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*Embracing a Sustainable Tomorrow :
Empowering Resilience through Climate
Action and Adaptive Strategies*

23rd December, 2023

ORGANIZED BY
The Sri Lanka Students' Association in Japan (SLSAJ)
in Collaboration with Sri Lanka Academics' Association in Japan



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Message from the Chief Guest



Mr. Rodney M. Perera

*His Excellency the Ambassador,
Embassy of Sri Lanka in Japan*

I take this opportunity to extend my felicitations and gratitude to the Sri Lanka Students' Association of Japan for organizing the Annual Research Conference of the SLSAJ 2023.

The theme "Embracing a Sustainable Tomorrow: Empowering Resilience through Climate Action and Adaptive Strategies" reflects the Association's commitment to addressing crucial issues such as climate change and sustainable development. The choice of this topic underscores the organization's awareness of the contemporary challenges Sri Lanka faces and its dedication to contributing to the nation's resilient and sustainable future.

Further, I extend my heartfelt congratulations to the President and all members of the SLSAJ for their commendable efforts to fostering an invaluable platform for intellectual discourse and knowledge sharing. I commend the researchers who presented their work at the conference. Their dedication to advancing research and addressing pertinent issues are noteworthy and aligns with the broader goals of academic excellence and societal progress.

As the Embassy of Sri Lanka in Japan, we are grateful for the Association's dedication to exploring and discussing topics that are not only academically enriching but also have practical implications for the socio-economic development of Sri Lanka. The focus on sustainable practices and climate resilience is particularly timely and positively reflects the forward-thinking mindset of the Association.

Once again, I convey my warmest congratulations to the Sri Lankan Students' Association in Japan, all those who presented their research findings including the renowned Academics at the Annual Research Conference. May the research presented and published in the Book of Abstracts contribute significantly to the academic community and, more importantly, to the sustainable development goals of Sri Lanka.

Message from the Conference Chair



Prof. N. S. Cooray

*Professor,
International University of Japan,
President,
Sri Lanka Academics' Association in Japan*

As the Conference Chair, I write this message with great pleasure to the book of abstracts submitted to the Annual Research Conference SLSAJARC 2023. This conference is an important event annually organised by the Sri Lanka Students' Association in Japan (SLSAJ) in collaboration with the Sri Lanka Academics' Association in Japan (SLAcJ).

This year's conference theme is “Embracing a Sustainable Tomorrow: Empowering Resilience through Climate Action and Adaptive Strategies”, which is very much linked to the pursuit of human happiness. As you know, human happiness depends on material well-being or social progress. Increasing material well-being is sustainable only if humans care about the environment. Both material well-being and environmental sustainability depend on the quality of institutions, which in turn depend on public and corporate governance. This implies that the three pillars of ESG (Environmental, Social, and Governance) are interdependent and strongly linked with 17 Sustainable Development Goals (SDGs) that focus on human well-being. The ecosystem-based adaptation has become the norm as a management method leading to sustainability. Governments must encourage an integrative approach to assess the value of ecosystem services which are insufficiently valued. I firmly believe that good governance and inclusive institutions are essential in climate action, adaptive strategies, and enhancing the integrated approach toward sustainability.

Considering the above, the Conference brings stimulating discussions, insightful presentations, and invaluable networking opportunities. As the conference chair, I am thrilled to witness the convergence of brilliant minds from diverse fields contributing to the collective pursuit of knowledge and innovation to embrace a sustainable tomorrow: empowering resilience through climate action and adaptive strategies.

On behalf of the organising committee, I extend my deepest gratitude to all the participants, our chief guest, the keynote speaker, panellists, presenters, paper reviewers, sponsors, volunteers and well-wishers who have played a pivotal role in successfully shaping this event. Together, we can nurture an environment that fosters collaboration and interactions, leading to new ideas and discoveries that will impact our academic and professional landscapes and societies.

Message from the President of SLSAJ



Mr. Kasun Thalgaskotuwa

President,

Sri Lanka Students' Association in Japan (SLSAJ) 2023

On behalf of the organizing committee, it was my pleasure to extend a warm welcome to all delegates to the 2023 Annual Research Conference of the Sri Lanka Students' Association in Japan. Our conference offers the opportunity to meet with colleagues, exchange research ideas, and share new knowledge.

This year's conference theme was “Embracing a Sustainable Tomorrow: Empowering Resilience through Climate Action and Adaptive Strategies” and abstracts were called based on four conference tracks including Management, Economics, and Environmental Studies /Governance and Institutions and Social Sciences/ Engineering and Information Technology / Biological and Agricultural Sciences.

We are honored to have His Excellency, The Ambassador, Embassy of Sri Lanka in Japan, Mr. E. Rodney M. Perera as our chief guest. We are also honored to Prof. Alistair Munro, National Graduate Institute for Policy Studies, Japan has kindly accepted our invitation to be the keynote speaker and share his inspirations with us.

I would like to convey my regards to all the panellists including Prof. Wimal Rankaduwa from the University of Prince Edward Island, Prof. Buddhi Marambe from the University of Peradeniya, Sri Lanka, Prof. Kelum Jayasinghe from the University of Sheffield, United Kingdom, Prof. Prasanna Divigalpitiya, Kyushu university, Japan, and Prof. N.S Cooray from the International University of Japan for accepting our invitation and allocating your valuable time to add your thoughts during the panel discussion. Our sincere gratitude also goes to all the session chairs and reviewers for accepting our requests giving your support in shaping these abstracts and giving your comments with your vast knowledge.

We received more than 35 papers which were blind reviewed and finally 31 papers were accepted for presentation at the conference. We are convinced that this unique gathering of experts will guarantee rich, useful, and effective deliberations.

I would also like to congratulate all the researchers who have achieved the desired results in their research work, and I hope their findings will be translated into practical use in the relevant fields, thus benefiting our nation and others beyond borders.

Thank you.

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The background features a soft-focus photograph of a dense forest of evergreen trees, partially obscured by a light mist or fog. The scene is framed by several large, overlapping geometric shapes in shades of teal and light green, which create a modern, abstract design. The text is centered horizontally in the middle of the page.

Session 1: Management, Economics, and Environmental Studies

Overview of the Prevalence of Undernourishment of Sri Lanka

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Abstract

The research study about information on populations that are undernourished at sector level and estimate the affecting factors on under-nourishment. The estimation of Prevalence of Undernourishment important to effective food policy formulation. The Prevalence of Undernourishment (PoU) of Sri Lankan's was estimated based on food energy deprivation compared to the recommended food energy intake. The method was applied to primary data available on 25,000 household unit information were collected from the National Household Income and Expenditure Surveys conducted by Department of Census and Statistics in 2016. The estimated proportion of the population whose per capita dietary energy intake per day fell below are recommended minimum dietary energy requirement at national, sector and district levels. The recommended daily per capita standard energy requirement in Sri Lanka is considered as 2095 Kcal. Pearson correlation test was applied to determine the relationship between derived Prevalence of Undernourishment and monetary poverty. Head Count Index (HCI) and energy intake were used as variables. Among the results there is no significant relationship between HCI and energy intake ($r=-0.009$, $P=0.966$). The test was also used to determine the affecting factors on prevalence of undernourishment. Mainly food expenditure ($r=0.350$, $P=0.000$) and household size ($r=-0.138$, $P=0.000$) are directly affecting on undernourishment. Estimated PoU is important for the monitoring and evaluation of the food policy formulation.

Keywords: *Prevalence of Undernourishment, dietary energy, standard energy requirement, HeadCount Index, energy intake*

A study on Opportunities Sri Lanka has in achieving Economic Cooperation through BIMSTEC

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Abstract

The emergence of regionalism led to the establishment of different kinds of unions and associations, such as the European Union, intending to achieve common interests shared by the states in that region. Regional Cooperation has been recognized as a critical element under regionalism, driving development, stability, and prosperity in a world that is becoming more interconnected and interdependent. Regional Cooperation refers to when countries work together to handle shared issues, seize joint opportunities, and promote growth among themselves. Specifically, countries began to focus on achieving economic Cooperation, which is profitable in the global market. As a sub-regional organization, BIMSTEC was established in 1997 with multi-sectoral purposes, mainly focusing on technical and economic Cooperation between member states. BIMSTEC is being recognized as an alternative regional grouping to connect South Asia with Southeast Asia. Therefore, this study was conducted to identify opportunities Sri Lanka has in achieving economic Cooperation through BIMSTEC in favor of the Sri Lankan economy. The study was conducted using qualitative methods using primary and secondary data. Secondary data was obtained through journal articles, newspaper articles, websites, and publications on BIMSTEC and economic cooperation. Primary data was collected through an in-depth interview method. The purposive sampling method was used to select interview samples, and the SWOT analysis method was used for data analysis. The study was concluded by identifying opportunities for Sri Lanka in BIMSTEC under three significant areas: maritime security, Buddhism tourism, and bilateral relationships. Under the maritime security area, the strategic location of Sri Lanka was identified as an opportunity in BIMSTEC, where Sri Lanka could act as a leading member state in securing maritime security in the Bay of Bengal. Also, it was concluded that Sri Lanka has a specific opportunity in BIMSTEC to promote 'Buddhism Tourism' by initiating intra-regional tourism. The third opportunity for Sri Lanka in BIMSTEC concluded with bilateral relationships with Thailand and Myanmar. Likewise, the study was concluded with identifying these opportunities as valuable insights for Sri Lankan officials engaging in economic cooperation discussions with other BIMSTEC member states. Further, research findings suggested that the Sri Lankan government should practice neutral foreign policies to use the country's strategic location in the Bay of Bengal. It was also suggested that BIMSTEC as a cooperation should focus on implementing policies that promote trade facilitation rather than implementing an FTA.

