as negative impacts from the mining and processing of raw materials for the production of new anode materials.

Keywords: Lithium-ion batteries; Anode; Recycling; Cost effective

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Synthesis, characterization, and determination of antimicrobial activity of Curcumin Schiff base metal complexes

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Curcumin is the key ingredient responsible for the biological activity of turmeric. Curcumin has a wide range of applications in the pharmaceutical industry. It acts as an effective antimicrobial agent, but the major drawbacks of its application are its less stability and poor solubility in aqueous media. However, previous research studies prove its stability improvement upon binding to various transition metal ions. Scientists focus on Schiff base metal complexes because of their potent antimicrobial properties. This study was based on curcumin-derived Schiff base and its metal complexes to determine whether these newly synthesized compounds would enhance the antimicrobial activity of curcumin. A Schiff base ligand was synthesized using curcumin and ethylenediamine. Furthermore, copper (II) and nickel(II) metal ions were incorporated into the synthesized Schiff base ligand. The extracted curcumin was characterized using TLC, UV-Visible, FTIR, and ^{1}H NMR spectroscopy. The synthesized ligand and its metal complexes were characterized using FTIR spectroscopy. Azomethine stretching vibration at 1582 cm^{-1} indicated the formation of the Schiff base ligand. The new band appearing at 629 cm^{-1} indicated the incorporation of Cu(II) ion and 604 cm^{-1} and 548 cm^{-1} showed the Ni(II) ion complexation. Antimicrobial activity was screened against two Gram-positive (*Staphylococcus aureus* and Methicillin-Resistant *Staphylococcus aureus*-MRSA) and three Gram-negative (*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and *Escherichia coli*) bacterial strains and the fungus, *Candida albicans*. The minimum inhibitory concentration (MIC) of curcumin and the Schiff base was ≤ 160 mg L^{-1} for all six species of microorganisms. The MIC of the Cu(II) complex for *Staphylococcus aureus* was 160 mg L^{-1} and all the other species ranged below 160 mg L^{-1}. The MIC of the Ni(II) complex for *Klebsiella pneumoniae* was 320 mg L^{-1} and for *Candida albicans* was 160 mg L^{-1}. The newly synthesized complexes can be developed as potent antimicrobial agents since they exhibit inhibition at considerable concentration levels.

Keywords: Curcumin; Schiff base; Ethylenediamine; Metal complexes; Antimicrobial activity

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Morphology and crystallography analysis of magnetocalorically significant Ni-Mn-Cu-Ga Heusler alloys

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The increasing need for cooling energy poses climate-related issues because of the environmental consequences associated with current technologies. The magnetocaloric effect offers a potential solid-state, eco-friendly solution for efficient cooling and thermal management. This research work investigated the magnetocaloric properties of a Ni-Mn-Ga-Cu based Heusler alloy, which exhibits promising characteristics for magnetic refrigeration applications as suggested by the literature. The objective of this study was to explore the elemental composition, surface morphology, phase transformation temperatures, and room-temperature crystallographic structures of the proposed Heusler alloy. The research methodology involved the synthesis of high-purity Ni-Mn-Cu-Ga alloys through a combination of arc melting and subsequent annealing processes. The desired sample composition for the arc-melting procedure was $Ni_{50}Mn_{18.75}Cu_{6.25}Ga_{25}$. The intended sample composition did not align with the observed composition as determined by Energy Dispersive X-Ray (EDX) data. Sample 1 exhibited a composition of 47.94% Ni, 15.30% Mn, 7.01% Cu, and 21.96% Ga, while Sample 2 displayed a composition of 46.13% Ni, 10.80% Mn, 6.32% Cu, and 23.48% Ga by weight percentage. Scanning Electron Microscopic (SEM) analysis was done to identify the surface morphology of the samples and it revealed inconsistent results compared to the existing literature. Using a Differential Scanning Calorimeter (DSC), the phase transformation temperatures of the samples were assessed, revealing that the proposed alloy exhibits martensitic phase transformation with start and finish temperatures of 184.41°C and 181.54°C, respectively. The structural characterization was carried out using X-ray diffraction (XRD) analysis, revealing the martensitic phase has a non-modulated tetragonal structure in two samples used to have an orthorhombic seven-layer martensitic structure as per the references used in the analysis. The XRD results showed similarities to the previous studies. Investigation of the proposed alloy by changing experimental methods is needed with more improved methodologies to understand the magnetocaloric behavior and properties of the proposed Heusler alloy. Based on the results obtained in this work, it can be concluded that the two compositions of the samples by weight percentage; $Ni_{47.94}Mn_{15.30}Cu_{7.01}Ga_{21.96}$ and $Ni_{46.13}Mn_{10.80}Cu_{6.32}Ga_{23.48}$ alloys do not exhibit a significant magnetocaloric effect near room temperature.

Keywords: Magnetocaloric.effect; Heusler alloys; Martensitic structure; Phase transformation

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Use of modified corn cob derived cellulose for elimination of metal ions causing water hardness

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Water pollution and its remediation is one of the major challenges faced by the world today. Calcium and magnesium ions are the most common sources of water hardness. To reduce water hardness various methods are employed such as; ion exchange, lime softening and reverse osmosis. Over time, the ion exchange resin becomes saturated with calcium and magnesium ions and needs to be regenerated. Regeneration can be a time-consuming and costly process. The reverse osmosis process requires significant energy input to overcome the osmotic pressure and force water through the membrane. This can result in high operational costs, especially for large-scale applications. This study was conducted to develop an environmental-friendly softener by modifying the cellulose with EDTA. Even though EDTA is a good complexing agent for calcium ions, it is difficult to remove the metal ions from water as the complex is water soluble. When EDTA is attached to an insoluble substrate like cellulose will facilitate to adsorb and remove the metal ions from the water. Cellulose fibers extracted from corn cob were modified using the esterification method with EDTA. A 50.0 ml of 100.195 ppm calcium ion (Ca^{2+}) solution and 3.0 g of modified cellulose were kept in contact to check the adsorption capacity and it was successful. The variation of adsorption capacity with respect to the weight of the adsorbent was analyzed by varying the weight from 1.0 g – 10.0 g and found that adsorption behavior was well fitted to the Freundlich isotherm model. The Ca^{2+} adoption capacity of modified cellulose from corn cob was calculated at around 0.87 mg/g at a concentration of 100.195 ppm.

Keywords: Adsorption; Calcium; Corncobs; EDTA; Extracted cellulose; Isotherm

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The effects of organic soil amendments on Nickel phytomining efficiency in Ginigalpelessa Serpentine soil

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Phytomining is an eco-friendly mining technique which employs hyperaccumulator plants for nickel (Ni), copper, and gold recovery from low-grade ores. At present, Ni phytomining field trials have been directed to optimize the Ni accumulation levels and the overall biomass of plants using soil treatments. The Ginigalpelessa serpentinite deposit in Sri Lanka contains a high concentration of Ni in soil which is difficult to value economically under conventional mining practices. Therefore, the present study aimed to explore the Ni phytomining potential in Ginigalpelessa serpentine soil and evaluated the effect of compost fertilizer on Ni hyperaccumulation levels in plants. To achieve these, pot trials were carried out using two hyperaccumulator species, namely *Crotalaria verrucosa* (as a native species) and *Brassica juncea* (as an introduced species). These experiments were carried out ex-situ in a greenhouse, using the serpentine soil collected from the Ginigalpelessa deposit. Compost fertilizer was added to the soil media at different rates including 0 wt% (control), 10 wt%, 20 wt%, and 30 wt% to improve the soil quality. The plants were harvested after 6 months at their seed-producing stage. The present study observed that the average metal concentration among the plant species varied according to their soil amendment practice. Notably, the highest Ni concentration in both *C. verrucosa* and *B. juncea* was observed in the 10 wt% compost treatment (1,281 mg kg^{-1} and 1,340 mg kg^{-1}, respectively). Ni content in *B. juncea* exhibited a significant decline when increasing the compost level, although *C. verrucosa* plant had not shown any significant relationship between metal accumulation and compost content. *B. juncea* grown in untreated serpentine soil showed stunted growth and failed to survive until the flowering stage. Furthermore, the *C. verrucosa* species grown in untreated soil accumulated 1,257 mg kg^{-1} of Ni indicating native hyperaccumulator species can survive in the serpentine soil under these toxic conditions better than any introduced species. However, further investigation through in-situ field experiments is necessary to assess the efficiency of these soil amendments on hyperaccumulation. The findings of the present study offer valuable insights for implementing Ni phytomining in Ginigalpelessa using suitable native hyperaccumulators in the future.

Keywords: Hyperaccumulation; Low-grade soils; Phytomining; Soil amendment

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Enhancing the performance of Dye-sensitized solar cells with hybrid WO_3/TiO_2 and ZnO/TiO_2 photoanodes using Ruthenium dye(N719)

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The development of cost-effective and scalable energy systems for sustainable solar energy production holds great promise for the future. Over the past two decades, the utilization of commercial Titanium dioxide (TiO_2) nanoparticles has significantly improved the overall efficiency of dye-sensitized solar cells (DSSC). Hence, the high cost of the nanostructure synthesis process with the TiO_2 photoanode remains a doubt, despite several attempts. Conventional TiO_2 manufacturing techniques typically require higher temperatures and post-processing steps to remove additives, improve photoanode porosity, and crystallize the metal oxide. During this study, hydrothermally produced TiO_2 nanorods were employed to synthesize anatase TiO_2 photoanodes by using the recently investigated non-hazardous approach. By using this methodology, as-synthesized TiO_2 nanoparticles can be transformed into over 99% pure anatase phase with 90% crystallinity. Within this approach, it was reported the development of solar cell efficiency (ŋ%) of TiO_2 based DSSCs without any material characterization, and the results were compared with the performance of a DSSC fabricated with a bare TiO_2 photoanode, which was 6.70%. Two distinct configurations were examined differing in the nanocomposite of the photo anode: (i) A thin nanorods type anatase TiO_2 and WO_3 (composition 4:1 w/w) (ii) A thin nanorods type anatase TiO_2 and ZnO (composition 4:1 w/w) were doctor bladed on the Fluorine doped Tin Oxide (FTO) substrate. The nanorod shape of the TiO_2 nanoparticles was verified by Scanning electron Microscope (SEM) images and X-Ray Diffraction (XRD) analysis and confirmed the presence of the anatase phase of TiO_2. Then, DSSC performance was investigated by the use of simulated AM 1.5 sunlight illumination with a light source power of 100 mW/cm^2. The introduced first configuration had a positive effect on the performance of the cell, with an increase in both open-circuit voltage (V_{oc}) and current density (J_{sc}) for 674.25 mV and 4.80 mA/cm^2 respectively. Then the fill factor (FF) was 0.557 and achieved 7.43% for the ŋ%. During the second configuration with ZnO, the results indicated an increase in photovoltaic performance by 2.71% solar cell efficiency compared to reported values of 0.13%. For the second configuration, V_{oc}, J_{sc}, and FF were 693.35 mV, 1.76 mA/cm^2, and 0.554 respectively.

