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VIRTUAL PRESENTATIONS

Keynote Addresses

DAILY INTAKE OF ESSENTIAL MINERALS THROUGH DRINKING WATER IN A CHRONIC KIDNEY DISEASE OF UNKNOWN ETIOLOGY PREVALENCE AREA, SRI LANKA

Janitha A Liyanage

Chronic Kidney Disease of unknown etiology (CKDu) is increasing at an alarming rate in North Central Province, Sri Lanka. It was observed that, CKDu has a profound relationship with drinking water quality and the contribution of drinking water to the total dietary intake of essential minerals is pronounced. Essential minerals are required for humans in limited quantities, and excessive or insufficient intake of vital minerals can cause various chronic effects such as CKDu.

An assessment of the essential mineral intake of human body via drinking water was randomly collected from CKDu endemic areas, Girandurukotte grama-niladhari division in Badulla District, Sri Lanka. The water samples were analyzed using Inductive Coupled Plasma Mass Spectrometry (ICP-Agilent-7800) for selected essential minerals, calcium (Ca), magnesium (Mg), copper (Cu), zinc (Zn), ferrous (Fe), and manganese (Mn). The mean Oral Daily Intake (ODI) for an adult human for Ca, Mg, Cu, Zn, Fe, and Mn were 1.1±0.1 mg/L, 20.3±0.8 mg/L, 1.1±0.0 µg/L, 18.4±1.0 µg/L, 108.3±12.6 µg/L, and 143.0±21.6 µg/L respectively. Mean ODI value (µgkg^{-1} day^{-1}) for Ca, Mg, Cu, Zn, Fe, and Mn were 0.04, 0.74, 3.89x10^{-5}, 0.07x10^{-2}, 0.04x10^{-1}, and 0.01 respectively. Mean concentrations of selected essential elements in drinking water complied with WHO standards except for Mg. The reported chronic ODI values indicate low potential harmful health risks to the people of the study area. However, long-term use of this water may pose a hazard to human health. Therefore, regular monitoring and taking all necessary precautionary measures before using this water can be recommended.

Keywords: *Chronic Kidney Disease, Drinking water quality, Essential minerals, Humans, Sri Lanka*

THE IMPACT OF COVID – 19 PANDEMIC ON THE TOURISM INDUSTRY OF SRI LANKA

Prof. V. Kanagasingam

Over the past three decades, tourism industry around in Sri Lanka has faced various crises including civil war, political instability, economic crises and terrorist attacks. In fact, as far as tourism industry in Sri Lanka is concerned, coronavirus pandemic is the second external trauma that hit the Sri Lankan tourism industry within the last 12 month period, while the Easter Sunday bombings of April - 2019 was the first crisis which affected tourism. A qualitative analytical approach in this study has been used as it oriented towards exploration and discovery. Multiple data collection techniques including eleven semi – structure interviews and document analysis have been employed. Snowball sampling techniques was also employed to recruit various stakeholders. Stakeholders were recruited for interviews by using a Snowball sampling techniques. Data collected using different techniques in this study have been analyzed by using discourse analysis. This research concludes that there is no doubt that Sri Lanka tourism has been severely disturbed by COVID – 19 because tourism industry is extremely vulnerable and trends of the industry is determinant by several macro and micro environmental factors.

Keywords: *COVID – 19; Tourism transformation; Pandemic; Source market; Re- profiling; Tourism industry*

Oral Presentations

USE OF EXISTING GENE SEQUENCING DATA TO PREDICT FURTHER POSSIBLE COVID -19 VIRUS STRAINS AND THEIR IMPACT USING EVOLUTIONARY COMPUTING AND MACHINE LEARNING

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Covid - 19 pandemic is critically impacting the lives of billions throughout the globe. Even after taking huge shielding measures like nation-wide lockdowns, discontinuation of worldwide flight offerings, rigorous checking out etc., the contamination spreading is still developing steadily that causes thousands of deaths and severe socio-monetary crisis over the globe. At the moment Sri Lanka is also passing in it's so called the third wave, where each and every wave subsequently make the harm more and more severe. That leads many people including many scientists to make various assumptions for the severity differences. In-born immunity of Sri Lankans, our local food patterns, being Sri Lanka and evenly India are located near to the equator etc. are some of among such assumptions. Consequently it has been reported that the biological gene sequencing process was also initiated in Sri Lanka, which does significant identification of many strains currently dominating in Sri Lanka with their sources and respective severity levels. Through this work, an Evolutionary Computing (EC) / Genetic Algorithm (GA) based conceptual approach has been proposed to model its ability of generating the optimized large number of Covid - 19 virus strains computationally. Machine Learning (ML) based approach has been proposed to estimate the severity or harmfulness levels of such novel strains computationally, by accounting the same factors of already existing strains. For the sake of obtaining needed gene sequencing data NCBI like world leading gene libraries are referred. Computer scientists especially from the sub domains of Artificial Intelligence (AI), such as GA, EC, ML can make new avenues for the health authorities to think the possible precautions in a novel angle is the key intension of this paper.