Keywords: *BIMSTEC, economic cooperation, regional cooperation, Sri Lanka*

Impact of Covid 19 Pandemic and Economic Crisis on Construction Industry in Sri Lanka

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Abstract

The construction industry in Sri Lanka, like many other sectors, faced unprecedented challenges due to the dual impact of the COVID-19 pandemic and the economic crisis. As of the latest annual report of the Central Bank of Sri Lanka (CBSL), the construction sector is the fourth-largest employer in the country, contributing significantly to the Gross National Production. However, in 2022, there has been an overall decline of the construction industry of 20.9% on a year-on-year basis, reflecting an overall industry downturn as per the CBSL.

A systematic review of literature on the impact of Covid-19 and global economic crises revealed that such incidents are likely to have a negative impact on the operational and functional aspects of the constructions industry. However, there was a lack of empirical studies from the context of the construction industry in Sri Lanka, as a majority of literature focused on the global crises. Hence, initially this research addresses the questions “How did Covid-19 impact the construction industry?” and “How did the economic crisis of Sri Lanka impact on the construction industry?”.

Semi-Structured interviews were conducted with five major institutions overlooking construction projects including the Ministry of Urban Development and Housing, Central Engineering Consultancy Bureau in terms of public sector institutions, Access Engineering PLC, Apsara Metal Crusher (A raw material supplier) and the NSBM Green University’s second phase construction project were considered from the private sector. These institutions were selected under convenience sampling as they overlook a majority of the large and medium scale construction projects in Sri Lanka. One representative each was selected from these companies. The analysis of the responses gathered from the interviews, processed through a thematic analysis revealed three themes for the impact of Covid-19 namely, the increase in operational costs due to the strict supervision and health related regulations, high labour costs due to the requirement to provide safety wear and accommodation to workers on rotation and the intrigue to adopt technology as remote working ratified in the construction sector. Furthermore, two themes were discovered for the impact of the economic crisis on the construction sector firstly, the shortage of raw materials and subsequently, it was identified that the operational costs increased. Therefore, as per the thematic analysis performed in this study, it is concluded that the covid-19 pandemic and the economic crisis in Sri Lanka had a back-to-back negative impact on the construction industry in terms of affecting the operational costs, construction management processes and functions as well as fluctuations in the prices of raw materials and labor costs. Hence, these findings can be applied by the practitioners in the construction industry in developing contingency strategies to face the ongoing volatile and uncertain economic occurrences.

Keywords: *Construction industry, Covid-19 pandemic, economic crisis, operational costs, technology adoption*

Environment Management Accounting for Cleaner Production: A Case Study from the Mining Industry in Sri Lanka

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Abstract

Today there is a sharp intensification in identifying and analyzing environmental costs due to the growing concern on environment. Environmental degeneration, market and regulatory pressures have forced companies to change their operational models and manage environmental costs. This study aims to investigate the role of Environmental Management Accounting (EMA) practices in cleaner production (CP) in the mining industry of Sri Lanka and identify key barriers for the adoption of EMA practices in a developing country. The adoption of EMA practices in developing economies has been low compared to the developed world.

The study identified the existing EMA practices and the institutional factors, namely coercive, normative and mimetic pressures that influence the adaption of EMA practices. Further, it examined the use of EMA for CP, viz. efficiency, consistency, and sufficiency strategies, in achieving operational performance from economic, legislation, and environmental perspectives.

The study followed a qualitative research strategy by undertaking a case study on a Phosphate manufacturing company in Eppawala, Sri Lanka. The mining industry is generally considered unfavorable for its negative impact on the environment. In particular, the phosphate manufacturing process consumes large amounts of natural resources, and generates excessive waste and creates significant adverse ecological impacts. Data were gathered by conducting 25 semi-structured interviews with the operational and accounts staff. Data were then analyzed according to the themes that emerged from the literature.

The results show that the degree of adaptation of EMA practices is scant in the case organization. The existing EMA practices generate limited information regarding the consumption of natural resources and environmental-related costs. Further, such EMA information is employed in economic strategies to achieve CP practices. But there was no evidence for using such information in implementing consistency and sufficiency strategies. This clearly shows the lack of environment concerns of the case organization. It may be because of the lack of pressure on the company through the normative and mimetic isomorphisms. The study also found several barriers that undermine the role of EMA practices in CP within the case organization, namely, low priority given for accounting for environmental costs, absence of a system to recognize environmental costs, resource constraints, and lack of environmental accountability. These findings suggest that the company has to change their perception towards the environmental concerns in addressing these drawbacks without delay. It will ensure the company's long-term existence with high environmental responsibility and accountability.

Keywords: *Cleaner production, environment management accounting, institutional pressures, mining industry, Sri Lanka.*

Assessing Ethno-Climatology Knowledge for Climate-Resilient Organic Tea Cultivation: A Study in the Uva High-Grown Region of Sri Lanka

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Abstract

The impact of climate change on organic tea cultivation is a significant challenge that requires effective adaptation measures. Ethno-climatology is a multidisciplinary field that investigates the relationship between human societies and climate. It examines how various cultures and communities perceive, adjust to, and interact with climate and weather patterns in their environment.

This study evaluated the level of ethno-climatology knowledge among organic tea smallholders and assessed their degree of adaptation measures to improve climate resilience in Organic Tea Cultivation in the Uva High Grown Region Sri Lanka. The study employed different methods for data collection, including interviews, questionnaires, in-depth interviews, focus group discussions, expert consultations, field observations, and surveys. The sample size comprised 100 individual organic tea smallholders selected using a random sampling technique. The correlation and multiple regression analyses were employed to identify the influence of independent variables such as age, family and land size, gender, education, and experience gained in tea cultivation and organic farming on the dependent variable of the degree of awareness of ethno-climatology among tea smallholders.

The results of the study indicate that the mean age of organic tea smallholders was 55 years, with a gender distribution showing 64% male-oriented farmers. The average land size was found to be 0.76 acres, while the average experience in organic cultivation and tea cultivation was 27 years and 8 years, respectively. The study also revealed that a significant proportion of farmers in the sample displayed a high level of awareness of ethno-climatology, as demonstrated by scores exceeding 75%. In particular, 37 farmers demonstrated a high level of awareness, scoring above 85%. The correlation analysis suggests that factors such as age, experience in organic tea cultivation, knowledge gained through experience, observations, beliefs, and cultural practices played an important role in shaping tea smallholders' awareness and understanding of ethno-climatology. On the other hand, the variables related to education and the number of information sources showed weak or non-significant relationships with awareness levels in this specific field. The multiple regression model used in the study had a strong fit, with an R-squared value of 0.962, accounting for 96.2% of the variance observed in the dependent variable. These findings can be used to guide policy and practice in the organic tea sector, with an aim to enhance the awareness of ethno-climatology among smallholders. Hence, this study suggests that policymakers should develop strategies to increase smallholders' awareness of ethno-climatology practices and facilitate support for the application of long and mid-term climate resilience adaptive strategies.

Keywords: *Awareness level, climate resilience, ethno-climatology, mitigation measures, organic tea cultivation*

Modeling Monsoon Season Tea Production in Sri Lanka Using Time Series Analysis

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Abstract

The first recorded tea plant in Sri Lanka was planted by Britain for non-commercial use, and in 1867, the Sri Lankan commercial tea sector was started. As of today, tea has become one of the major export crops in Sri Lanka, and it has had a great impact on the Sri Lankan economy. Production of tea can vary in every month due to climate and weather conditions of the country. Precipitation is one of the major climate variables and is an important environmental issue that greatly affects the growth and production of tea. The rainfall and wind experienced during a year in Sri Lanka are characterized by four monsoon seasons (First inter, Southwest, Second inter, Northeast). This report provided an overview of the effective monsoon season for Sri Lankan tea production, and the main purpose of this study was to investigate the suitable forecasting method and build up the time series model.

The research employed a comparison between Autoregressive Integrated Moving Average (ARIMA) using Box-Jenkins methodology and exponential smoothing method. Monthly tea production data from 2010 to 2022 was collected from Forbes & Walker Tea Brokers (Pvt) Limited. According to the time series plot it can be seen that the first inter monsoon season is producing a higher volume of tea. Seasonality of series was tested by Friedman test (p-value: 0.022), and stationarity of series was tested by Augmented Dickey Fuller test (p-value: 0.01) and Kwiatkowski-Phillips-Schmidt-Shin test (p-value: 0.1). Differencing techniques were applied to transform non-stationary series to stationary series. The model diagnostics were accomplished by Ljung-Box test. The best forecasting method was selected by considering lower Mean Absolute Percentage Error (MAPE) value and Mean Absolute Error (MAE) value of residuals.