Keywords: Dye sensitized solar cells; Nanostructure; Titanium-dioxide; Tungsten oxide; Zinc oxide

Sustainable Animal Production

Paper ID: IRCUWU2023-071

Methane emission from cattle in Melsiripura NLDB farm

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Global warming has increased as a result of the increased atmospheric concentration of greenhouse gases (GHG) over the last century due to anthropogenic activities. Agriculture is one of the main economic sectors in Sri Lanka contributing 7% of the gross domestic product and livestock contributes 0.9% of the total Gross Domestic Product. When considering the agriculture sector ruminants are the main contributor to GHG emissions in the livestock sector (mainly CH_4). There are more than one million cattle populations scattered in different agro-ecological zones in Sri Lanka at present and the total emissions from different zones vary greatly due to the differences in animal numbers and other factors. However, agroecological zone-specific emission estimates are lacking at present. This study aimed to calculate the CH_4 emission (both enteric fermentation and manure management) from cattle based on Intergovernmental Panel on Climate Change (IPCC) 2006 tier 2 methodology. Based on the results, emission factors for enteric fermentation of bulls, pregnant milking cows, non-pregnant milking cows, dry cows, pregnant heifers, non-pregnant heifers and calves were 52.75, 72.40, 71.05, 40.38, 50.66, 40.16 and 17.05 kg $year^{-1}$ $head^{-1}$, respectively. The emission factors for manure management for the same cattle groups were 0.53, 0.95, 0.90, 0.53, 0.66, 0.52 and 0.22 kg $year^{-1}$ $head^{-1}$ respectively. Further, the developed farm-specific emission factors were shown to be higher than the previously developed emission factors available in Sri Lanka. Thus, new emission factors could be used to accurately estimate methane emission in intermediate zone low country (respective agroecological zone for the farm) and encourage mitigation of Green House Gas emissions from dairy farming in specific regions of the country.

Keywords: Methane; Enteric fermentation; Manure management; Cattle; Emission

Paper ID: IRCUWU2023-134

Comparisons of functional properties of blood plasma proteins and their hydrolysates from local goats

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Slaughterhouse blood is a major underutilized animal by-product that can be used as a good source of animal protein in food industries. Blood plasma (BP) and its hydrolyzed products possess various bioactive compounds and properties. However, functional properties can vary with the blood source, hydrolyzing enzymes, and hydrolyzing conditions. Thus, this study aimed to evaluate the functional properties of the blood plasma and their hydrolysates from two native goat breeds. A total of six female goat blood samples (age 1-1.5 yrs old, weight =30-35 kg) were collected from slaughterhouses in Badulla and Jaffna. Immediately after receiving, the blood plasma was separated and lyophilized after the dialysis process to remove the EDTA. Initially, isolated blood plasma was hydrolyzed using three different proteolytic enzymes (*Bacillus* protease (pH-6.5/55°C), papain (pH-6.5/37°C), and elastase (pH-7.2, 25°C) at six different incubation times (0, 3, 6, 9, 12, and 24 h) and the degree of hydrolysis and efficiency were analyzed using 15% SDS-PAGE. Only papain and protease enzymes at 3 h incubation had sufficient hydrolysis results. Thus, the plasma hydrolysates obtained by papain (pH 6.5/37°C/3 h) and protease (pH 6.5/55°C/3 h) were selected along with non-hydrolyszed blood plasma to assess the antioxidant capacity (TBARS and DPPH assays) and metal-chelating ability (Cu^{2+} and Fe^{2+} chelating activity). Both Badulla and Jaffna non-hydrolyzed blood plasma had significantly high (p = 0.016) DPPH radical scavenging assay values. Whereas the lowest DPPH value of 2.23±1.13 was observed in Jaffna protease hydrolysates. The TBAR assay that measures the malonaldehyde concentration (mg/MDA/L) in the sample was not significant (p>0.05). But except the Badulla protease hydrolysate three other treatments had lower TBAR values than their non-hydrolyzed plasma. Both Fe^{2+} and Cu^{2+} chelating activity of the hydrolysates were higher than that of their intact counterparts. Particularly, the hydrolysates from both types of enzymes for Jaffna goat had higher Fe^{2+} (18.57±0.75, p = 0.000) and Cu^{+2} (23.79±2.96, p = 0.052) chelating activities. Overall, the hydrolyzed blood plasma showed more favorable functional properties than that non-hydrolyzed blood plasma.

Keywords: Local goat; Blood plasma; Bioactive peptides; Hydrolysis; Peptides

Paper ID: IRCUWU2023-135

The effect of room temperature on the shelf life of eggs collected from the chicken reared in the battery cage system

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Chicken egg is a highly nutritious food. The quality of the eggs deteriorates with the storage and thus affects the acceptance of the customers. The objective of this study was to identify the physicochemical changes and microbiological contaminations in eggs collected from the Hyline brown birds at the age of 28 weeks who were reared under battery cage system conditions and were stored at room temperature (25 ± 2^0C). Totally 150 medium sized eggs were brought and stored in a safe place. Microbiological changes were assessed by the Salmonella test on day one. Physicochemical changes such as shape index, Haugh index, yolk colour, yolk index, grade, yolk and albumen percentage, yolk to albumen ratio, yolk and albumen pH, shell thickness, weight loss, hard boiled structure of eggs and FTIR analysis were carried out storage days 1, 3, 7, 10, 14, 21, 28, 35, 42, and 49. Salmonella test gave negative results for all 5 replicates. The shape index of eggs was 78.99±1.84. Haugh index of eggs deviated from day 01 to 49 as 98.76±2.67 to 39.44±4.95 (p<0.05). Yolk colour had no effect on storage time (p>0.05). The Yolk index decreased from day 01 to day 42 from 0.52±0.06 to 0.20±0.03 (p<0.05). The grade of the eggs was on days 01, and 03 as AA, days 07 to 21 as A, and days 28 to 49 as B. Yolk percentage was increased from day 01 to 49 as 25.42±1.76 to 30.99±0.55 (p<0.05). Albumen percentage was recorded from day 01 to 49 as 61.32±1.24 to 55.08±0.84 (p<0.05). Yolk to albumen ratio had no significant difference with the storage (p>0.05). Yolk pH was decreased from day 01 to 49 from 7.97±0.10 to 6. 81±0.03. Albumen pH was increased from day 01 to 49 as 8.06±0.20 to 9.30± .06. Weight eggs were significantly increased with the storage up to 49 days (p>0.05). Considering the results of the present study, eggs which have similar conditions as these eggs can be kept under room temperature (25 ± 2^0C) for up to 30 days.

Key Words: Egg quality; Egg yolk; Egg white; Room temperature; Egg grade

Paper ID: IRCUWU2023-179

Effect of transportation distance on the occurrence of PSE and DFD conditions in chicken meat at a commercial broiler processing plant and their impact on quality traits of raw and smoked breast meat

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This research aimed to identify the effect of transportation distance on the occurrence of PSE (Pale, soft, and exudative) and DFD (Dark, firm, and dry) conditions in chicken meat at a commercial broiler processing plant and their impact on quality traits of raw and smoked breast meat. A total of 299 broilers from three different farms (50, short distance- ≤50 km; 72, medium distance- 50–100 km; 172, long distance- >100 km) were randomly selected and slaughtered. Breast fillets (299) were then tested for the PSE and DFD conditions based on the lightness (L*) value (PSE: L*>58, Normal: 48 ≤ L*≤ 58 and DFD: L*<48) and the prevalences were calculated. A total of 45 breast fillets representing different farms (15 PSE, 15 normal, and 15 DFD) were analyzed for colour, pH, and water holding capacity (WHC). Then, smoked breast meat was prepared using 15 breast fillets (5 PSE, 5 normal, and 5 DFD) and evaluated for WHC, pH, colour, and texture profile. The incidences of PSE at short, medium and long distance farms were 5%, 5%, and 82%, and those of DFD were 5%, 18%, and 6%, respectively (p<0.001). Both transportation distance and meat type (PSE/Normal/DFD) significantly affected the lightness and WHC of raw meat. However, meat-type had no significant effect on the pH of meat (p>0.05). PSE and DFD meat reported the lowest and the highest WHC, respectively (p<0.05). In addition, the former had a higher cooking loss value as opposed to the latter (p<0.05). Both transportation distance and meat-type had significant impacts on the L* value of smoked breast (p<0.05). In contrast, they did not affect the texture profile of smoked meat. In conclusion, the transportation distance had a noteworthy impact on PSE and DFD incidences in chicken meat and WHC and the pH of raw breast meat.

Keywords: Breast fillets; DFD; Meat colour; PSE; Transportation distance; Water holding capacity

Paper ID: IRCUWU2023-180

Antimicrobial resistant , multidrug-resistant and extended spectrum beta lactamase producing *Escherichia coli* in fresh retail broiler chicken sells at Kurunegala: Municipal Council and Pradeshiya Sabha area

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Multidrug-resistant (MDR) and Extended Spectrum Beta Lactamase (ESBL) producing Enterobacteriaceae such as *Escherichia coli (E. coli*) are serious public health threats globally. Since majority of ESBL genes are plasmid mediated, *E. coli* acts as a reservoir of Antimicrobial resistant (AMR) genes that can be transmitted vertically and horizontally to both *E. coli* and other bacteria developing co-resistance to several classes of antimicrobials. Chicken produced with low hygienic practices is a key risk factor for human *E. coli* infections and on-request produced fresh chicken is more popular than frozen chicken among a considerable group of local consumers. This study investigated the presence of AMR, MDR and ESBL producing *E coli* in fresh broiler meat. Forty-six broiler chicken meat samples were collected from 23 retail shops (2 from each) in Kurunegala: Municipal Council (KuMC) and Pradeshiya Sabha area. Isolation and identification of *E coli* were done following standard protocols and confirmed by polymerase chain reaction (PCR). AMR profiles of the *E. coli* were tested by disk diffusion assay and utilizing AMR data MDR isolates were identified. The double disc synergy test with Cefpodoxime combination disk kit was used for identifying ESBL *E. coli*. ESBL positive isolates were checked for the presence of ESBL encoding genes: $bla_{CTX\text{-}M}$, bla_{SHV}, and bla_{TEM} using multiplex PCR. Standard quality control strains were used. Among 46 samples 29 samples were positive (63%) for *E. coli*. All the isolates were resistant to erythromycin while susceptible to both amoxicillin-clavulanic acid and imipenem. Resistance rates for tetracycline, ampicillin, sulfamethoxazole-trimethoprim were 89.65%, 79.31%, 72.41% respectively. About 93% (27/29) of isolated *E. coli* were MDRs with resistance to >/=3 classes of antimicrobials. Of 29 isolates one *E. coli* isolate (3.44%) was phenotypically and genotypically positive for ESBL with the presence of $bla_{CTX\text{-}M}$, bla_{TEM} genes. The presence of *AMR and* MDR *E. coli* with ESBL highlights the necessity of adopting measures to produce safe meat.