Keywords: *Genetic Algorithm, Evolutionary Computing, Covid – 19, Artificial Intelligence, Gene Sequencing*

INTERNET OF THINGS ENABLED RECOGNITION BASED ATTENDANCE MANAGEMENT SYSTEM

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Attendance management is a very important task for each and every university or an institute. Most of the institutes do the attendance marking manually and it is time consuming. And also it may cause many errors. The purpose of the following research is to design and develop a new system using different technologies together with internet of things concepts. This system uses face recognition and radio frequency identification together to come up with a proper solution. The system is using an online MySQL database to store data required to the system. Python is used to program the system and Open CV is used for face recognition. One main finding of the research is identification of the student with different angles of face after getting the RFID tag value. When the face is recognized correctly, the system checks for the correct time slot for the class. After verifying both student and the time slot, system marks attendance and notification email is sent to the student so that student can know his or her attendance was marked successfully.

Keywords: *Attendance management, IOT (Internet of Things), RFID (Radio Frequency Identification), Face recognition, OpenCV*

COMPARISON OF FINANCIAL MODELS FOR STOCK PRICE PREDICTION WITH SPECIAL REFERENCE TO COLOMBO STOCK EXCHANGE, SRI LANKA

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Time series analysis of daily stock price and building predictive models are important and complex. The successful prediction of a stock's future price will maximize investor's gains. This paper presents a comparative study and predictions for stock prices of companies listed on the Colombo Stock Exchange (CSE) using three different methods; namely, Auto-Regressive Integrated Moving Average (ARIMA), Fractional Brownian Motion Process with Adaptive Parameters (FBMAP), and Artificial Neural Network (ANN). Each of the methods was used to build predictive models using historical stock data from January 2012 to June 2018. The main objective of the study was to investigate whether stock prices follow the Random Walk Hypothesis (RWH) and to compare three major forecasting methods. To check RWH, we used Chi-square Test, the Runs Test, and the Auto-correlation Test. The Augmented Dickey-Fuller Test (ADF Test) was used to verify the stationarity of the data set. In the first phase, the best fitted ARIMA model was found using Akaike Information Criteria (AIC), Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). In the second and third phases, FBMAP and ANN were used to predict future stock prices. Finally, the output from each of the models was compared with the actual stock price. The findings showed that the ARIMA and the FBMAP models provide a better approximation for stock price prediction compared to the ANN model. Moreover, the simulation results showed that the FBMAP model is more suitable for forecasting daily closing prices than the ARIMA model.

Keywords: *Stock price; Auto-Regressive Integrated Moving Average; Artificial Neural Network; Fractional Brownian Motion Process with Adaptive Parameters*

OPPORTUNITIES AND CHALLENGES OF SECURITY SECTOR REFORMS IN THE POST CONFLICT CONTEXT

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The United Nations have a pessimistic view of Security Sector Reforms (SSR) as a process of assessment, review, monitoring and, evaluation accountability in the post conflict period. The principle objective of this research is to examine what are the significant opportunities and challenges of SSR and SSR strengthen to avoid shortcomings in the post conflict context. This research is mainly based on the interpretive research approach. The interpretive approach covers various knowledge about the existing phenomena via understanding. The research findings indicated that, defence, law enforcement, corrections, intelligence services, institutions, customs and civil emergencies are responsible for border management under the security sector. Moreover, the study shows the SSR has a possibility to build a more coherent framework to reducing risk and make a mutual understanding with the government and rebel groups. Although, the UNO has a pessimistic view of SSR; some scholars argued that some implementing challenges of the SSR. The challenges are; mismatch norms, lack of coherent strategy and insufficient knowledge to bring changes. Moreover, SSR focus on the short term reforms rather than the long term strategies. Some scholars criticized that SSR policy and practices have not effectively supported women's participation in high-level security sector decision-making processes. In addition to that, lack of respect and protect human rights and low consideration of accountability are prominent challenges implementing a human rights approach to SSR. The SSR is prominent to build a trustworthy environment between security forces and warring parties before going to the stable solutions in the post conflict settings.

Keywords: *SSR, Opportunities, Challenges, Post-Conflict*

HOPE AND OPTIMISM PREDICTING WORK ENGAGEMENT: A SURVEY ON EMPLOYEES IN HANDLOOM INDUSTRY IN SRI LANKA

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The Handloom Industry is recognized as a highly labuor-intensive, rural-based cottage industry, and Handloom industry employees have hand creative skills and are engaged in the development process of ecologically sustainable products under low capital investment. Numerous psychological capital specialists stated that workers' morale could be improved by personal resources to improve employee work engagement. The researcher has selected two components of psychological resources for the current study. The main aim was to investigate how hope and optimism affect employees' work engagement in Sri Lanka's handloom industry. The respondent of the study were employees in the Handloom industry in Sri Lanka and selected 90 employees from the western province through convenience sampling technique. The data were collected through a standard and validated questionnaire survey, and data were analyzed through reliability analysis, confirmatory factor analysis, correlation, and regression tools with the support of the SPSS 20.0 version. The result revealed that hope and optimism positively and significantly influence on work engagement of employees of the Handloom industry in Sri Lanka. On the whole, hope and optimism accounted for almost 55% of the variance in employees' work engagement in the Handloom industry in Sri Lanka. Most of the empirical studies investigated how psychological resources affect work engagement, and lack of studies investigating how individually four types of psychological resources affect work engagement. This research makes a novel contribution by finding out how two components of psychological resources separately affect employees' work engagement in the Handloom industry in Sri Lanka.