Based on the Box-Jenkins methodology, ARIMA(3,1,0)(1,0,0)[4] with drift (MAPE= 8.168293, MAE= 2010663) and based on the exponential smoothing method, additive Holt's Winters method with exponential parameters; $\alpha = 0.0124$, $\beta = 1$, $\gamma = 0.1016$ (MAPE= 7.934784, MAE= 1893613) were best fitting models for this study. As stated in MAPE value was less than 10, therefore above mentioned two forecasting models were appropriate.

Furthermore, accuracy of residuals of additive Holt's Winters method was less than ARIMA forecasting method. In conclusion that additive Holt's Winters method was the best fitting model for monsoon seasonal tea production. Finally, this recommends that the Sri Lankan government, private tea producers, and investors in tea production give more priority to the first inter monsoon season for increasing tea production.

Keywords: ARIMA, exponential smoothing, forecasting, monsoon seasons, tea production

Currency Depreciation as a Determinants of Inflation in Sri Lanka (1977-2019)

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Abstract

The objective of this study is to examine the how currency depreciation impacts inflation in Sri Lanka during 1977-2019 period. Sri Lanka as a nation heavily depend on imports and thus impact of the exchange rate is an important factor, especially once the currency is depreciation, the country may have to face economic repercussions which will have impact on society at large. Hence, knowing the real gravity of the issue is important to policy makers who deal with macroeconomic policies.

Time Series data used in this study taken from annual reports of the Central Bank of Sri Lanka. To test the order of integration of the variables used in this study, the augmented Dickey–Fuller (ADF) and Phillips and Perron (PP) unit root tests were employed. The autoregressive distributed lag (ARDL) bounds co-integration technique was used to examine the long-run relationship between the variables. The Granger causality test was used to examine the causal relationship between the variables.

The unit root tests confirm that the variables are stationary at levels $I(0)$ and 1st difference $I(1)$. Meanwhile, the ARDL test results show that currency depreciation has a positive long-run relationship with inflation in Sri Lanka. The coefficient of the error correction term indicates that 1.19 % of disequilibrium error is adjusted each year and the response variable of the inflation moves towards the long-run equilibrium path.

The findings have some important policy implications for the design of efficient exchange rate in Sri Lanka. Further policy related to workers' remittances and consumption expenditure pattern can be shaped accordingly. It is an integral part of policy makers to think carefully especially when they decide to depreciation currency as against the other basket of currencies. Therefore, empirical findings may be not only helpful but also in fulfilling the existing research gaps in the economy. Thus, it is believed that these will contribute much to promote the macroeconomic stability and welfare of people in Sri Lanka.

This study contributes to the existing literature by using newly developed ARDL bounds co-integration techniques to investigate the long-run relationship between currency depreciation and inflation in Sri Lanka. Furthermore, few empirical work has been done on the same topic in relations to Sri Lankan situation.

Keywords: *Inflation, currency depreciation, co-integration, determinants, Sri Lanka*

Challenges Encountered by Women Entrepreneurs in Sri Lanka: The Effect of SED Programs on the Sustainability of Small and Medium-Sized Enterprises

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Abstract

This research delves into the evolving landscape of entrepreneurship in Sri Lanka, particularly focusing on the remarkable surge of female entrepreneurs in recent years. Breaking free from traditional norms that confined entrepreneurship predominantly to men, women in Sri Lanka are increasingly making significant strides in business ownership and leadership roles. This transformative shift, highlighted by Prince et al. (2021) and Ratten (2023), not only signifies a pursuit of equality but also emerges as a vital catalyst for economic development and social progress. Despite the growing success stories, female entrepreneurs in Sri Lanka grapple with a myriad of challenges, ranging from those common to entrepreneurship to those specific to their gender. Issues related to social expectations, resource accessibility, market biases, and support networks pose significant hurdles, as noted by Empowering Women Entrepreneurs in Sri Lanka (2023). The participation of women in entrepreneurship, however, has proven instrumental in fostering innovation, job creation, and promoting gender equality (Wijewardena et al., 2023). Nevertheless, the persistence of challenges necessitates a deeper understanding to unlock the full potential of female-led businesses. This research specifically investigates the unique challenges faced by female entrepreneurs in Sri Lanka, with a keen focus on the impact of the Small and Medium Enterprise Development (SED) Program in the Badulla district. The study aims to provide valuable insights for policymakers, authorities, and entrepreneurs by delving into the tailored approach of the SED Program, designed to address the specific obstacles faced by women entrepreneurs. The ultimate goal is to contribute to the advancement of gender equality, economic growth, and social empowerment through targeted support for female-led SMEs in Sri Lanka. The research objectives encompass identifying and analyzing key challenges faced by female entrepreneurs in Sri Lanka, exploring the experiences of female entrepreneurs in Badulla district with a specific focus on their interactions with the SED Program, assessing the effectiveness of the SED Badulla program in promoting gender inclusivity, and evaluating the sustainability and growth trajectories of small and medium enterprises led by women in the region. Additionally, the study aims to investigate the role of societal norms, cultural factors, and gender biases in shaping the entrepreneurial landscape for women in Sri Lanka and to provide policy recommendations based on research findings.

The methodology employs an inductive approach and interpretivism philosophy, utilizing semi-structured interviews with six purposively selected female entrepreneurs participating in the SED Program in Badulla district. Thematic analysis is employed to identify patterns and themes within participants' narratives, ensuring a nuanced and contextually relevant understanding. Preliminary findings from the qualitative analysis underscore common challenges faced by female entrepreneurs in Badulla, emphasizing the importance of gender-sensitive policies, financial literacy programs, and tailored networking platforms. The study advocates for a comprehensive understanding and targeted interventions to create an environment conducive to the sustainable growth of women-led businesses. In conclusion, this research contributes valuable insights to the discourse on women's entrepreneurship, shedding light on challenges, successes, and the impact of support programs like the SED Program.

Keywords: *Women entrepreneurs, sustainability, small and medium enterprises*

Towards a Sustainable Energy Future: Re-framing Patent Laws for a Re-enforced Energy Sector in Sri Lanka

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Abstract

Sri Lanka, for the past few years has been experiencing a major energy crisis which was compounded by its recent economic crisis and the fluctuations in the international energy market, caused by the prolonged Ukrainian war and the post-Covid economic stress. As a result, huge queues of vehicles waiting for fuel became common place in Sri Lanka while the power cuts extended up to 13 hours a day during the height of the economic crisis. Hence, it appears that, Sri Lanka as a country failed miserably in ensuring her citizens the access to affordable, reliable, sustainable and modern energy which is considered as the seventh goal of the sustainable development agenda of the United Nations, to which Sri Lanka is also a signatory. Following such crises, discussions spurred in the country on envisioning a sustainable energy future which could acknowledge not only the role scientific and technological innovations can play in such endeavours, but also the need to remove legal barriers that hinder those efforts.

Thus, this study intends to revisit Sri Lanka's current patent laws to identify the role they would play in ensuring access to affordable, reliable, sustainable and modern energy through the advancement of science and technology. On the other hand, it reviews the domestic statutory frameworks on intellectual property laws and the Sri Lankan energy sector including Intellectual Property Act No.36 of 2003, Sri Lanka Sustainable Energy Authority Act No. 35 of 2007 and Sri Lanka Electricity Act No. 20 of 2009 to identify the challenges associated with the prevailing legal structures in realising the said objective.

Drawing from the above data, the present study argues for ensuring more legal leeway to encourage public and private partnerships in the energy sector, and to promote locally sourced energy resources as significant to realise a sustainable energy future. It also contends that the substantive and procedural shortcomings of the present Sri Lankan law have reduced the enforceability of intellectual property rights of local inventors which may hinder the expansion of the local energy market. Finally, the study intends to suggest ways in which the prevailing laws could be amended in light of the lessons from other jurisdictions and internationally recognized best practices, arguing that strong laws on patents and legal endorsement of scientific research may help Sri Lanka to develop a sustainable energy future. It also acknowledges the role judicial activism can play in safeguarding the scientists and investors while helping to update substantive laws through innovative judgements which may become crucial in such endeavours.

Therefore, this study concludes that strengthening Sri Lanka's laws on intellectual property rights and sustainable energy remains an important call of the day to build a sustainable future for the country.

Keywords: *Energy crisis, intellectual property law, patents, Sri Lanka, sustainable development*

The background features a soft-focus photograph of a dense forest of evergreen trees, likely pines or firs, shrouded in a light mist or fog. The scene is framed by several large, semi-transparent geometric shapes in shades of teal and light green, which are layered over the image. These shapes are primarily triangular and trapezoidal, creating a modern, abstract design.