Keywords: *E coli*; Fresh chicken meat; AMR;MDR;ESBL

Paper ID: IRCUWU2023-294

Effect of hatching eggs storage duration on embryonic development and yolk-free biomass in Cobb 500 broiler

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Pre-incubation storage is a critical step that can directly affect hatchery performance and the quality of day-old chicks. This study focused to determine the effect of different egg storage durations on embryonic development, hatchability, hatch weight, and yolk-free biomass. Eggs were collected from Cobb 500 broiler cross parents' line of age 39-40 weeks and weight ranged between 65-67 g. Eggs were stored under 18–21°C and 75% RH with five storage durations (Control (C)-3 days, Treatment 1 (T1)-6 days, Treatment 2 (T2) -9 days, Treatment 3 (T3)-12 days and Treatment 4 (T4)-15 days) as treatments with four replicates (700 eggs for each). All eggs were provided with the same conditions (38.0-36.2ºC, 60-45% RH) during the incubation period. The diameters of blastoderm and embryonic membranes (blood ring), the highest distance between the air sac and blood vessel spread area, the weight of the embryo (15th and 18th days), and the weight of the yolk (15th and 18th days) were measured. The yolk weight, yolk-free biomass, and hatch weight at 21 days were measured. The maximum embryonic development and the hatching weight were observed on day 3 of storage. Blastoderm, blood ring development (mm), and distance between blood vessel area and air sac (mm) were significantly high (18.46 mm, 16.36 mm, 23.60 mm, respectively) in control. As a result, the development of embryos has been confirmed to be significantly lower in eggs stored for more than 9 days. The embryonic development decreased (p<0.05) from day 9 of the storage, and the hatching weight decreased (p<0.05) from day 6 of the storage. When increasing the storage time from 3, 6, and 15 days, the hatch weight losses were 2.28%, 2.57%, and 3.77% respectively. It was observed that yolk-free biomass and hatch weight decreased gradually with the increase in storage time (C >T1>T2>T3 >T4). The hatchability of eggs stored for 15 days (82.9%) was significantly lower than others. Therefore, storing hatching eggs for more than 9 days in cool rooms is not recommended.

Keywords: Pre-incubation storage; Embryonic development; Yolk-free biomass; Hatchability; Cobb 500.

Paper ID: IRCUWU2023-303

Consumption of animal origin foods by the undergraduates of regional universities in Sri Lanka during the economic crisis

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Numerous studies have demonstrated the significant impact of the economic crisis on changes in food consumption patterns in various economies. This research examined the impact of the economic crisis on purchasing changes in animal-origin foods among undergraduate students. Further, the research investigated the reasons for the changes in individual consumption of animal-origin foods. The study was based on primary data collected from pre-tested, self-administered online questionnaires developed as google forms. The questionnaire consisted of questions related to socio-demographics and dietary behaviours. A self-selective simple random sampling method was adopted to select 239 participants representing five regional universities in Sri Lanka. The primary data were analyzed utilizing the regression model and descriptive statistical methodologies. The analysis was based on multiple linear regression where the conceptual model was tested before and after food price inflation. The chosen variables covered the socio-economic, demographic, preference, availability, and affordability criteria. The log-linear models of regression were applied to distinguish the differences in chicken and sausage consumption in two periods of price change. The statistical significance was less than 0.05. The study revealed that the impact of the economic crisis has increased chicken meat consumption in Islamic undergraduates (standard coefficient before and after the economic crisis= 0.174 and 0.124, respectively; p = 0.000) than those from other ethnicities. Moreover, the "price" variable was highly effective on animal-origin food consumption. Animal-origin foods take the form of staple food when scarcity rises with a positive price effect. In conclusion, the study revealed that the animal-origin food consumption of undergraduates from regional universities shows a positive price impact due to the relative price increment of substitutes.

Keywords: Economic crisis; Animal-origin food; Regional universities; Chicken consumption; Sausages

Paper ID: IRCUWU2023-309

Dairy calf management practices that affect animal welfare: Small-scale dairy farms in Badulla district, Sri Lanka

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The management practices conduct in dairy calf rearing systems play a crucial role in ensuring the welfare of calves. In total, 150 small scale dairy farmers in Badulla district, Sri Lanka were interviewed in a face-to-face conversation on calf management by using a pre prepared questionnaire to identify calf management practices that affect animal welfare. Collected data were statistically analyzed using SPSS version 23.0. The majority of the farmers were men (70%), whereas with primary education level (85%) and part-time involvement (55%) were noticed. As the major welfare positive practices, frequent checking and assisting with the calving (93%), providing colostrum less than 2 hours of birth (100%), providing shelter in the daytime (60%) and night (100%), and providing beddings (53%) were identified. Moreover, painful practices of dehorning and branding were practiced by none of the farmers. All the farmers practice gradual weaning and get the service of trained person in ear tagging. A few critical risk factors of calf welfare were identified: not providing bedding materials during the calving (28%), not practicing naval disinfection (49%), applying ear tags after 3 months of age (55%), deworming after one month of age (90%), not providing of water during tethering in day time (30%), less caring (17%) and feeding of male calves (17%) in comparison to females. Furthermore, none of the farmers used pain relief methods in ear tagging or other painful practices. All farmers were uncertain on the correct time of introducing water to new born calves. A correlation between the farmer profile and management practices revealed that there was a correlation between the farmers' education level and the 1st deworming age of the calf ($p<0.05$, $r=0.169$). This study provides a better insight into the current understanding of management practices and their impact on dairy calf welfare. Thus, we suggest adopting effective strategies to overcome the identified welfare issues to ensure the well-being of calves during their critical early-life stages, ultimately contributing to the long-term success and sustainability of the dairy industry in Sri Lanka.

Key words: Calves; Dairy farmers; Management practices; Welfare

Paper ID: IRCUWU2023-320

Growth performance and quality evaluation of fresh and ensiled Napier cultivars (*Pennisetum purpureum*)

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Hybrid Napier (*Pennisetum purpureum*) cultivars are identified as high-yielding fodder varieties with good adaptability that surpass tropical grasses. The objective of this study was to determine the most suitable cultivar between Red Napier and Pakchong-1 based on the growth characteristics, yield and nutritional composition of both fresh and ensiled forms. The experiment was conducted at the university model farm, Uva Wellassa University, Badulla. The experimental design was a randomized complete block design (RCBD) having 3 blocks, 2 treatments, and 18 replicates in each block. Two node stem cuttings of both cultivars were planted following standard recommendations and all the other agronomic practices were kept constant across treatments. The number of leaves per plant, number of tillers, plant height and leaf length were recorded at 15 days intervals and plants were harvested at 45 days. Fresh matter yield, plant height and leaves per plant were measured. The chemical composition of fresh and ensiled forage and the fermentation profile of silage were analyzed. The highest growth performance was recorded by Red Napier when compared to Pakchong-1 having higher plant height (p = 0.01), number of tillers (p = 0.00) and fresh matter yield. The average dry matter content of fresh Red Napier and Pakchong-1 was 19% and 11%, respectively (p = 0.00). The Pakchong- 1 showed higher crude protein content than Red Napier (18% Vs 15%) (p = 0.00). The crude fat and ash contents of fresh forages were not different (p = 0.97). The nutritional composition of silages followed similar patterns as those of the fresh forage. However, the contents of crude protein and crude fat reduced slightly in both forages. The pH of ensiled forages was not different among treatments. In conclusion, the cultivar Red Napier could be recommended as a fresh forage as well as silage for dairy cows due to higher growth performance and fresh matter yield compared to Pakchong-1.

Keywords: Forage; Silage; Napier; Dairy cattle

Paper ID: IRCUWU2023- 325

Comparative analysis of the nutrient composition of two corn varieties (Ruwan and Badhra) grown in Sri Lanka

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Corn (*Zea mays* L.) is widely used as a raw material in the food and feed industry in Sri Lanka. Different corn varieties have different nutrient levels and physical properties which affect the overall nutrition of the corn. The objective of the present study was to compare the nutrient composition of two corn varieties (Ruwan and Badhra) grown in Sri Lanka and to determine the best corn variety for animal feed production based on their nutrient composition. Two and a half kilograms of each two varieties of corn seed samples were obtained from the Government Seed Storage at Palwehera, which is accredited by the Gannoruwa Seed Certification and Plant Protection Centre. Twelve sub-samples from each variety were prepared using a sample divider and each sample was considered as a replicate. Six replicates from each variety were analyzed for proximate composition, neutral detergent fibre (NDF), and acid detergent fibre (ADF) after sub-sampling and the rest were analyzed after 1 month of storage period under a temperature of 27°C. The experimental design of the study was Complete Randomized Block Design and data were subjected to one-way ANOVA (Minitab 2020 version) and a probability level of less than 5% was considered statistically significant. According to the results, the Ruwan variety had the highest crude protein (10.08%, $p<0.001$), ADF content (2.08%, $p<0.036$) and ash content (1.34%, $p<0.004$) than the Badhra variety. After 1 month of storage, the samples of the Ruwan variety had the highest crude protein (10.19%, $p<0.001$) and ash content (1.35%, $p<0.001$) compared to the Badhra variety. There were no significant differences among the varieties for moisture, crude fat and NDF levels. According to the findings of the present study, the Ruwan variety had better nutrient composition than the Badhra variety.

Keywords: Corn Varieties; Proximate composition; Acid detergent fiber; Neutral detergent fiber

Paper ID: IRCUWU2023-326

Characterization of gastrointestinal helminths in backyard chickens in selected veterinary ranges in Kandy district of Sri Lanka

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Backyard chickens provide an additional source of income for low-income households in developing countries. Backyard poultry production in Sri Lanka continues to fall short of its full potential due to extension program deficits, internal economic fluctuations, and infectious disease losses. Backyard flocks are particularly vulnerable to parasitic infections. Parasitism can have long-term effects on growth and production, as well as pose a risk to nearby commercial poultry production systems. Backyard poultry parasites have received little attention in Sri Lanka, with no published reports on the characterization of gastrointestinal helminths in backyard chickens. Therefore, the current study aimed at identifying the gastrointestinal helminth burden in backyard chickens in selected veterinary ranges in Kandy district, and molecular characterization of the identified parasitic species. The gastrointestinal tracts (GIT) of 63 backyard chickens were collected from six veterinary ranges in the Kandy district. Adult helminths were identified using predefined morphological features. The presence of helminthic eggs in the gut was determined qualitatively and quantitatively using the salt floatation and McMaster techniques, respectively. A segment of the large subunit (LSU) and cytochrome oxidase 1 (CO1) genes of the identified subset of helminths were amplified for molecular characterization. Helminths were found in 57.14% of the GIT, with 16.67% of the infections being mixed. Helminthic eggs were found in 42.85% of the GIT contents, with 29.63% of mixed infections. *Ascaridia* spp (50.39%), *Heterakis* spp (0.99%), *Capillaria* spp (4.18%), and *Raillietina* spp (44.42%) were identified. No adult trematodes or eggs were discovered. According to CO1 sequence analysis, local *Ascaridia* spp shared 98.25% sequence identity with *Ascaridia galli* reported in China and Denmark. In phylogenetic analysis, the local *Ascaridia* sequence did not form a clade with either the highly similar Chinese or Danish sequences. Thus, backyard chickens in the study area bear heavy GIT helminth burden. The reason could be that farmers are not deworming their chickens on a regular basis, are under-dosing anti-helminthics, are no longer effective against these GIT helminths. As confinement or high biosecurity is impractical for backyard farming in a Sri Lankan setting, avenues for optimal anthelmintic use should be investigated, and farmers should be educated accordingly.