Session 2: Governance and Institutions, and Social Sciences

Sustainable Procurement Practices and Organizational Performance in the Sri Lankan Public Sector

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Abstract

This study mainly focuses on establishing Sustainable Procurement Practices (SPP) and Organizational Performance in Sri Lankan Public sector organisations and analyses the barriers to achieving sustainable procurement practices in the Sri Lankan public sector. This provides an overview of the research study. Data was collected through a questionnaire survey distributed among public sector employees and organizations. A deductive approach was used to test the hypothesis through the collection and analysis of empirical data. Using a judgmental sample technique, this research focuses on sustainable procurement practices in public sector organisations in Sri Lanka. The researcher chooses respondents based on their knowledge of sustainable procurement practices and policies. 97 public procurement firms in Sri Lanka make up the sample size. As a result of the study was found there is no significant direct impact on Diversity and Human Rights on Organizational Performance. Rather than producing original ideas, this approach seeks to test theories and hypotheses. The aim of the study was to the impediments hindering the adoption of sustainable procurement practices within public sector organizations in Sri Lanka, with the ultimate goal of enhancing their performance and investigating the barriers to sustainable procurement practices in Sri Lankan public sector organizations. These results can provide valuable insights for organizations looking to improve their performance by focusing on these areas.

Keywords: *Organization performance, procurement practices, public procurement, sustainable public procurement, sustainable procurement practices.*

Impact of Social Media on Higher Education: An Empirical Study at the College of Chemical Sciences, Sri Lanka

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Abstract

Social media has become an essential part of our lives, altering the manner in which we communicate and form relationships. In recent years, the impact of the proliferation of social media platforms on higher education has emerged as an important topic. Students around the globe utilise social media as an integral part of their daily existence. Researchers have become interested in the effects of social media on higher education in recent years. The impact of social media on academic performance can be both positive and negative. On the one hand, social media can aid students in communicating and collaborating while also providing them with access to educational resources. On the other hand, social media can be a distraction, resulting in a decline in academic performance. The purpose of this study is to investigate the impact of social media on students' academic performance in the higher education sector.

The research employed a quantitative methodology. This empirical investigation has been conducted at the College of Chemical Sciences by using survey methodology and one hundred valid responses have been received. Data analysis has been performed using SPSS and hypotheses have been tested using correlation and regression analysis. Validity and reliability analysis have been performed on the data set.

The outcome of this research has illustrated that there is moderately positive correlation between the social media usage of students and their academic performance, which indicates that the usage of social media is positively affecting the academic performance and this finding is comparable with some of the previous studies on this research area.

In conclusion, this study shows that there is a moderate correlation between the variables and the impact that the usage of social media has on the academic performance of university students. Moreover, this study indicates that the use of social media has a moderately positive impact on their academic achievement. Further, the results illustrates that there is no significance between the ratings given by males and females on academic performance.

Keywords: *Academic performance, Facebook, social media, WhatsApp*

Navigating Educational Journeys: An In-Depth Exploration of Sri Lankan Students' Experiences in Japanese Higher Education

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Abstract

The rising trend of educational migration, particularly to destinations like Japan, has made it a significant choice for Sri Lankan higher education students, ranking as the second-most sought-after destination. Driven by its appealing blend of culture, nature, and quality of life, Japan's prominence raises concerns about the lack of detailed research on the experiences of international students, leaving a notable gap in understanding the nuanced challenges faced by Sri Lankan students. This study addresses this gap by comprehensively exploring the multifaceted journeys of these students in Japan, focusing on the intricate interplay between challenges and personal growth throughout their educational pursuits. The primary objective of this study is to unravel their experiences, shedding light on the challenges they face, the transformative journeys they undertake, and the processes of personal growth, cultural exchange, and identity development. Employing a qualitative research design, eight Sri Lankan students in Saitama, Japan, participated in semi-structured interviews voluntarily, and research ethics were maintained. Thematic analysis revealed key challenges, adaptation mechanisms, and coping strategies, providing a comprehensive understanding of the examined topic. The study highlights the financial, cultural, and language challenges intricately connected with social networks among Japanese peers. Despite scholarships, participants faced varied financial struggles, illustrating the nuanced intersection of economic capital, experiences, and resource access. Language barriers presented obstacles in academic and daily life, influencing social interactions and cultural assimilation. Friendships and social networks in Japan were perceived as distant and temporary, contrasting with the close bonds experienced in Sri Lanka. The breakdown of social relations significantly impacted participants' lives, revealing struggles with cultural and environmental differences, family separation, and the intricate interplay between admiration for Japan's societal structure and the challenges of adjusting to cultural and social differences. The study underscores the importance of personal agency and sociological intersections shaping the experiences of Sri Lankan students in Japan. Additionally, it emphasizes the significance of supportive systems from the host university and the Japanese government. Recommendations include awareness programs, foundational language courses, and regular scholarship program reviews to enhance the overall quality of life for international students. In conclusion, this study offers a profound exploration of the transformative journeys of Sri Lankan students in Japanese higher education, contributing valuable insights to the broader discourse on international education, migration, and sociocultural adaptation, while paving the way for further research to improve support systems for international students navigating their journey to success in foreign academic settings.

Keywords: *Challenges, higher education, Japan, Sri Lanka, students*

An Introduction to Evolution and Usage-based Approaches of Sanskrit-Chinese/Japanese Bilingual Dictionaries

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Abstract

In the 5th century AD, monk Fa Xian translated 6 of 11 or 12 Buddhist texts from Pali or Sanskrit language with the help of Nepalese Buddhist monk called Buddhahadra. This Nepalese Buddhist monk was a resource person and a “living dictionary” being helpful in the translation process. Until the application of modern translation methodologies with dictionaries, the process of translation from one language to another language was very primitive, from early Buddhist era to the Medieval period. This abstract provided an overview of the evolution and usage-based approaches of Sanskrit-Chinese/Japanese bilingual dictionaries that contribute to the improvement of further studies in this field.

This research used qualitative methodology with mixed methods to collect necessary data and information. These methods resulted in collecting data on the evolution and usage-based approaches of Sanskrit-Chinese/Japanese bilingual dictionaries.

The findings of this research included phonological and semantic (譯音譯) glossaries of Chinese-Buddhist terms, such as “Translation of Sanskrit” (翻梵語-Fan Fanyu) by monk Bao Chang in 6th century, “Sarva Sutra Shabda Artha” (一切經音義-Yiqie jing yinyi) by monk Huilin and Xuanying in 7th century and “Collection of Translated Buddhist Terms” (翻譯名義集-Fanyi mingyi Ji) by monk Fa yun (1088-1158AD) and the very first Chinese-Sanskrit glossary with Sanskrit words and Chinese characters by monk Yi jing (635-713 AD). He was the first author who prepared a Chinese-Sanskrit glossary with Sanskrit words and Chinese characters. The name of his work is called “One thousand Sanskrit words” (梵語千字文-Fanyu qianzi wen. Those works were only glossaries and they helped the scholars to translate and read the Sanskrit texts.

With the influence of the Industrial Revolution, there were significant developments in East Asian Buddhist studies. One of the great developments was the preparation of Sanskrit-Chinese bilingual dictionaries such as “Handbook of Chinese Buddhism being A Sanskrit-Chinese Dictionary” by Ernest J. Eitel, published in 1888. This book included a collection of vocabularies of Buddhist terms in Sanskrit, Chinese, Pali, Sinhalese, Siamese, Burmese, Tibetan, Mongolian and Japanese, though it contained only 230 pages.

In the beginning of the 20th century, Ogiwara Unrai edited “Kan’yaku taishō bonwa daijiten “(漢訳対照梵和大辞典), a Sanskrit and Japanese dictionary with Chinese words. This dictionary is widely used, up to now by both Chinese and Japanese scholars for Buddhist Studies. The Buddhist Chinese-Sanskrit Dictionary authored by Akira Hirakawa in 1997 is now widely used for academic purposes in Japan and China as well. With the addition of Japanese language, the bilingual concept is being widen by trilingual in Buddhist studies.

The outcomes of this research enhanced the studies on evolution and usage-based approaches of Sanskrit/Chinese/Japanese trilingual dictionaries. In conclusion, the findings of this research improved the existing knowledge of the early stages of the Sanskrit, Chinese/Japanese bilingual dictionaries and their usage-based approaches being transformed into trilingual dictionaries.

keywords: Usage-based approaches, translation of Buddhist terms, Sanskrit/Chinese/Japanese, bilingual & trilingual, dictionaries

Effectiveness of Time-Management Training and the Moderating Role of Conscientiousness in the Public Sector: A Longitudinal Experimental Study

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Abstract

This study examines the effectiveness of time-management training based on two training outcomes namely learning and training transfer/behavior change. It also analyzes the understudied moderating effect of conscientiousness on the effect of time-management training on its outcomes using a sample of public sector officials in Sri Lanka.

Randomized controlled trial methodology and longitudinal design were used to analyze the learning and behavior change between treatment and control groups over three months after the training. The hypothesized model was assessed using independent sample t-tests and hierarchical regression procedures on 120 government officials in the Western Provincial Council in Sri Lanka.