Keywords: Backyard chicken; Gastrointestinal tract (GIT); Helminths; Kandy district

Paper ID: IRCUWU2023-337

Effect of rearing substrate on waste reduction efficiency and nutrition composition of black soldier fly (*Hermetia illucens*) larvae

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The increasing demand for animal products and feed cost challenges have led to the search for sustainable alternatives in livestock feed production. The Black Soldier Fly larvae (BSFL) (*Hermetia illucens*) offer a valuable solution as they efficiently convert organic waste into biomass and provide a nutrient-rich source for animal feed. The choice of rearing substrate however significantly impacts waste reduction efficiency and nutrition in BSFL. This study aimed to evaluate the effects of different rearing substrates on the waste reduction efficiency and nutrition composition of BSFL. Three substrates, namely swine manure (SM), vegetable waste (VW), and poultry litter (PL) were used to rear BSFL. The experiment was conducted over an 18-day period. Nine grams (approximately 600 larvae) of 5-day-old BSFL were reared in 4000 mL plastic containers at 28±2°C temperature and 76±2% relative humidity. The experiment was conducted with a complete randomized design, comprising three treatments with six replicates for each. Six replicates in each treatment and each replicate contained 150 g of substrate, which was replenished every 3 days. The remaining substrate weights at each replenishment were measured to calculate the waste reduction percentage, and the waste reduction index and proximate analysis of BSFL were done to determine the nutrition composition of BSFL. All the data were analyzed through one-way ANOVA using the Minitab software. The results showed that larvae reared on SM exhibited the highest waste reduction percentage (21.89%, $p = 0.001$), followed by VW (17.91%) and PL (12.91%). Crude protein and crude fat content were highest in larvae reared on SM (45.50%, 21.05%, $p = 0.00$, respectively) compared to those reared on VW (40.07%, 15.52%, respectively) and PL (35.71%, 17.82%, respectively). Swine manure emerged as the most effective substrate for larval growth due to its waste reduction efficiency, resulting in larvae with higher nutritional content. In conclusion, among the three substrates; swine manure was the best substrate for rare BSFL with high nutrient levels and higher waste reduction percentage.

Keywords: *Hermetia illucens*; Livestock feed production; Waste management; Rearing substrate; Nutrition composition

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Prevalence of *Salmonella, Escherichia coli* and antimicrobial resistance in beef production chain and its associated environment in Kandy district

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Consumption of meat contaminated with *Salmonella* and some of the pathotypes of *Escherichia coli* can lead to serious illnesses and even death in humans. Worsening the condition, the emergence of antimicrobial resistance in foodborne pathogens including *Salmonella* and *E. coli* has become a serious burden to public health. However, only little is known about the extent of antimicrobial resistance (AMR) prevailing in the beef production chain and its associated environments in Sri Lanka. Hence, this investigation was conducted to establish the prevalence and AMR status of *Salmonella* and *E. coli* isolates in raw beef, bovine manure, and wastewater arising from cattle farms and beef stalls located in the Kandy district. Overall, 44 samples of bovine manure, and 40 samples of associated wastewater were collected from cattle farms in five selected veterinary ranges. Nine raw beef samples and five associated wastewater samples were collected from the municipal area in Kandy district. Isolation and identification of *Salmonella* and *E. coli* were done using standard and ISO methods and polymerase chain reaction. Phenotypic determination of AMR was done following the recommended methods in CLSI. The presence of *Salmonella* and *E. coli* in manure was 4.55 and 79.55%, respectively. Among the beef samples tested, 88.89% were contaminated with *Salmonella* and 44.44% were contaminated with *E. coli*. The isolation rates of *Salmonella* and *E. coli* from wastewater were 15.0 and 62.5%, respectively. The findings revealed that the presence of *Salmonella* in beef was significantly higher than its presence in manure and wastewater. All the *Salmonella* and *E. coli* isolates were resistant to erythromycin (100%). Further, considerable levels of resistance were detected for tetracycline and ampicillin. Additionally, 100% susceptibility was observed for gentamycin and ceftriaxone. A high prevalence of AMR was detected in this study. In conclusion, the low levels of *Salmonella* in manure but its high prevalence in beef indicate post-harvest contaminations that exist in the beef production chain where control measures need to be implemented. This study alarms the necessity for investigating the risks of foodborne pathogens and AMR in one of the underexplored research areas in the country, the beef industry.

Keywords: Bovine manure; Polymerase chain reaction; Erythromycin; Post harvest contamination; Susceptibility

Paper ID: IRCUWU2023-352

The effect of xylanase enzyme treated parboiled rice offal on broiler growth performances and meat quality

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The poultry industry, particularly broiler farming, plays a significant role in global meat production. To meet the growing demand for broiler meat, it is essential to optimize the growth performance and meat quality of broiler chickens. At present, high costs and scarcity or shortage of the various components used to formulate animal feed for broiler feed production place a high risk on optimized production. This research aimed to investigate the effect of supplementing broiler diets with xylanase enzyme-treated parboiled rice offal on broiler growth performances and meat quality. A total of 375 and 14-day old straight run broiler chicks were randomly assigned to 03 dietary treatments with 05 replicates, each replicate consisted of 25 birds and was reared for 41 days. The experimental design of the study was a complete randomized design. The commercial diet was prepared according to NRC (1994) nutrient requirements including maize as the basal ingredient. The dietary treatments consisted of control group (C):- Commercial diet; Treatment 1(T1):- Commercial diet maize replaced by 20% of xylanase enzyme treated parboiled rice offal; Treatment 2 (T2):- Commercial diet maize replaced by 20% of rice offal without xylanase enzyme. Birds were reared in cages under the same environmental conditions. Body weight and feed intake were measured on a weekly basis and based on that feed conversion ratios were calculated. The relative weights of organs, meat quality parameters, and moisture levels of litter and feces samples were measured at the end of the experiment. The results were analyzed using one-way ANOVA under MINITAB 2016 package. The body weight gain was increased (p<0.05) and the feed conversion ratio was decreased (p<0.05) in T1 birds. The relative weights of the liver and small intestine were decreased (p<0.05), and Gizzard weight was increased (p<0.05) in broilers treated with 20% parboiled rice offal and xylanase enzyme. The cooking loss of meat samples of broilers in T1 was decreased compared to the control. The moisture levels of litter and feces samples were decreased (p<0.05) in T1 compared to the control. Conclusively, parboiled rice offal treated with xylanase enzyme can be used successfully to replace 20% of maize for broiler feed production without making an adverse effect on the growth performance and meat quality of broiler chicken.

Keywords: Broiler chicken; Growth performance; Meat quality; Xylanase enzyme; Parboiled rice offal

Paper ID: IRCUWU2023-393

Factors affecting the physicochemical properties of duck meat

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Duck meat is the world's third most widely produced poultry meat, after chicken and turkey. Asian countries alone account for 84% of total duck meat production worldwide. Duck meat is increasing in popularity globally due to its excellent nutritional content, taste, and the fact that they contain significant levels of essential amino acids and fatty acids. Duck meat has higher lipid content than chicken and turkey meat. Similar to the meat of other poultry species, it includes significant quantities of unsaturated fatty acids (about 60% of total fatty acids) and higher levels of haemoglobin and myoglobin, both rich in iron and good catalysts for oxidation reactions. The aim of this review was to elucidate the determinants of the physicochemical properties and nutritional profile of duck meat. Previous studies have stated that genotype significantly alters the physicochemical properties such as color, pH, and shear force, and the nutritional profile of duck meat. Furthermore, the age of birds, rearing system, diet, gender, ageing, additives, and irradiation have significant influences on the physicochemical properties of duck meat. Post-mortem ageing can improve the tenderness of duck meat. Hence, physicochemical properties of duck meat can be influenced by many factors including genetics, age, management practices, environments, and pre- and post-slaughter conditions and others.

Keywords: Ageing; Breed; Duck meat; Meat quality; Tenderness

Paper ID: IRCUWU2023-466

Comparison of growth performance (2 to 16 weeks post-hatch) and MHC-linked LEI0258 marker diversity of Sri Lankan local chicken

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Local chickens have thrived under back yard running system, primarily due to their resilience and genetic adaptation to the local environmental conditions. Implementing modest feeding and management practices has the potential to significantly enhance the performance of local chickens. This study was conducted to investigate the growth performance of three Sri Lankan native chicken breeds from 2 to 16 weeks post-hatch. Also, to assess their MHC allele diversity using *MHC-B* linked microsatellite marker (LEI0258) genotyping. A total of 60, day-old chicks from three local chicken breeds (naked neck: NN; local black: LB; normal white: LW) were allocated into 15 replicate pens in a completely randomized design (114±2.25 g/bird). Birds had unrestricted access to feed and water in a closed house identical floor pen system. Body weight (BW), shank length, tibia length and, feed intake, mortality was measured and the feed conversion ratio was calculated on a weekly basis. Along with their morphological features, the variability of the LEI0258 marker in each breed was investigated using polymerase chain reaction and agarose gel electrophoresis. Tibia length and shank length were not significantly different (p> 0.05) between the three breeds during the whole experiment period. Three breeds showed significant differences for BW (p= 0.007) and weight gain (p= 0.007) for 2 to 8 weeks post-hatch period where NN birds had 17.5% (584 versus 497 g/bird) and 22.4% (584 versus 477 g/bird) higher BW than LB and LW birds, respectively. There were no significant differences observed in growth performance for the 8 to 16-week period and for the whole experiment period (2 to 16 weeks). Overall, NN birds outperformed LB and LW birds during the 2 to 8-week post-hatch period, but LB and LW birds exhibited compensatory growth during the 8 to 16-week period resulting in growth performance that was not significantly different from NN birds. According to the 3% agarose gel electrophoresis results, the LEI0258 allele sizes ranged between 193-575 bp with high overall observed heterozygosity (Hob = 70.3%). Further, LEI0258 as a low-resolution genotyping tool predicts the high MHC diversity in the current population that may be responsible for their disease resistance.

Key words: Local chicken; Growth performance; Tibia length; LEI0258

Sustainable Crop Production

Paper ID: IRCUWU2023-36

Role of exogenous gibberellic acid in mitigating drought stress in immature tea plants (*Camellia sinensis*)

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Gibberellic acid (GA) plays a major role in response to drought stress. Although a lot of attention has been focused on different crops on understanding the relationship between the exogenous application of GA with physiological and biochemical responses under drought stress conditions, little information is available on tea. Therefore, this study was conducted with the objective of understanding the relationship between exogenous applications of GA with physiological and biochemical responses in tea plants under short-term drought stress conditions. A glasshouse experiment was conducted at the Tea Research Institute of Sri Lanka, using one-year-old cultivars, namely, TRI 2025 (drought tolerant) and TRI 2023 (drought susceptible) arranged according to Randomized Complete Block Design (RCBD) with 2 blocks and 24 replicate plants per cultivar per treatment. Plants were exposed to a drying cycle by withholding water. When plants achieved moderate moisture stress (gravimetric water content around 25%), they were foliar sprayed with gibberellic acid (GA), at various concentrations [0 (water-spray – WS), 50, 100, 150 and 200 mgL^{-1}] along with well-watered and no-spray treatments. At 21 days after spraying, plants were re-watered and the recovery was visually assessed after another 7 days. Physiological and biochemical parameters were measured along with soil moisture content in the glasshouse experiment at 18 hours and 3, 7, 14 and 21 days after applying the treatments from randomly selected plants. Drought stress led to declining in gas exchange parameters, leaf relative water content (RWC) and accumulation of osmolytes in both tea cultivars. Exogenous GA increased plant metabolic activities throughout the drying cycle which resulted in higher productivity while preserving antioxidant capacity resulting restricted risk of oxidative damage under drought. The 50 mgL^{-1} concentration of GA was the most effective in terms of increasing the gas exchange parameters, antioxidant activity and recovery after drought in immature tea plants. The exogenous application of a low concentration of GA (50 mgL^{-1}) can mitigate abiotic stresses such as drought.

Keywords: Drought; Gibberellic acid; Immature tea; Physiological responses; Plant hormones.

Paper ID: IRCUWU2023-72

Evaluation of crown gall disease resistance in hybrids of *Rosa* 'PEKcougel' and tetraploid of *R. multiflora* 'Matsushima No. 3'

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Crown gall disease caused by *Agrobacterium tumefaciens* causes economic loss in ornamental production in Japan. To breed a resistant rootstock, we used crown gall resistant Rosa 'PEKcougel' to hybridize with tetraploid of *R. multiflora* 'Matsushima No. 3'. In this study, we investigated the crown gall resistance characteristics in their progenies. In the needle prick test, eight tested progenies showed significantly smaller wounds than R. 'PEKcougel'. In the stem segment culture and opine assay, six progenies formed no callus tissue while three progenies formed calluses and had no opine detected. Further oncogene expression analysis was performed to evaluate crown gall disease resistance, since the low callus formation rate limited the application of opine assay. In the oncogene expression analysis, some progenies of tetraploid of R. multiflora 'Matsushima No. 3' showed a lower expression level of both ipt and iaaM than R. 'PEKcougel'. Furthermore, ipt expression had a significant positive relationship with tumor size. Taken together, these results suggest that ipt expression analysis can be used for evaluating crown gall disease resistance in rose progenies. Furthermore, eight progenies with strong crown gall disease resistance were confirmed.

Keywords: Crown gall disease; 'Matsushima No. 3'; R. 'PEKcougel'; Prick test

Paper ID: IRCUWU2023-81

Propagation of *Psidium friedrichsthalianum* (O.Berg)Nied. (Myrtaceae) using stem cuttings

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Psidium friedrichsthalianum fruits are recognized for their therapeutic and nutritional benefits due to the presence of high vitamin C content with anticancer and anti-inflammatory compounds. This native Latin American species has been introduced to Sri Lanka about nine decades ago but it has not yet been widely cultivated in the country. In order to popularize the species and to introduce the species at a commercial scale, it is necessary to propagate the plants but uncertainties in seed production led to identifying successful propagation methods to improve the rooting of this species using stem cuttings. Softwood cuttings, semi-hardwood cuttings, and hardwood cuttings of the species were dipped in 0.2%, 0.4% and 0.8% W/V Indole Butyric Acid (IBA) solution and potted in a topsoil, coir dust and river sand (1:1:1) potting mixture in 20 replicates. The stem cuttings dipped in *Moringa oleifera* leaf extract (20% W/V) and stem cuttings dipped in half-cut ripened banana were potted in the same way in 20 replicates. Distilled water was used as the control. The pots were kept inside a plant house under 12-hour/12-hour dark/light conditions in a completely randomized design. The stems were well watered and observed for the occurrence of new shoots and roots over 60 days. Results revealed that the tested treatments were not very effective in propagating the species but compared to softwood and semi-hardwood cuttings, the hardwood cuttings dipped in 0.4% IBA exhibited the highest percentage of early budding (8 ±3.60%) and rooting (44 ±22%) with the highest rate of survival of live plants (50±12%), after 60 days (p<0.05). The used IBA solution significantly influenced the rooting success of hardwood stem cuttings of the species (p<0.05), by producing the highest number of roots per cutting (1.75±0.58), the longest average root length (1±0.39cm) and the highest average root weight (0.013±0.005g). The low-cost conventional natural methods such as the use of *Moringa oleifera* leaf extract and half-cut ripened banana didn't affect the rooting success or survival of *P. friedrichsthalianum* stem cuttings. Hardwood cuttings treated with 0.4% IBA can be used for vegetative propagation of the species. However further experiments such as changing the IBA concentrations are required to optimize the propagation protocols so as to gain higher success rates of propagation.

Keywords: Hardwood cuttings; IBA; *Psidium friedrichsthalianum;* Stem cuttings

Paper ID**:** IRCUWU2023**-**108

Effect of pyrolysis temperature on yield and chemical composition of coconut husk biochar: A characterization study

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Agricultural waste generation and mismanagement pose significant challenges to global food production, impacting both the environment and economies. The utilization of agricultural waste presents a promising solution, offering a matrix of environmental and agricultural benefits. This study focuses on utilizing coconut husk waste through biochar production, addressing the abundant waste generated by the rapidly expanding Sri Lankan coconut export industry. Biochar, produced through pyrolysis at different temperatures (325, 350, 400, 500, 600, and 700°C) under limited oxygen supply, at a 7°C /min heating rate for 3 h), was evaluated for its potential yield and chemical composition using Scanning Electron Microscopy with Energy Dispersive X-ray Spectroscopy technique. The results indicated that pyrolysis temperature significantly affects yield and some chemical properties of biochar ($p < 0.05$). The highest biochar yield of 42.79% was observed at 325°C, whereas the lowest of 26.98% at 600ºC. Concerning the chemical composition, C, O, N, and P did not depict significant differences ($p > 0.05$) across the studied temperature range. However, a significant difference ($p < 0.05$) was depicted in K content concerning the studied temperature range, which decreased from 6.83% at 350°C to 1.43% at 700°C. Further research is warranted to explore the influence of pyrolysis time, nutrient dynamics, and heavy metal content in coconut husk biochar. In conclusion, this study highlights the suitability of low pyrolysis temperatures for biochar production using coconut husk. The utilization of agricultural waste through biochar production will offer a promising approach to addressing environmental challenges while enhancing agricultural productivity.

Keywords: Chemical properties; Pyrolysis temperatures; Coconut husk; Biochar; Agricultural waste

Paper ID: IRCUWU2023-160

Effect of biochar on pest and disease management in crops: A meta-analysis and a systematic review

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Biochar is an organic amendment more stable in the soil system than animal manure and plant biomass amendments and is currently being studied for its efficacy in controlling plant pests and diseases. This meta-analysis was conducted to quantitatively analyze the efficacy of biochar produced from various feedstock materials against plant pests and diseases. Original research articles were identified in Scopus® and ScienceDirect® databases and other literature. Types of feedstock, pyrolyzing temperature, properties of biochar, crop, pest or disease incidence/ severity were recorded along with standard deviation or error. The response ratios (natural logarithms) of biochar against pests and diseases were calculated in comparison with the controls (untreated conditions). Forest plots were developed with response ratios and variance. The results revealed that biochar can reduce insect pest and nematode numbers and damage by ~22% compared to the control. The results further demonstrated that biochar can reduce plant pathogens and the severity of plant diseases by 52% compared to the control. The highest control of insect pests and nematodes was observed from biochar produced from citrus wood. This overall estimation could vary for individual pathogens depending on the severity of the virulency of the pathogen, susceptibility of the crop, and favourable environmental conditions. Variable performances against pests and diseases of biochar pyrolyzed at different temperatures were observed. According to the present meta-analysis, biochar produced at high temperatures such as 800ºC has not been effective against pests and diseases on average though feedstocks pyrolyzed at 600 and 650ºC demonstrated favourable effects on pest and disease control. The temperatures of 450ºC and below (400 and 350ºC) demonstrated control of pests and diseases compared to control on average. Therefore, biochar type, pyrolyzing temperature and concentration combination should be evaluated and adjusted before use in crop protection. In addition, in-depth investigations of the mechanisms associated with biochar against plant pests and diseases are needed in future.

Keywords: Organic amendments; Feedstock material; Crop protection; Pyrolyze performance

Paper ID**:** IRCUWU2023**-**220

Evaluate the effect sugarcane distillery spent wash on growth and yield of paddy (*Oryza sativa*): Bg 300 variety

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Sugarcane Distillery Spent Wash is a waste product generated in large quantities during alcohol production. However, it is rich in organic matter and nutrients, but it is considered a waste in the sugarcane industry. This study aimed to investigate the potential of utilizing sugarcane distillery spent wash as a fertilizer source to reduce the environmental impact of waste disposal and address the fertilizer shortage in Sri Lanka. The study was conducted to evaluate the effect of sugarcane distillery spent on the growth and yield of Bg 300 rice variety. The experiment was designed as a pot experiment with three replicates and 19 treatments as independent applications of both Raw Distillery Spent Wash (RDSW) & Bio Methanated Distillery Spent Wash (BMDSW) at rates of 25%, 50%, 75%, 100%. And integrated application of both RDSW & BMDSW with 50% recommended NPK fertilizer. And also, 50%, 100% recommended NPK fertilizer as a control treatment. The results showed that the application of different treatments significantly affected ($P< 0.05$) the growth and yield of Bg 300 rice variety. The study revealed that 50% of recommended NPK usage can be reduced by replaced with 50% independent RDSW and 75% independent BMDSW without affecting the growth and yield of Bg 300. The highest total yield, 100 grains weight, maximum tiller number, leaf area index, and chlorophyll content respectively 27±0.4 g, 2.36 ± 0.08, 19±0.5, 3.869 ± 0.01, 134.59 ± 0.2 μmol m^2 observed in the application of integrated 50:50 ratio of BMDSW and recommended NPK fertilizer. However, concentrations of 75% and 100% of sugarcane distillery spent wash showed a declining trend in all parameters from the control. This study suggests that the utilization of sugarcane distillery spent wash as a fertilizer source has the potential to reduce waste in the sugarcane industry and improve soil fertility.

Keywords: Sugarcane distillery spent wash; Bg 300 variety; Nutrient management; Inorganic fertilizer

Paper ID**:** IRCUWU2023**-**237

Performance of intercropped *Annona muricata, Citrus sinensis* and *Psidium guajava* under two spatial arrangements of *Hevea brasiliensis* in low country intermediate zone of Sri Lanka

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Hevea brasiliensis Muell. Arg. Cultivation in Sri Lanka has been expanded to the Intermediate Zone to cater for the demand. Due to climatic differences, the unproductive immature period of rubber extends into the Intermediate Zone. The study was conducted at the Rubber Research Institute of Sri Lanka Sub Station Monaragala, situated in the Low Country Intermediate Zone of Sri Lanka, from February to June 2022. In this study growth and physiological performances of perennial fruit crops, soursop (*Annona muricata L.*), Orange (*Citrus sinensis L.*), and Guava (*Psidium guajava*) together with rubber were studied. Planting of both rubber and fruit crops has been done following the recommendations of the Rubber Research Institute of Sri Lanka and the Department of Agriculture in 2018. RRIC 121 rubber clone was established under 2.5 m x 7.75 m and 2.5 m x 12 m spatial arrangements. Split plot design where the planting distance was the main plot whilst intercrops were the subplot was used. In each plot, Tree Height (TH), Canopy Spread (CS), Girth, Stomatal Conductance (SC) and Chlorophyll Index (CI) of both rubber and intercrops were measured at 0.05 level of significance. Further, the fruit count was obtained as the yield of intercrops. SAS software was used to perform statistical analysis and Duncan's Multiple Range Test (DMRT) was used to compare the mean at a significance level of 0.05. Overall results indicated that all the parameters were not significantly different at 0.05 significant level up to 42 months after planting with no significant interaction among rubber and intercrops. Therefore, the growth performance of rubber and intercrops were not affected by the spatial arrangement of rubber or the type of intercrops during the immature phase of rubber.