Even though prior research has yielded mixed findings on the effectiveness of time-management training, especially in terms of behavior change/training transfer, this study's results demonstrate that time-management skills can be significantly transferred as behavior changes. Also, it was found that time-management training positively affected learning. According to expectancy theory, highly conscientious individuals are more likely to learn from and transfer training than low conscientious individuals. However, the findings of the study exhibit that conscientiousness moderated the effect of training on learning but not on behavior change. These findings advance the discussion on expectancy theory by showing the boundary condition of its applicability since it is applicable to the training effect on learning, but not to its effect on transfer.

In conclusion, time management training is vital for the public sector since our results demonstrated that time management training has a positive effect on learning and time-management skills can be significantly transferred as behavior changes. However, it was observed that the positive significant moderation effect of conscientiousness was only on the effect of training on learning but not on the transfer. Thus, public sector managers and human resource partitioners do not have to consider their trainees' level of conscientiousness when they intend to enhance training transfer.

Keywords: *Conscientiousness, learning, time-management, training effectiveness, training transfer*

Social Capital & Competitiveness in Sri Lankan Tea Plantation Sector

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Abstract

Due to the phenomenon of globalization, the concept of competition has assumed considerable importance in the business world. To thrive in today's competitive economic world, any given industry must recognize and effectively manage the determinants associated with competitiveness. This study has been designed to investigate the role of social capital in securing the competitiveness of Sri Lanka's tea plantation industry. Accordingly, the study describes the intervening relationship of social capital on the competitiveness of the Sri Lankan tea plantation industry. A quantitative approach was employed in this study and structured questionnaires were employed as the data collection method. The study engaged respondents from eight Regional Plantation Companies (RPCs) to facilitate qualitative analysis and utilized a sample of 200 managerial and non-managerial employees from 100 RPC profit centers for quantitative analysis. The unit of analysis for this study is considered to be the RPC profit center. The study involved a mediation analysis using Prof. Andrew Hayes's Process Macro with the support of SPSS. The study identified a significant positive impact of social capital on competitiveness and knowledge sharing. Additionally, social capital was found to partially mediate the influence of social capital on competitiveness. This research significantly contributes to an improved understanding of how social capital can be effectively leveraged to enhance business performance and competitiveness within the tea plantation sector. It is imperative to acknowledge the inherent limitations associated with both quantitative and qualitative methods in this study. To advance the findings and robustness of future research, it is recommended to employ a larger sample size and diverse analytical tools.

Keywords: *Competitiveness, knowledge sharing, social capital, tea plantation sector*

A Comprehensive Analysis: Exploring the Intersection of Buddhism and Women's Rights

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Abstract

This research undertakes a dual-focused analysis, examining the historical evolution of women's rights within Buddhism and comparing them with the Western perspective. By exploring this intersection, the study aims to provide insights into the complexities of gender equality. The research's significance lies in contributing to a broader understanding of these dynamics, offering valuable perspectives for scholars and practitioners in religion, gender studies, and human rights as societies grapple with evolving notions of equality and justice.

The methodology involves a multifaceted approach, encompassing a thorough literature survey of Early Buddhist Tenets and integrating contemporary perspectives through research articles and interviews. Participant selection prioritizes expertise, diversity, global representation, gender balance, and women's rights experience for comprehensive insights.

Complementing this, the study engages with contemporary perspectives through research articles and scholarly interviews, providing insights into the evolving interpretations and practices of women's rights in Buddhist communities. Shifting focus to the Western perspective, the research explores the history of women's rights, identifying key milestones and examining relevant international instruments such as the Universal Declaration of Human Rights (UDHR) and other conventions. The investigation into women's Rights in Buddhism traces its roots back to the 6th century BC in India.

The major finding reveals that Buddhism, from its inception, has emphasized women's rights, acknowledging them as daughters, wives, mothers, lay devotees, and even as nuns. This historical perspective sheds light on the rich tradition within Buddhism that extends equitable treatment to women. Simultaneously, the study delves into Western women's rights, examining historical milestones and key documents such as the Universal Declaration of Human Rights (UDHR). The findings underscore that, akin to Buddhism, Western approaches to women's rights have evolved over time with a parallel focus on recognizing women's roles in various societal capacities. The comparative analysis of the two reveals striking similarities in their foundational principles. Both Buddhist and Western ideologies converge in treating women as integral members of society, entitled to equal rights and opportunities. The parallel development of human rights in Buddhism and Western societies becomes evident, emphasizing the universal nature of the quest for gender equality.

This conclusion illuminates the convergence of Buddhist and Western perspectives on women's rights, acknowledging their evolution in unique historical and cultural contexts. Despite diverse origins, both traditions endorse gender equality, underscoring its universal nature. Further exploration of broader implications and future research avenues would enhance our understanding of transcendent impacts across cultural and religious boundaries.

Keywords: *Buddhism, gender equality, intersectionality, women's rights*

Factors affecting to Employee Motivation among Apparel Sectors Employees in Gampaha District, Sri Lanka

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Abstract

Employee motivation is a critical aspect in today's competitive business environment, particularly in the apparel sector where attracting and retaining skilled workers is vital for sustained success. Since 1986, Sri Lanka's greatest gross export earner has been the textile and apparel sectors, which have generated over 52% of the nation's overall export earnings (Ministry of Industries, 2023). Subsequently, still the apparel sector with the highest employment capacity alone standing for 13.7 percent of the total employees and Gampaha being the second largest district with the highest employment (Department of Labour, 2020), this study choose to study the selected factors affecting on employee motivation reference to the apparel sector employees in Gampaha District.

This research focuses on four key factors: rewards & recognition, salary & benefits, work environment, and job security. These factors are examined in relation to how they impact employee motivation and ultimately drive organizational performance. The study employes quantitative research method and structured questionnaires were distributed among 357 garment sectors' operational workers at Gampaha district. In the analysis, the Cronbach's alpha value for each variable being greater than 0.6, confirms the reliability of the collected data and the significance value of the Pearson correlation provides evidence for the validity of the items.

The findings of this research project included a the strong, positive, and significant correlation of rewards & recognition, salary & benefits, work environment, and job security with employee motivation, which informed the requirement of developing the strategies to enhance these analyzed factors. The outcome contributed to the ongoing motivational strategies followed by the apparel sector in Gampaha district.

In conclusion, this study outlined the strong positive correlation of employee motivation associated with of rewards & recognition, salary & benefits, work environment, and job security and this will enable the apparel sector in Gampaha District to widen their focus in employee motivation by addressing all these strong areas confirmed. Further, the study aims to build up a motivated workforce in the apparel industry as one of most significantly contributing towards economic growth of country.

Keywords: *Employee motivation, rewards, salary & benefit, work environment, job security*

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Session 3: Engineering and Information Technology

Development of a Chain-Driven Powertrain for a Single-Seater Rear-Wheel Drive Race Car

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Abstract

This project encapsulates one of many areas that make up the Formula Society of Automotive Engineers (FSAE) vehicle for entry into the motorsport history of Sri Lanka as the second FSAE race car named Heroic Forerunners Prototype-14 (HFP-14). This project aimed to undertake the design and development of the powertrain system, including the engine, Limited Slip Differential (LSD) unit, chain drive, drive axles, and wheels, which would optimize performance and reliability in the competition. An investigation into the powertrain of this vehicle was also conducted along with the review of the competition rules and regulations of the 2021 version. The design and simulation phase of the vehicle was succeeded by use of the SolidWorks 2018 version. The improvement segment of the powertrain system changed into executed, using less-weight and economical components. An LSD unit and a high-performance engine were considered to be the optimum options to implement into the car for future years when resources are available. The performance of the vehicle was improved and identified as mainly dependent upon this differential unit which was developed by own techniques. The solid rear axle design chosen for this year's car was critically analysed for stress and fatigue. The remaining drivetrain components including sprockets, bearings, CV assembly, and wheel hubs were all sourced and designed to complete the assembly. The final outcome of the project HFP-14 was authenticated by following two consecutive tests to assess engine temperature as well as overall performance.

Keywords: *FSAE, LSD, performance, powertrain, rac*

Artificial Intelligence and Product Quality: Conceptual Review

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Abstract

We are in the digital era and applications of modern technologies are inevitable as far as manufacturing of products are concerned. In recent years, Artificial Intelligence has emerged from the technological revolution, radically altering the landscape of product quality which is one of the most important aspects as far as the performance of a product is concerned. The purpose of this conceptual review is to revisit the prevailing literature related to artificial intelligence and product quality and explore future research opportunities in this area.

As the methodology, PRISMA framework has been used to conduct the Systematic Literature Review (SLR). Total of 21 papers were selected from the Scopus database to ensure the quality of the input of this conceptual paper using the key words “Artificial Intelligence” and “Product Quality”. Review protocol has been developed according to the PRISMA guidelines. Keyword co-occurrence analysis has been performed to reveal the areas that need attention of researchers using VOSviewer software (Version 1.6.19).