Key Words: Growth; Immature phase; Intercropping; Rubber

Paper ID: IRCUWU2023-242

Determining the effectiveness of selected nucleopolyhedrovirus isolates against *Spodoptera litura* larvae infestations in horticultural crops

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Spodoptera litura Fabricius (Noctuidae; Lepidoptera) is a major polyphagous pest in a variety of major horticultural crops. Biopesticides such as Nucleopolyhedroviruses (NPVs) have been tested against the *Spodoptera* species in the world; however, no investigations have been recorded in determining the efficacy of NPVs against *S.litura* in the Sri Lankan context. This study was conducted to evaluate the effectiveness of 17 isolates of NPVs, which were extracted from *Helicoverpa armigera* against *S. litura* for the first time in Sri Lanka. Leaf spread and leaf dip methods were used as two types of virus inoculation methods against *S. litura*. First expanded leaves of 2 to 3-week-old cabbage plants were used to feed for the *Spodoptera* larvae and the highest concentrations (10^{10} POBs/ml) of each of the 17 NPV isolates were used. Eighteen treatments, including the control (distilled water), were used in the experiment, wherein the treatments were laid out in a Completely Randomized Design. There were three replicates of each treatment, where 30 identical second instar-larvae were introduced randomly to each treatment plot. Mean larval mortality was recorded daily for 10 days following the application. Results revealed that all 17 NPV isolates tested exhibited zero or very low mortality in both virus inoculation methods. In the final post-treatment count after 10 days of application, it was clearly shown that the mortality of all tested NPV isolates showed no significant difference compared to the control treatment. However, a significantly low level of feeding was recorded in the isolate number "2" under both virus inoculation methods. The poor efficacy against *S. litura* suggests the host range specificity and species-specific compatibility of NPVs. Therefore, it was concluded that NPVs could not be used as a biocontrol agent for the management of *S. litura* larvae in Sri Lanka.

Keywords: *Spodoptera litura*; *Helicoverpa armigera*; Nucleopolyhedroviruses; host-specificity

Paper ID: IRCUWU2023-244

Effects of sodium hypochlorite and ethanol to control the mite attacks in tissue culture

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Mites are tiny arthropods that can negatively impact plant tissue culture media, culture vessels, and plants, leading to economic losses for growers. The aim of this study was to identify the effective treatment of sodium hypochlorite (NaOCl) and ethanol (C_2H_5OH) to control mites which may occur naturally during the sub-culturing process of orchids produced *in-vitro*. Prior to the main experiment, a preliminary experiment was conducted to assess the phytotoxic effects of the treatments on tissue-cultured orchids. Three concentration levels of NaOCl (3.75%, 7.5%, 15%) and four concentration levels of C_2H_5OH (60%, 70%, 80%, 90%) were tested against mite infestation at three exposure time periods of 5, 10, 15 minutes and 30, 60, 90 seconds, respectively. There was a control treatment which was performed with distilled water. Mite counts were taken in a way by dipping the orchid shoots in respective solutions followed by shaking for a while, and live mite count was taken if any live mites were collected into the solution. The survival of mites and plant growth (shoot height, number of leaves, number of roots) were assessed against each test chemical at all of its concentration levels. Data were analyzed by employing a Generalized Linear Model followed by paired comparisons. The results demonstrated that all NaOCl concentrations and their exposure times did not exhibit any phytotoxic effects, while 90% C_2H_5OH treatment at all of its exposure time periods was shown to be phytotoxic. All concentration levels of NaOCl at its exposure times except for 15 minutes demonstrated statistically higher mite mortality than that of ethanol treatments. However, neither NaOCl nor C_2H_5OH has affected the growth parameters of the orchid plants. The findings of this study suggest that sodium hypochlorite is more effective than ethanol in managing mite infestation during the sub-culturing process wherein the lowest concentration of NaOCl for 10 minute-exposure time can be recommended for commercial applications.

Keywords: Ethanol; Mite infestation; Mite mortality; Phytotoxicity; Sodium hypochlorite

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Assessing the ethnoclimatology knowledge and adaptation practices of organic tea farmers in the Uva high grown region

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Climate change poses significant challenges that necessitate the implementation of effective adaptation measures in organic tea cultivation. Ethno-climatology, a multidisciplinary field, explores the relationship between human societies and climate, focusing on how different cultures and communities perceive, adapt to, and interact with their environment's climate and weather patterns. This study evaluates the ethno-climatology knowledge of organic tea farmers in the Uva High Grown region and their adoption of adaptation measures to mitigate climate change impacts. The study utilized a cross-sectional and exploratory research design, incorporating data collection methods such as questionnaires, in-depth interviews, focus group discussions, and surveys. The sample comprised 100 individual farmers. To identify independent variables significantly influencing farmers' awareness of ethno-climatology, descriptive and multiple regression analyses were employed. The descriptive results reveal that the mean age of organic holders, gender distribution, land size, and experience in organic farming of the tested farming community was 55 years, 64% male-oriented, about 0.76 acres in extent, 27 years in tea cultivation and 8 years in organic farming respectively. The findings revealed that over half of the farmers in the sample demonstrated a significant level of awareness concerning ethno-climatology, as evidenced by scores surpassing 75%. Approximately 37 farmers exhibited a high level of awareness, scoring above 85%. These findings indicate a positive trend of awareness among farmers' analysis. The multiple regression model has a strong fit with an R-squared value of 0.962 ($p < .001$). The model accounts for 96.2% of the variance observed in the dependent variable. Correlation analysis indicated that factors such as age, experience in the Organic Tea field (years), knowledge gained through experience, observations, beliefs, and cultural practices played pivotal roles in shaping farmers' awareness of ethno-climatology. Conversely, Education and information sources showed weak or non-significant relationships with awareness levels. In conclusion, the perception of the organic farming community on Ethno-climatology offers valuable insights into the existing understanding of ethno-climatology and the adoption of adaptation measures within the organic tea ecosystem. By elucidating farmers' awareness and application of ethno-climatology practices, this research contributes to the development of sustainable strategies for organic tea production under evolving climatic conditions.

Keywords: Adaptive measures; Climate mitigation; Ethno-climatology; Famers' awareness

Paper ID: IRCUWU2023-259

Phosphorous fractionation in tropical rainforest and montane forest soils along an altitudinal gradient of Sri Lanka

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Phosphorus (P) availability is commonly assumed to limit productivity in tropical forests. There is relatively little information available on soil P fractionation in such ecosystems. The aim of this study was to determine variation in soil P fractions along an altitudinal gradient in tropical rainforests & montane forests in Sri Lanka. Soil samples were collected up to 25 cm depth from eight permanent sampling plots (PSPs) located at 117 (Kanneliya 1), 174 (Kanneliya 2), 509 (Pitadeniya 1), 618 (Pitadeniya 2) 1042 (Enasalwatte 1),1065 (Enasalwatte 2), 2080 (Pidurutalagala) and 2132 m asl (Horton Plains). Each sampling plot was 1 ha in size and 17 near-surface representative soil samples were collected up to 0.25 m depth. Four replicates from each PSP were used for the study. Different P fractions were determined using the modified Hedley extraction method Basic soil physico-chemical properties: pH, electrical conductivity (EC), redox potential, cation exchange capacity (CEC), organic carbon (C) content, bulk density and soil porosity were also determined. The results showed that there was a significant (p <0.05) effect of elevation on soil P fractions (organic, inorganic & residual P) and some soil properties. Enasalwatta 2 had the highest average total organic P (638.33 ± 114.44 kg/ha) whereas Pitadeniya 1 had the lowest (353.93 ± 93.33 kg/ha). Among the sampling plots, Enasalwatta 2 had the highest total inorganic fractions (45.95 ± 5.85 kg/ha) while the lowest was observed in Pitadeniya 1 (20.89 ± 4.63 kg/ha). The highest and the lowest residual P fractions were recorded in Piduruthalagala (149.36 ± 23.36 kg/ha) and Kanneliya 1 (56.29 ± 14.40 kg/ha), respectively. There was a significant (p <0.05) positive correlation between soil P fractions with organic C content, bulk density and redox potential. Meanwhile, the soil P fractions had significant (p <0.05) negative correlations with soil porosity and EC. Overall, P fractions showed a spatial variation in the tested tropical rainforests and montane forests and the observed variation is supported by the variation of soil physico-chemical properties of the sampling plots.

Keywords: Permanent sampling plots; Phosphorus; Physico-chemical properties; Tropical rainforests; Tropical montane forests

Paper ID**:** IRCUWU2023**-**283

Assessing the effectiveness of organic tea smallholder organization models for the sustainability of agri-business supply chain of bio tea

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The organic tea industry in Sri Lanka has experienced growth due to rising demand for organic products, but sustainability faces challenges amid the current economic crisis. This study aims to offer valuable insights and recommendations for improving the productivity and sustainability of organic tea farming communities. Using a quantitative research approach to assess land productivity as a measure of effectiveness for Organic Tea Smallholder Organization Models, the study establishes relationships between productivity in organic smallholdings and various factors influencing the effectiveness of smallholder organizations. A cross sectional field survey followed by lead farmer interviews was operationalized among randomly selected 100 organic farmers in the Uva-High Grown Area using pretested and validated questionnaires by adopting reliability tests to measure farmers' perspectives and the influence of key variables on effectiveness. The study analyzed primary data collected about insights on socio-economic status, environmental sustainability, institutional involvement, and compliance of farmers aligned with their land productivity by applying descriptive and inferential analysis using the SPSS statistical package. The descriptive results reveal that the mean age of organic holders, gender distribution, and experience in organic farming of tested farming communities was 56 years, 57% male dominant, over 24 years in tea cultivation and 7 years in organic farming respectively. Reliability analysis ensured measurements are within consistency and accuracy (Cronbach's alpha > 0.80), The regression model has a strong fit with an R-squared value of .914 ($p < .001$), explaining 91.4% of the positive and significant variation in organic land productivity. The study identifies key factors such as education, experience in organic farming, environmental sustainability, institutional involvement, compliance with organic standards, and economic viability that influence organic land productivity. Age, family and farm size, gender, and experience in tea cultivation were found to have no significant impact. Important recommendations include prioritizing organic farming experience through tailored training programs to raise awareness of organic standards and sustainable practices among farmers. Implementing these insights can strengthen smallholder organizations, fostering a more sustainable and productive organic tea industry in Sri Lanka.

Keywords: Organic tea; Effectiveness; Marginalized organic producer; Sustainability

Paper ID**:** IRCUWU2023-314

Investigating the synergistic effect of exposure time and dosage of phosphine gas on the control of rice weevil (*Sitophilus oryzae*) infestation in stored rice grains in Sri Lanka

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This study aimed to develop a fumigation protocol using phosphine tablets (Aluminium Phosphide 56% w/w) to control rice weevil (*Sitophilus oryzae)* infestation in stored milled rice, with the goal of enhancing food safety at the quarantine service in Sri Lanka. The experiment followed a Complete Randomized Design with three concentration levels of phosphine tablets (1, 2, and 3 tablets) and a control treatment. Each concentration level was tested under three different time regimes (72, 96, and 120 hours). Clean rice grain samples stored in PVC vials were allowed to get infested by different life stages of *S. oryzae*. Resultsshowed that, except for the control treatment, all tested concentration levels achieved 100% mortality in the adult stage across all time regimes. However, the lowest concentration and fumigation time that achieved 100% mortality for all stages of *S. oryzae* was determined to be 1.3381 ± 0.507mg/L with a 96 hour fumigation time. Based on these findings, the concentration level of 1.3381 ± 0.507 mg/L with a 96-hour fumigation time can be recommended as an effective interaction of dose and time for achieving 100% mortality of *S. oryzae* during phosphine tablet fumigation treatments. This research contributes to the development of an effective fumigation protocol for controlling rice weevil infestation in stored rice grains.