As the major findings of this conceptual paper, we identified future research directions and research gaps including knowledge gaps, empirical gaps, contextual gaps and methodological gaps. Contextual gaps exist, with limited studies on developing nations. Empirical gaps exist with limited research on Artificial Intelligence in automotive and food manufacturing sectors. Methodological gaps exist, with limited research combining qualitative and quantitative methods. Knowledge gaps exist due to the isolated studies conducted. A comprehensive framework is needed to understand the issue's scope, including the technical and social implications of robots and the Industrial Internet of Things (IIoT). Future research should focus on expanding hardware sensors and improving software capabilities for non-precision data processing and prediction. Additionally, it is crucial to study how operational workers are impacted and the consequences of adopting Artificial Intelligence to sustain product quality.

In conclusion, manufacturers should be encouraged to employ intelligent manufacturing processes in order to improve product quality. The impact of artificial intelligence on product quality would be a major problem in a manufacturing-based economy. This study discovered several contextual gaps, empirical gaps, methodological gaps, and knowledge gaps, and future research can be focused on these indicated areas to fill the identified gaps.

Keywords: *Artificial intelligence, product quality*

Expanding Universe and the Periodic Time of a Planet Moving Around the Sun

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Abstract

The expansion of the Universe is a vast and significant topic that is frequently explored in cosmology. Many objects in the Universe may exhibit different behaviors as a result of this expansion of the Universe. Periodic time of any object P on an elliptical orbit is given by $T = 2\pi abh$ where h is the angular momentum constant ($h = r^2$), a is the length of semi major axis and b is the length of semi minor axis. This equation clearly shows that the periodic time of a planet depends on the lengths of elliptical axes. So throughout this study, we are entirely concerned with whether the aforementioned expansion of the Universe has an effect on the changes in the lengths of the axes of a planet's elliptical orbit, and whether that has an effect on the periodic time.

Einstein's Field Equations were modified by introducing a variable (Λ) (cosmological parameter) by M.D.P.Hemantha and L.N.K.de Silva. By using the Robertson-Walker metric, relevant assumptions, and boundary conditions, these modified Einstein's Field Equations are solved in this study and the result is two independent equations with four unknown variables. Moreover, the Robertson Walker metric was used to obtain non-vanishing Christoffel symbols and Ricci tensor components in order to obtain relevant expressions. Since the matter is distributed in to space according to the big bang, the pressure of the Universe is considered to be zero (zero pressure model). The appropriate model solution of R (radius of the Universe) was used to explain the main objective of this study. In addition, all calculations relied on four-dimensional space-time coordinates, and it was assumed that the Universe would remain spherical in shape as it expanded.

The expressions for the major and minor axes of an elliptical orbit of a planet moving around the Sun are derived by using above appropriate solution model of R and Robertson-Walker metric. Using those expressions and Newtonian dynamics, it is derived that the periodic time of Earth can be found by introducing new constant A.

Keywords: *Einstein's field equations, expansion of the universe, periodic time of a planet, radius of the universe, Robertson Walker metric*

Development of Single-Seat, 4-Wheel, Independent Suspension Buggy for Off-Road Drive

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Abstract

Farmers with large farms face a transportation problem around the farm. It takes a lot of energy and time to move around the land and to transport or transport goods that a person cannot carry. A buggy plan has been developed to deal with this problem. This design acts as a basis for the buggy built up to carry the load in the farm compound. The design process emphasizes safety, functionality, weight, reliability, and cost considerations, aiming for a lightweight frame, optimal powertrain, and effective suspension for off-road performance.

In this project, there are several stages of development. Designing a buggy roll cage using CAD software, analyzing the stress distribution on the roll cage, loading and processing the roll cage, designing and fitting the gear transmission system, the new design and mechanism of the connection, and finally the analysis required for the design work. This project requires the development of processing, design and testing capabilities. Includes an appropriate project design for the entire project, processing for transmission connections and mechanism of buggy. The buggy used independent suspension with double wish born arms and rack and pinion used for steering mechanism. Gear box and drive shaft combined with roller chain mechanism. Disk brake was used to control the speed of the buggy.

Keywords: *Braking, independent suspension, roll cage, transmission, wheel assembly*

Analysis of Characteristics in Pomegranate Based Natural Antioxidant Lip Balm

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Abstract

The purpose of this study was to analyze the characteristics of a natural antioxidant lip balm formulated with pomegranate as the primary ingredient. The current study aimed to examine the pH changes over a specific period of time, conduct sensory evaluations, and assess the antioxidant ability of the formulated lip balm. The methodology employed in this study involved the selection of four lip balms formulated with varying concentrations of pomegranate as the key ingredient. The pH of each lip balm was measured over a period of six weeks to assess any changes. Additionally, a sensory evaluation was conducted using a panel of 33 untrained individuals. The participants provided feedback on the lip balms using a 5-point hedonic scale rating system, allowing for the collection of qualitative data regarding the sensory characteristics of the products. The results of the sensory analysis indicated that sample number 375 was favoured over the other natural lip balms tested. The pH values of the formulated lip balms did not exhibit a discernible trend of either decreasing or increasing over the duration of the study. The pH values ranged from 4.85 to 6.04. It is noteworthy that the pH range of 4 to 6.5 is generally considered suitable and safe for cosmetic products intended for skin application, including the lips. Thus, the observed pH values of the formulated lip balms in this study fall within the recommended range for optimal compatibility with the average human skin. The lip balm sample that received the highest ratings during the sensory evaluation, denoted as sample number 375, was chosen for subsequent analysis of its antioxidant activity using the DPPH radical scavenging assay. Based on the data, the IC₅₀ value for the pomegranate extract was determined to be 132 ppm, indicating a high level of antioxidant capacity in the sample. In conclusion, the evaluation of lip balm products should consider multiple factors, including antioxidant activity, sensory evaluation, and pH value. Pomegranate extract emerges as a promising ingredient for lip balms due to its notable antioxidant properties. However, further testing is necessary to assess the long-term stability and other relevant factors for the public's safe and sustained use of these products.

Keywords: *Antioxidant activity, lip care, organic lip balm, pomegranate, safe pH*

The background features a soft-focus photograph of a dense forest of evergreen trees, likely pines or firs, shrouded in a light mist or fog. The scene is framed by several large, semi-transparent geometric shapes in shades of teal and light green, which are layered over the image. These shapes include diagonal bands and triangular forms, creating a modern, abstract design.

Session 4: Biological and Agricultural Sciences

Forecasting monthly infected cases of Dengue in Sri Lanka by the Double Exponential Smoothing method

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Abstract

Dengue is one of the most important mosquito-borne viral diseases affecting humans worldwide; Current scientific evidence shows that sequential infection increases the risk of a severe form of the infection with bleeding tendencies. In the absence of specific treatment for dengue viral infection, prevention and control play a major role in reducing the disease burden. As an initial step, forecasting the number of infected cases is necessary for better preparedness to prevent outbreaks of infection which will help to reduce dengue related morbidity and mortality.

The Double Exponential Smoothing (DES) method is a general smoothing method and provides short-term forecasts when the data have a trend and do not have a seasonal component. Therefore, the aim of this study was to determine the best model and to forecast the monthly infected cases of Dengue in Sri Lanka by the Double Exponential Smoothing (DES) method.

The monthly infected cases reported in Sri Lanka for the period of December 2016 to June 2022 were obtained from the publicly available databases of Epidemiology Unit of Sri Lanka. Time series analysis of data was performed using Minitab statistical software (18th version). To select the mathematical model, pattern recognition of the monthly infected cases were examined by time series plot and Auto Correlation Function (ACF). Based on the pattern, DES method was used to forecast monthly infected cases of dengue in Sri Lanka. Validation and verification of the model was performed using transformed data (dividing by 10⁶).

The model validation was performed by the Anderson Darling test which confirmed the normality of residuals ($p > 0.05$) and ACF that confirmed the independence of residuals of the model. The forecasting ability of the model was assessed by the three measurements of errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE) and RMSE (Root Mean Square Error). DES model with α (level) 0.999 and γ (trend) 0.200 had the least relative and absolute measurement of errors during the model fitting and verification. In this model, MAD, MSE and RMSE were 0.2001, 0.0874 and 0.2957, respectively. The fits and the forecast of this model followed a similar pattern of the actual monthly infected cases concluding that this model can be used to forecast dengue outbreaks in Sri Lanka.

Key Words: *Dengue, double exponential smoothing, forecasting, infected cases*

The Impact of Vacuum Packaging on Grain Characteristics and Shelf Life of Rice

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Abstract

Rice (*Oryza sativa* L.), the staple food of Sri Lankan people, is cultivated mainly in two seasons known as “Yala” and “Maha”. Even though the production can be high during those seasons, during the non-cultivating times, there is a shortage of rice mainly due to the post-harvest losses. One of the main reasons for post-harvest losses is the lack of suitable storage and processing facilities. There are many storage methods for rice, however, the problem is whether they can preserve the rice quality for a long period as rice plays a critical role in human nutrition. This study focused to evaluate the impact of vacuum packaging of rice on its grain characteristics and shelf life. The benefits of the study receive a solution to minimise post-harvest losses and a way of gaining profit to the country by exporting high quality rice production.