Keywords: Rice weevil; Stored rice grains; Fumigation protocol; Aluminium phosphide

Paper ID**:** IRCUWU2023–408

Risk in Sri Lankan up-country vegetable farming: Sources, attitudes, and management strategies

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Sri Lanka is a tropical country with agriculture spread over the entire island. According to the agroecological adaptability, Sri Lankan vegetables are divided into two categories as up-country vegetables and low-country vegetables. This study mainly focuses on up-country vegetable farmers who are mainly cultivating short-term crops. Up-country vegetable farmers in Sri Lanka are constantly confronted with risky situations. These risks cause the harvest, and income, to be erratic and in most cases, to be reduced. This study aimed to investigate and categorize various sources of risks faced by Sri Lankan up-country vegetable farmers, their attitudes toward risks, and the risk management strategies adopted. Primary data were gathered by using a structured questionnaire, surveying randomly selected 200 up-country vegetable farmers in the Badulla District. The descriptive analysis of data showed that only 20% of farmers were solely dependent on vegetable farming while the remaining 80% claimed to have another source of income. Only 4.5% of farmers had higher education qualifications. The majority of the respondents had stopped going to school after the eighth or ninth grade. Five-point Likert scale statements were used to collect data on the three risks related variables; the degree of impact of risk sources, farmers' attitudes toward risks, and risk management strategies adopted. Each risk-related variable was analyzed using Confirmatory Factor Analysis. The majority of the variance of the data on sources of risks was explained by institutional risks. The analysis of farmers' attitudes towards risk revealed that farmers range in a risk-taking continuum from positively seeking risk to being more neutral and avoiding risk. Financial risk management strategies explained the majority of the variance in the adoption of risk management strategies. Results concluded that farmers have a risk-seeking attitude towards financial risks and they are trying to mitigate the impact of most of the risk sources by adopting financial risk management strategies. This study provides implications for individuals who seek to manage the risks in farming by identifying the most impactful sources of risks, differentiating farmers' attitudes toward risks, and weighing the most applicable risk management strategies for Sri Lankan up-country vegetable farmers.

Keywords: Confirmatory factor analysis; Risk attitude; Risk management; Risk sources; Up-country vegetables

Paper ID**:** IRCUWU2023**-**428

Effect of IBA and NAA on rooting of top cuttings of *Dracaena surculosa var. punctulate*

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Dracaena surculosa var. punctulata is one of the most demanded ornamental foliage plants used in cutting-based vegetative propagation to grow fully formed plants. It is essential to employ the most appropriate hormone types in proper dosages to achieve successful rooting on a commercial scale. Thus, the effect of various concentrations of IBA and NAA and their combinations on the rooting of top cuttings of *Dracaena surculosa var. punctulata* was assessed using two different sub-experiments. Experiments were conducted using two types of *Dracaena surculosa* cuttings: top cuttings with the topmost leaf fully opened and top cuttings with the topmost leaf unopened, treated with 13 different hormone combinations in a Completely Randomized Design with 10 replicates. After 12 weeks of establishment, the percentage of rooted cuttings (%), the highest root length per cutting (cm), the number of roots per cutting, and the survival percentage (%) were recorded. Data were analyzed using ANOVA with a statistical analysis system at a 5% significance level. The results revealed that top cuttings with fully opened topmost leaves, treated with IBA 0.2 g + BAP 0.3 ppm showed significantly ($p \leq 0.5$) the highest number of rooted cutting percentage (90%) and root length per cutting (14cm) as well as higher number of roots per cutting (7). The topmost cuttings with fully unopened topmost leaf, treated with IBA: NAA – 0.25 g + 0.25 g + BAP 0.3 ppm, showed significantly ($p \leq 0.5$) the highest rooted cutting percentage (66%), survival percentage (90%) as well as higher roots per cutting (5). However, the hormone concentrations were not significantly ($p \geq 0.05$) affected by the survival percentage of top cuttings with fully opened topmost leaf and root length per cutting of topmost cuttings with fully unopened topmost leaf. According to the results, it can be concluded that the hormone concentrations; IBA 0.2 g + BAP 0.3 ppm and IBA: NAA – 0.25 g + 0.25 g + BAP 0.3 ppm were found to be superior for top cuttings with topmost leaf fully opened and top cuttings with the topmost leaf unopened respectively. Future comprehensive studies must be carried out to select the proper rooting hormone concentrations, employing more hormone combinations.

Keywords: BAP; IBA; NAA; Rooting; Vegetative cuttings

Paper ID: IRCUWU2023-441

Effect of different drying techniques on physicochemical properties of turmeric (*Curcuma longa* L.)

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Turmeric (*Curcuma longa*) belongs to the family Zingiberaceae. It is native to Southwest India and widely cultivated in Southeast Asia. Turmeric mainly consists of curcuminoids and essential oils. Therefore, turmeric rhizomes are widely used as food preservatives, spices, colourings and Ayurvedic medicine. In Sri Lanka, the annual turmeric requirement is approximately 7500 metric tons, while the annual turmeric production stands at around 1500 metric tons. As the Sri Lankan government moved to ban the import of turmeric, farmers were encouraged to grow turmeric. However, postharvest losses occurred due to ineffective processing methods. Drying is an important step in turmeric processing. Curcuminoids are sensitive to heat. Therefore, curcuminoids can be degraded during drying. This study investigated the effect of different drying techniques on the physicochemical properties of dried turmeric in terms of moisture content, volatile oil content, curcumin content, colour composition (Lab values) and antioxidant activity. The experiment consisted of four drying methods (open-air solar drying, greenhouse solar drying, and hot-air drying at 45°C and 55°C). The hot-air drying technique was used to evaluate the effect of drying temperature. The spectrophotometric technique was used to assess the amount of curcumin present. The findings indicated notable variations (p<0.05) between the different drying methods. The turmeric moisture content, volatile oil content, curcumin content and antioxidant level of four drying methods of turmeric ranges from 11.03±2.08 to 13.14±0.69, 4.31±0.66, 5.20±0.14 to 2.74±0.61 to 5.42±0.32, 29.45±2.96 to 36.35±0.58 respectively. The results of moisture content and volatile content were not significantly different in the four drying methods. Open-air solar drying and greenhouse solar drying caused a decline in curcuminoids. The findings summarize that the hot-air drying at 55°C method could be potentially applied in commercial turmeric drying preserving its colour while maintaining the optimal curcumin content, and it showed the lowest drying time than other drying methods.

Keywords: Solar drying; Greenhouse solar drying; Hot-air drying; Curcumin; Postharvest loss

Paper ID: IRCUWU2023-443

Comparative evaluations of the nursery performance of tea (C*amellia sinensis* L.) cultivars under conventional and coco pith based potting media

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Tea is a vital plantation crop and vegetative propagation is extensively used to supply planting materials. Conventionally, a top soil-based potting media is used for nursery propagation. However, continuous removal of topsoil and chemical fumigation has become an environmental hazard. Furthermore, the tea cultivar released for the Uva region (TRI 5002) exhibited poor success rates in conventional nurseries. Therefore, the current study was conducted to evaluate the nursery performance of tea cultivars on conventional and coco pith-based potting media. The TRI 3072, TRI 4052, TRI 4053, TRI 4071 and TRI 5002 cultivars were used for the study and 500 vegetative cuttings were obtained from each cultivar. Out of these, 250 cuttings were assigned for each treatment and a completely randomized design (CRD) was used. The leaf area, shoot height, root length, shoot, and root dry weight were measured for randomly selected 10 plants from each cultivar. The vegetative growth parameters were measured at 57, 71, 85, 99, 113, 127, 141, and 155 days after planting and data were analyzed using Minitab 17 statistical software. Further, a cost-benefit analysis was performed for both potting media. According to the results, TRI 4053, TRI 4071, and TRI 4052 cultivars had no significant differences in leaf area, shoot height and shoot dry weight between the two media ($p>0.05$). TRI 5002 cultivar showed significantly ($p<0.05$) higher vegetative growth performance and success rates on coco pith media than soil. However, the higher root thriving TRI 3072 cultivar exhibited significantly ($p<0.05$) higher shoot and root values in the soil medium. Generally, TRI 4053, TRI 4071, and TRI 4052 cultivars also showed comparatively poor root lengths and weights in coco pith media. The lower volume of the coco pith pellet could be attributed to the lower root growth. Yet, the cost analysis revealed Rs. 11.60 cheaper cost of production in coco pith media. Additionally, a conventional nursery bag weighs approximately 1 kg whereas the coco pith pellet weighs around 100 g. Therefore, coco pith media could be recommended as a cost-effective and easy-to-transport alternative potting media for the propagation of tea cultivars. However, further research is needed to optimize the pellet size for better root growth.

Keywords: Coco pith; Potting media; Rooting; Shoot growth; Vegetative propagation

Paper ID**:** IRCUWU2023-447

Evaluation of grafting using different rootstocks for management of bacterial wilt in tomato caused by *Ralstonia solanacearum*

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Bacterial wilt (BW), caused by *Ralstonia solanacearum*, is a devastating disease that affects tomato (*Solanum lycopersicum* L.) production worldwide. Grafting with resistant rootstocks may be an effective strategy for managing this disease. The objective of the present study was to evaluate the grafting efficacy of tomato against BW disease through resistant rootstocks while enhancing the plant vigour. Rootstocks of five tomato varieties, namely two Goraka thakkali varieties, two Cherry tomato varieties, and one Lanka Sour variety were tested for BW resistance and grafted using the clip grafting method with scions of two susceptible, most popular, and high yielding recommended tomato varieties, namely Thilina and HORDI Tomato hybrid 03 in a completely randomized design (CRD) with three replications of each treatment. The seeds of five tomato varieties were collected from Plant Genetic Resources Centre (PGRC), Gannoruwa, Horticultural Crops Research and Development Institute (HORDI), Gannoruwa and from a farmer's field in Kandy. The seeds of two susceptible scions were collected from Seed Certification Services (SCS), Gannoruwa. Disease severity and seedling grafting success were evaluated and analysed statistically. Mean separation was done using LSD at p <0.05. Disease incidence was determined by practicing the root inoculation method. Two Goraka thakkali cultivars and Lanka Sour cultivar showed resistance to BW. Whilst, two Cherry tomato cultivars were highly susceptible to BW according to the rating scale for bacterial wilt in HORDI. Seedlings grafted to resistant rootstocks such as Lanka Sour with HORDI Tomato hybrid 03, showed the highest healthy plant percentage (86.67%). This was followed by grafting of Goraka thakkali variety from the farmer's field with HORDI Tomato hybrid 03, Goraka thakkali variety from PGRC with HORDI Tomato hybrid 03, and Lanka Sour with Thilina. According to the output of this study, grafts made using all three resistant rootstocks with scions of HORDI Tomato hybrid 03 may effectively assist in controlling BW in tomatoes.