Three rice varieties were used for the study including white samba, red nadu and kalu heenati. Rice samples were vacuum packed into vacuum sealer bags and non-vacuum packed into normal polythene bags, and stored at normal room temperature. After five months of storage, the grain characteristics including length and grain shape were analysed. Furthermore, the parameters related to shelf life of rice samples including microbiological analysis and physio-chemical analysis were conducted. Under the microbiological analysis, total plate count, and enumeration of yeast and mould were analysed. Under physio-chemical analysis, number of pests and moisture content were analysed. The obtained results were analysed using Minitab 16.0 and Microsoft Excel.

After five months of storage, there were no significant difference observed on length (0.5-0.6cm except kalu heenati) and shape (medium) of rice grains, and no pests were recorded in both vacuum and non-vacuum packed all three rice varieties. It was observed lower values in total plate count ($>4.00 \times 10^3$ CFU/g), yeast and mould count ($>1.00 \times 10^3$ CFU/g except kalu heenati), and moisture content ($>12.67\%$ except red nadu) in all vacuum-packed rice samples. It was recognised that vacuum packaging is more suitable for the preservation of three selected rice varieties, since it creates a vacuum that removes the air before sealing and prevents the growth of microorganisms. Further testing and analysis need to be carried out for few years, to access a clear recommendation on effectiveness of vacuum packaging in long-term storage of rice. The success of this study will lead to an extension of long-term storage of other related crops.

Keywords: Grain shape, microbiological analysis, moisture content, non-vacuum packaging, physio-chemical analysis

Severity of Ankle Oedema as a Parameter to Assess Fluctuations in Blood Pressure in Managing CKDu Patients

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Abstract

Chronic Kidney Disease (CKD) and its variant, chronic kidney disease of Unknown aetiology (CKDu), have become significant public health concerns in specific regions of Sri Lanka, particularly in designated "hotspots." CKDu poses a substantial threat due to its elusive origins and severe health implications. Fluctuations in blood pressure among CKDu patients in these hotspots are recognized precursors to complications and heightened mortality rates, necessitating effective monitoring strategies. An additional layer of complexity is introduced by ankle oedema, a common manifestation in CKDu patients, compromising their quality of life and restricting physical activity.

Ankle oedema, characterised by swelling in the ankles and feet, is a common manifestation in CKDu patients. Compromised renal function disrupts fluid balance, leading to the accumulation of fluid in the lower extremities, presenting as ankle oedema. Understanding fluid balance disruption is crucial for unravelling the diagnostic potential of ankle oedema in CKDu.

Blood pressure dynamics play a crucial role in the formation and persistence of ankle oedema in CKDu. Elevated blood pressure contributes to increased venous pressure, exacerbating fluid retention in the lower extremities. Conversely, fluctuations in blood pressure may correlate with changes in the severity of ankle oedema, providing valuable insights into the diagnostic utility of ankle oedema and blood pressure parameters for assessing CKDu.

The study, conducted over a period of one year with 41 CKDu-diagnosed patients, employed statistical analyses, including paired t-tests, correlation analysis, and longitudinal analysis. The selection criteria for the study had a requirement of a minimum of 3 data points per patient. However, the findings suggest no significant relationship between ankle oedema and blood pressure, with P values exceeding the commonly accepted threshold of 0.05. The absence of consistent monthly data and gaps in the dataset prevent definitive conclusions, emphasising the need for future research to address these limitations and conduct more comprehensive studies.

In conclusion, while the initial hypothesis suggested ankle oedema as a potential parameter for early CKDu diagnosis, this study's results do not support a significant relationship between ankle oedema and blood pressure. Further research is essential to elucidate potential relationships between ankle oedema and other health parameters, contributing to a better understanding of CKDu and its diagnostic indicators.

Keywords: CKDu; CINAC; high blood pressure; serum creatinine; eGFR; ankle oedema

Influence of Black Soldier Fly Larvae (BSFL, *Hermetia illucens*) Meal on Hematological Parameters and Gut Microbes in Broiler Chicken

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Abstract

Rising feed costs could negatively impact commercial broiler growth and production targets. The black soldier fly larvae (*Hermetia illucens* L.; BSFL) is gaining popularity as a sustainable alternative to expensive protein sources like fishmeal (FM), as an environmentally friendly approach. The study examines the impact of BSFL full-fat (FF) and de-fatted (DF) meals with and without exogenous digestive enzymes on the hematological parameters and gut microflora of broiler chicken. Four experimental diets in mash form with the control diet (T1); replacing FM in the control diet at 5% with (T2) and without (T3) digestive enzymes by FF BSFL, 2.5% with (T4) and (T5) without digestive enzymes by BSFL DF meals for broiler starter and finisher phases. On day 14, hundred-twenty (120) birds having uniform weight (BW \pm SD: 322.98 \pm 10.13g) were randomly distributed into 20 battery cages (60 cm \times 60 cm \times 60 cm) (04 replicates per treatment, six birds per replicate). At day-35, two birds per replicate from each treatment were chosen based on the average final live weight for evaluating hematological parameters, and three birds per each treatment for gut microflora analysis.

The diet has a significant ($P < 0.05$) effect on heterophils, lymphocytes, and white blood cells (WBC). The T1 reported the highest value for lymphocytes (67.43% \pm 8.30), and T5 reported the highest value for WBC (9.81 $10^9/L \pm 2.73$) and heterophils (41.13% \pm 5.17). The BSFL meal inclusion significantly ($P < 0.05$) effected over blood serum parameters; total cholesterol, triglycerides, very low-density lipoprotein (VLDL) and blood creatinine levels. The highest value for total cholesterol (152.50 mg/dL \pm 14.75), triglycerides (125.38 mg/dL \pm 16.25), and VLDL (25.08 \pm 3.25 mg/dL) was reported for T3. The highest creatinine level was recorded for the control diet (T1 - 0.24 \pm 0.06mg/dL). When compared to the control diet, the BSFL meals fed diets indicated statistically similar for blood creatinine concentrations, suggesting that no renal injury or disruption occurred. The BSFL meal supplementation triggered the hematological parameters, indicating a stimulatory effect and a better immune system in chicken.

The study discovered that, when compared to the control (T2), the birds fed BSFL meal had higher microbial counts ($P < 0.05$), indicating an improvement in the gut microbial communities following the partial substitution of traditional FM. The study conclude that there is no any negative effect encountered when incorporating BSFL meal into broiler diets over the hematological and microbiological parameters tested.

Keywords: *Black Soldier Fly Larvae, broilers, hematology, gut microbiology*

Modeling and Forecasting Kidney Diseases in Southern Province Using Time Series Analysis and Kernel Smoothing

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Abstract

Kidney diseases are the main health problem which is the central province people are suffering from. But nowadays it has spread all around the country and affected people's lives including the Matara area in the southern province. Therefore, the present study was focused on identifying the pattern and suitable forecasting model for monthly kidney diseases in the Matara Area from January 2016 to August 2023 collected from District General Hospital Matara. In this study, we used Autoregressive Integrated Moving Average (ARIMA) models as a parametric method, and kernel smoothing method as a non-parametric method. The ARIMA (1,1,2) model has been found as the most suitable model for data sets with the least Akaike Information Criterion (AIC) of -201.7428. Furthermore, our model is validated by using the Ljung-box test (p-value > 0.05). We also employed kernel smoothing with Epanechnikov kernels, selecting smoothing parameters through cross-validation, resulting in 76. Then we used Mean Absolute Percentage Error (MAPE) to select the best model. The MAPE value of the ARIMA model was 1.86% and for the kernel smoothing method, it was 25.0%. It is observed that the ARIMA(1, 1, 2) model performs better than the kernel smoothing method. Also, we used RStudio software for the analysis of our study. Finally, we can conclude that the ARIMA(1, 1, 2) model can be used to forecast kidney diseases in Matara.

Keywords: ARIMA, Epanechnikov kernel, forecasting, kernel smoothing, kidney diseases.

Use of Calcium Silicate for Reduction of Soil Nitrous Oxide Emission and PO₄-P in Water

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Abstract

Nitrous oxide (N₂O) is one of the longest-lived greenhouse gases with a global warming potential 298 times that of carbon dioxide on a 100-y timescale. Presence of PO₄-P is an important water-quality parameter that indicates water pollution. Few studies have examined hindering of CO₂ emission and removal PO₄-P s by calcium silicate. Autoclaved lightweight aerated concrete (ALC) is a calcium silicate containing porous material, which is a civil construction waste, that is used as a soil conditioner. This study aims to examine the influence of ALC on N₂O gas emissions from soils at different moisture contents and removal of PO₄-P from water.

Effects of ALC on N₂O gas emission was tested using a paddy soil amended with 5% of ALC (non-carbonated) under two moisture conditions (60, 100% water holding capacity, WHC) in 200-mL glass bottles. Samples were incubated under aerobic condition for 21 days at 25°C. Emissions of N₂O were determined by using gas chromatography with thermal conductivity detector. Adsorption of PO₄-P by ALC was determined by treating 0.05 g of ALC (two types: non-carbonated and carbonated) with initial PO₄-P concentrations of 0 and 1 mg/L for 1, 3, 6, 24, 30 and 48 h shaking under constant temperature. The concentration of PO₄-P was analyzed by a continuous flow analyzer (Autoanalyzer QuAatro 2-HR, Bltec, Japan).

The addition of ALC significantly decreased N₂O emissions, showing 55% and 62% reductions at 60% and 100% WHC levels, respectively, compared with the control. The interaction between ALC addition and soil moisture content on cumulative N₂O emissions was statistically significant ($p < 0.05$). The PO₄-P isotherm for time dependent adsorption for non-carbonated ALC showed slow adsorption for 1, 3 and 6 h shaking and rapid adsorption for 24, 30 and 48 h. Carbonated ALC exhibited slow adsorption due to less adsorption sites available for PO₄-P.

Results revealed that ALC addition suppressed the N₂O emissions from soil, which was more effective at 100% WHC. ALC adsorbed PO₄-P most rapidly at 48 h. Compared with the non-carbonated, carbonated ALC was less effective in PO₄-P adsorption. Our results confirmed that ALC significantly contribute for the suppression of N₂O emissions from soil and it can be used as a good adsorbent to remove PO₄-P from low concentration aqueous solutions.

Keywords: *Aerobic incubation, autoclaved lightweight aerated concrete, calcium silicate, nitrous oxide, phosphate adsorption*

Effect of VEGF Isoforms and Stem Cell Factor (SCF) Interaction on Porcine Ovarian Follicle Viability and Development *In Vitro*.

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Abstract

The Stem Cell Factor, also known as the Kit ligand, has been identified as an anti-apoptotic molecule which regulates cell survival *in vivo*. Our previous studies indicate that SCF enhances porcine follicle viability *in vitro* while pro and anti-angiogenic VEGF isoforms are also important for maintenance of ovarian health and follicle progression.

Under the *in vivo* micro-environment, all these molecules are interacting closely; we hypothesised that the nuanced interplay between VEGF 165a and VEGF 165b and the Stem Cell Factor (SCF) in modulating follicular dynamics in pigs *in vitro* has a significant impact on follicle progression. This study aimed to unravel the intricate dynamics of early follicle development and progression with combine treatments with Stem Cell Factor, VEGF165a and VEGF165b *in vitro*.

The basic design of the study involved with the selection of two VEGF isoforms namely VEGF 165a- pro-angiogenic isoform and VEGF 165b- anti angiogenic isoform to determine porcine follicle viability and development, in combination with SCF. Abattoir-derived ovaries were collected from prepubertal pigs (n=18), transported to the laboratory under saline containing vacuum flask, subsequent three washes in Phosphate Buffered Saline (PBS) with Polyvinyl alcohol (PVA) and PBS containing 0.08% Kanamycin solution, dissection of ovarian cortical strips and *in vitro* culture. Each 5mm³ tissue stripes were placed on 24 well culture plate on Milli inserts. Each well supported with 350µl of α MEM culture medium treated with BSA and ITS. Treatments included varying concentrations of VEGF 165a, VEGF 165b, and SCF (0.1, 1, 10ng/ml) in 5% CO₂ and 37.5°C in a humidified incubator for 3 days; 50% of the media were changed every day.

Results indicate a concentration-dependent impact, with the lowest concentration of the VEGF 165a+165b+SCF combination demonstrating a significant reduction in follicle degeneration (3.40 ± 0.11) compared to the control (5.45 ± 0.58) and the highest follicle viability across various stages (Primordial 29.10 ± 0.20 ; Intermediate 14.25 ± 0.20 ; Primary 5.75 ± 0.12 ; Secondary 2.75 ± 0.22). Conversely, higher concentrations, notably 10.0 ng/ml VEGF 165a+VEGF 165b+SCF, resulted in decreased follicle viability and increased degeneration (33.60 ± 0.53). The study also reveals that VEGF alone struggles to complete follicle development without SCF.

In conclusion, the combined effect of VEGF isoforms and SCF at the lowest concentration (0.1 ng/ml) play an important role in maintaining the viability of porcine follicles *in vitro*. These findings contribute valuable insights into the regulatory mechanisms of angiogenesis and follicular development which help to navigate our knowledge towards novel therapeutic approaches for emerging diseases such as Polycystic ovary syndrome (PCOS).

Keywords: *Follicular viability, ovarian cortical stripes, Polycystic Ovarian Syndrome (PCOS) Stem Cell Factor (SCF), Vascular Endothelial Growth Factor (VEGF)*

Nut Shell Extracts of *Anacardium occidentale* as a Natural Treatment for *Xanthomonas axonopodis* pv. *betlicola*, Bacterial Pathogen of Betel Vine

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Abstract

Betel vine (*Piper betle* L.) is a vital perennial crop in countries like India, Bangladesh, and Sri Lanka, with a rich history. The major betel-producing districts include Kurunegala, Gampaha, and Colombo. Growing betel vine comes with elevated risks, mainly due to the prevalent bacterial leaf disease caused by *Xanthomonas axonopodis* pv. *betlicola*. The disease presents as brown spots on leaves, varying in size and shape, accompanied by blight symptoms. These spots exhibit a yellow halo, and the underside of the leaf shows a water-soaked zone surrounding the brown lesions, posing challenges for betel vine cultivation. This study aims to identify a natural treatment for *Xanthomonas axonopodis* pv. *betlicola*, using *Anacardium occidentale* (cashew) nut shell, which often contains valuable alkenyl phenols, primarily anacardic acid, and known for its commercial applications and medicinal attributes, including antimicrobial properties. The extraction process involved mixing cashew nut shell powder with acetone and hexane, followed by Soxhlet extraction. *Xanthomonas axonopodis* pv. *betlicola* thrived in Potato Sucrose Peptone Agar (PSPA), selected for its growth-promoting properties. Infected betel leaf parts were transferred to PSPA plates for bacterial culture incubation, with subsequent isolation using the streak plate method. Muller Hinton agar was chosen to assess bacterial growth inhibition. Bacterial cultures, adjusted to McFarland standard 0.5, were subjected to the Agar disk diffusion method. Diameter of 6 mm discs were impregnated with 100 µl of each 10% diluted *Anacardium occidentale* crude extracts then dried and dispensed onto the surface of the inoculated agar plate and incubated for 24 h at 37 °C and tested in triplicates. A parallel analysis study with commercial antimicrobial agent, Gentamicin (10 µg) as the positive control and 100 µl of each acetone and hexane as the negative controls conducted in order to compare their antimicrobial potency with the *Anacardium occidentale* extracts. The Disk diffusion technique demonstrated an 8mm inhibition zone with *Anacardium occidentale* nut shell extracts, indicating their ability to inhibit *Xanthomonas axonopodis* pv. *betlicola* growth. The absence of inhibition in negative controls supports their efficacy, and gentamicin revealed sensitivity against *Xanthomonas axonopodis* pv. *betlicola* in the study. The research suggests practical application in betel vine plantations for bacterial leaf disease management.

Keywords: *Anacardium occidentale*, disc diffusion technique, gentamicin, natural treatment, *xanthomonas axonopodis* pv. *betlicola*

Widely Applied Defense under Criminal Law for the Offenders who committed the Crimes due to Hypoglycemic Automatism: A Systematic Review

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Abstract

The medical condition of neuroglycopenia where low glucose level in the brain may develop the automatic behaviour of human beings, which can cause a wide range of criminal behaviour due to loss of control. This medical condition is called “Hypoglycemic Automatism” and criminals suffering from this condition are applied the criminal defences in the court of law to acquit from their criminal liability. This research aims to explore the widely used defence for the offenders who committed the crimes due to hypoglycemic automatism in different jurisdictions. To achieve that target systematic research was carried out for the research articles published between 1960 – 2022. A qualitative research method was applied to conduct this research. The data extraction was completed by retrieving full research papers from electronic databases. The result was synthesised by content synthesis and targeted to produce a descriptive summary to examine the widely use defence for hypoglycemic automatism in different jurisdictions. Among 908 full search papers, 14 were selected for the analysis. Fourteen articles were identified. Based on the data it has identified that, mainly, two criminal defences were applied in courthouses for the offences committed by the hypoglycemic accused: automatism and insanity. In some jurisdictions, automatism was divided into sane and insane automatism. Sane automatism was applied in the cases where the exogenous insulin was overdosed, and insane automatism was applied if caused by insulinoma. Among the sample, most jurisdictions applied automatism other than the insanity as a defence for the offenders who committed their crimes triggered by hypoglycemia. From the research findings, it was identified that the defence of automatism is the widely applied defence compared to the defence of insanity for the accused who are suffering from hypoglycemia.

Keywords – *Automatism, criminal law, defences, hypoglycemia, insanity*