Keywords: Bacterial wilt; Rootstocks; Scions; Seedling grafting; *Solanum lycopersicum*

Paper ID: IRCUWU2023-448

Evaluation of brown plant hopper *Nilaparvata lugens* (Stäl) resistance in selected traditional rice varieties in Sri Lanka

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Rice is the staple food in Sri Lanka and traditional rice varieties are cultivated based on several important characteristics. Among them, resistance to biotic and abiotic stresses is a basic trait. Brown plant hopper *Nilaparvata lugens* (Stäl) is one of rice's most destructive pests. This study aimed to evaluate brown plant hoppers' resistance in selected traditional rice varieties/accessions in Sri Lanka through the honeydew excretion method. Eleven accessions of five selected traditional rice varieties namely Baba wee (ACC#003272), Kaharamana (ACC#003595, ACC#005381), Muthumanikkan (ACC#003399, ACC#004565, ACC#003645) Rathuheenati (ACC#003390, ACC#002080, ACC#005486) and Hondarawala (ACC# 003528, ACC #006199) were screened for BPH resistance against Bg 380 and Ptb 33, which were susceptible and resistance check varieties respectively. Using the honeydew test. The experiment was arranged in a completely randomized design, and data were analyzed statistically using Minitab. The honeydew area was calculated by using image j software. Significant differences were observed for BPH resistance in some accession of traditional varieties in response to the honeydew test. Bg 380, Kaharamana ACC#005381, and Rathuheenati ACC#002080 showed the highest honeydew excretion confirming their susceptibility to BPH. Muthumanikkam ACC#004565 and ACC#003645 showed the lowest amount of honeydew excretion confirming their resistance to the BPH in comparison to the resistant check Ptb 33. This study revealed that accessions ACC#004565 and ACC#003645 of the traditional variety Muthumanikkam might effectively be used as the donor parent for developing BPH-resistant rice varieties in rice breeding programs.

Keywords: Brown plant hopper resistance; Honeydew test; Rice pest control; Traditional rice varieties

Paper ID**:** IRCUWU2023**-**457

Potential use of biofilm biofertilizers in fully organic rice cultivation of Sri Lanka

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Conventional agricultural practices that rely solely on chemical inputs [synthetic chemical fertilizers (CF) and agrochemicals] lead to degrade agroecosystems with retarded crop quality and yield. Organic agriculture (OA) is becoming popular as it reduces the usage of chemical inputs and also helps mitigate global warming through soil carbon (C) sequestration. However, the global OA share is only about 1.6%. The main reason behind this value is the impracticability of the application of organic matter (OM) in bulky quantities, E.g., 10 t/ha, as recommended in the OA practices. In this context, a biofilm biofertilizer (BFBF)-based OA practice may be a solution given its ability to cut down OM application. The present study was designed to evaluate the potential use of BFBF in OA of Sri Lanka by using rice (*Oryza sativa* L.) as the test crop. A field experiment was carried out in three schools of agriculture: Angunakolapalessa, Pelwehera, and Vavuniya. Three farming practices i.e. farmers' CF practice (100% CF, 340 kg NPK/ha); BFBF practice (66% CF + BFBF, 2.5 L/ha); and BFBF-based OA practice (nutrient-rich compost, 0.5 t/ha with NPK > 1% + BFBF, 2.5 L/ha) were compared with a reference treatment (66% CF) and under no amendments (control) for changes in soil C and nutrients, soil and plant microbes, plant growth, and yield. Results showed that the soil C, potassium, diazotrophs, and plant root dry weight were not significantly differed between the three farming practices in all three locations. The BFBF practice produced a significantly high ($P = 0.000$) grain yield in Vavuniya (6,131 kg/ha) and Angunakolapalessa (5,948 kg/ha). The yields produced by the OA practice (3,724 kg/ha) and farmers' CF practice (4,176 kg/ha) were not significantly different at Angunakolapalessa. It is concluded that the BFBF-based OA practice has the potential to be adapted in OA of Sri Lanka, because of the less bulky OM use (10 t/ha versus 0.5 t/ha). The OA practice can be recommended as an eco-friendly, economically viable, and farmer-friendly farming practice for sustainable agriculture. However, further research is needed to popularize and establish this OA practice with the use of nutrient-rich compost materials.

Keywords: Agroecosystems; Biofilm biofertilizers; Organic agriculture; Rice cultivation

Paper ID**:** IRCUWU2023**-**458

Screening of brinjal germplasm for resistance to bacterial-wilt caused by *Ralstonia solanacearum*

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Bacterial wilt caused by *Ralstonia solanacearum* is a major soil-borne disease of brinjal (*Solanum melongena*) cultivation around the world. In Sri Lanka, overall yield losses due to bacterial wilt ranged from 20-60%. The best strategy to control the disease is the cultivation of resistant varieties. The main objective of this study was to evaluate brinjal varieties and accessions from selected 40 brinjal germplasm obtained from Plant Genetic Resources Centre (PGRC) and Horticulture Crop Research and Development Institute (HORDI), Gannoruwa for bacterial wilt resistance. Symptomatic brinjal plants were collected, *Ralstonia solanacearum* isolates were isolated and characterization of isolates was done using morphological and biochemical features with three replicates. The colony morphology of the isolates was studied on Tetrazolium Chloride (TZC) media. Isolates showed the typical colony morphology of *Ralstonia solanacearum* by producing colonies with pinkish-red centres and cream-white edges on TZC media. Biochemical-based biovar identification was done according to their ability to utilize carbohydrates and sugar alcohols, the colour changes were observed and recorded after 3,7, and 14 days. After 14 days, the solutions of all Eppendorf tubes were yellow in colour except the control tubes. The isolates of *Ralstonia solanacearum* from brinjal were grouped into biovar III according to biochemical characterization. Pathogenicity proving test was conducted using the root inoculation method under greenhouse conditions. Resistant variety Padagoda and Susceptible variety HORDI lena-iri were used as controls. The occurrence of disease incidence of all tested brinjal germplasms was assessed 30 days after inoculating 1×10^8 CFU/ml bacterial suspensions at two-time intervals. Based on the severity of symptom development and according to the rating scale for bacterial wilt in HORDI, 17 germplasm were found to be resistant, 06 were moderately resistant,13 were moderately susceptible and 04 were susceptible for race 1 or 3, biovar III of *Ralstonia solanacearum.* Resistant accessions and varieties resulting in the present study may be utilized for developing resistant brinjal varieties to manage this devasting disease.

Keywords: Bacterial wilt; Biovar; Root inoculation; Wilt screening

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Potential of compost tea as an organic liquid fertilizer for hydroponics

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Compost tea is a liquid organic fertilizer which serves as a nutrient rich and microbe packed solution to improve crop growth and health. However, its potential in hydroponics is still not fully discovered. Thus, the present study investigates the effectiveness of using compost tea as an organic liquid fertilizer for lettuce (*Letuca sativa* L.) cultivation in hydroponic systems. The research was conducted in a plant house. Compost tea was prepared by steeping 1 kg of compost in 10 litres of water for 10 days with aeration. Six different fertilizer treatments were used; T1- water (control), T2 - 100% Albert's solution (AS), T3 - 100% Compost tea (CT), T4 - 75% CT+ 25% AS, T5- 50% CT+ 50% AS and T6 - 25% CT+ 75% AS. The experiment was laid out in Complete Randomized Design (CRD) with four replicates. The pH and EC levels in fertilizer solutions were measured weekly. The pH levels were constant in all treatments but the EC level gradually decreased in fertilizer solutions except T1. Lettuce plants were harvested after 60 days. According to the results, T5 and T6 treatments were statistically similar values and significantly higher (p<0.05) than others, especially leaf number ($14.33^{a} \pm 2.52$, $16.33^{a} \pm 1.15$), leaf area ($743.00^{ab} \pm 124.01$, $846.33^{a} \pm 43.82$ cm^2), shoot fresh weight ($43.44^{a} \pm 12.99$, $42.15^{a} \pm 2.69$ g) and shoot dry weight ($7.04^{a} \pm 3.34$, $8.06^{a} \pm 0.89$ g). Furthermore, the greenness of leaves was significantly higher in plants grown in fertilizer solutions compared to T1. The highest growth and yield performances of lettuce were observed in T5 and T6 treatments. However, T5 can be considered as the best fertilizer combination considering the cost effectiveness. In conclusion, mixing of compost tea with Albert's fertilizer would improve the growth and yield of lettuce compared to the sole application of compost tea or Albert's fertilizer in hydroponically grown lettuce.

Keywords: Albert's solution; Compost tea; Hydroponics; Lettuce; Organic

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Study the inheritance of rust resistance gene *Ur-3*$^{+}$ in common bean

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Uromyces appendiculatus is one of the most destructive fungal diseases in common bean cultivation worldwide. An increase of 1% in bean rust disease severity leads to a yield loss of approximately 19 kg/ha. Since chemical control alone is not effective, resistant varieties are the way forward. Resistant to rust is governed by single dominant genes, recessive genes and genes with minor effects and up to date *Ur-3, Ur-3*$^{+}$*, Ur-4, Ur-5, Ur-6, Ur-7, Ur-9, Ur-11, Ur-12*, *Ur-13*, and *Ur-14* have been identified. The objective of this study was to evaluate the inheritance of the rust-resistance gene *Ur-3*$^{+}$ in the genetic background of Bandarwela Green. F2 generation of Bandarawela Green and BelDade RR-1 seedlings were inoculated with *U. appendiculatus* spores using the direct spore rubbing method under a protected house arranged in Complete Randomized Design. According to the results, the observed ratio (3:2) did not follow Mendel's First Law, behaving significantly differently from the expected ratio (3:1) where the Chi-square value (Goodness of fit) was at 12, which is greater than the table value. The observed results may be attributed to the segregation of minor genes within the gene cluster. Yet, there is currently no evidence regarding the distance between the dominant gene *Ur-3*$^{+}$ and the clustered gene. Further linkage analysis is required before confirming the genetic loci on the chromosomes. However, a rust-resistant segregating F2 generation was successfully generated by crossing BelDade RR-1 and Bandarawela Green and the F2 progenies were evaluated for rust resistance during the current study. In the future, the backcross breeding method will be applied using the rust-resistant bean lines selected during the current study to develop a new rust-resistant bean variety suitable for cultivation in Sri Lanka.

Keywords: Fungal disease; Gene cluster; Rust resistance; *Ur-3*$^{+}$gene

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Effect of artificial light on growth and leaf quality of betel (*Piper betle* L.)

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Betel leaves are graded according to the leaf size and quality for marketing. Usually, farmers can get a high price for the betel in the export market compared to the local market. Large leaves with dark green color, high fresh weight and crispy nature are suitable for the export market. It is challenging to fulfil these quality standards under field conditions. The possibility of regulating betel growth and leaf quality using artificial light has not been previously investigated in Sri Lanka. Therefore, this experiment was carried out inside a shade house, at Intercropping and Betel Research Station, Narammala to identify the effect of artificial light on the growth and leaf quality of betel. Betel vines of cultivar, *Maneru* were exposed to four light treatments (6:00 am - 6:00 pm) namely red, blue, and white light (using light emitting diodes; 50 W) and natural sunlight (control). The experiment was laid out according to the Complete Randomized Design (CRD) with four replicates. Growth and leaf quality attributes were examined. As per the results, white LED light and natural sunlight showed significantly (p <0.05) higher performance in leaf width (8.7±0.7 cm and 9.0±1.6 cm, respectively) leaf length (12.5±0.7 cm and 12.3±2.1 cm, respectively) and leaf colour (dark green) compared to red light (3.1±1.2 cm, 5.0±1.9 cm and mostly light green, respectively). Leaf thickness was greater under blue LED light followed by white LED light. Leaf fresh weight, shoot length, number of nodes, shoot diameter and internodal length were statistically (p < 0.05) similar across treatments. Natural sunlight, white and blue light recorded statistically similar (p <0.01) number of leaves (14, 10 and 9, respectively) which was higher than red light (7). Therefore, the present study concluded that both white and blue LED lights (50 W) can be successfully used to enhance the growth and leaf quality of betel as an alternative to natural sunlight especially when sunlight is limited under rainy or cloudy weather.

Keywords: Export market; Growth parameters; Leaf quality; Light emitting diodes

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