Keywords: *Hope, Optimism, Work Engagement*

PROPORTION OF THYROIDITIS AND ASSOCIATION OF THYROIDITIS WITH TWO POSSIBLE RISK FACTORS AMONG THE FEMALE PATIENTS WITH THYROID DISEASES

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Thyroiditis is inflammation of the thyroid gland. The Commonest one is chronic lymphocytic thyroiditis. The usage of iodized salts has been identified as another common cause for increasing incidence of thyroiditis. Our study was intended to assess the proportion of thyroiditis with the correlation of thyroiditis using the two possible risk factors such as the usage of hormonal contraceptives and the methods and the types of salt usage. An interviewer administered questionnaire was used. 246 female patients with thyroid diseases, attending to the surgical and ENT clinics of Colombo South Teaching Hospital were recruited. Clinical history of the patients was referred to extract the relevant data and analyzed using SPSS 21 version. Among 246 female patients, 146 were having thyroiditis (59.3%) and 123/146 (84.2%) were diagnosed with chronic lymphocytic thyroiditis using FNAC reports. The mean age was 47.21with the SD= 12.08 years, where most of the patients were belonged to the 31-50 age group category. The two possible risk factors such as the hormonal contraceptives ($p= 0.886$, $p<0.05$) and the use of table salts vs salt particles, time of adding salts when cooking for both salt types and washing and non-washing of salt particles before adding to meals were not statistically identified as significant for the incidence of thyroiditis. Our study concluded that 59.3% of study population had thyroiditis. The commonest type was chronic lymphocytic thyroiditis. There was no association between thyroiditis and usage of hormonal contraceptives and the type or method of salt used.

Keywords: *Chronic Lymphocytic Thyroiditis, Hormonal Contraceptives, Iodine*

CORPORATE SOCIAL RESPONSIBILITY AND PATIENTS' LOYALTY IN PRIVATE HEALTHCARE SERVICES - A CASE OF SRI LANKA

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Corporate social responsibility (CSR) and customer loyalty perform a vital role in firm performance and sustainability in any industry. Although research on effect of CSR on customer satisfaction, loyalty and firm performances has grown rapidly, studies on CSR in healthcare services and its impact on patient satisfaction and loyalty is scare, especially in the Sri Lankan context. This paper aims to examine the impact of CSR on patient loyalty and how it interacts with satisfaction and trust in affecting loyalty in the Sri Lankan private healthcare sector. A quantitative study was performed and data were collected through a well-structured online questionnaire, consisting of five demographic type questions and twenty-four Likert scale type questions. The data were analyzed using structural equation modelling. The findings show a significant positive relationship between CSR and patient loyalty, CSR and patient satisfaction and CSR and patient trust. Although the study also supports the claim that CSR has an indirect effect on patient loyalty through patient satisfaction as a mediator, there is no significant mediation effect of patient trust on loyalty. The study provides a set of findings relating to CSR initiatives and these findings provides important insights into how private health-care providers should incorporate CSR into their corporate strategic plans that would enhance patient satisfaction, consequently leading to patient loyalty.

Keywords: *Corporate social responsibility, Customer loyalty, Customer satisfaction, Customer trust, Private healthcare industry*

HANDWRITTEN CHARACTER RECOGNITION USING NEURAL NETWORK BASED ON SIFT ALGORITHM

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Handwritten character recognition system is used to convert a hand written text document on paper into a digital format which is difficult to recognize due to diverse human handwriting style, size and shape of letters. In this paper, we demonstrate a new methodology to recognize the handwritten characters (English alphabets) using SIFT algorithm and Neural Network in four major stages Pre-processing, Segmentation, Feature extraction and Recognition. We did noise reduction, binarization, normalization and thinning for pre-processing and extracted some useful information out of the thinned image using Scale Invariant Feature Extraction (SIFT) algorithm. Extracted features are given as an input to the trained classifier Artificial Neural Network to compare the extracted features with defined pattern and detect the most suitable class for each characters. The results showed that this framework provides good recognition accuracy of 92.56% of handwritten characters.

***Keywords**: SIFT, Artificial Neural Network, Handwritten character recognition, Classification*

THE ROLE OF DATA ANALYTICS TOWARDS EFFICIENT CLOUD PLATFORMS: COMPREHENSIVE REVIEW ON EXISTING TECHNOLOGIES AND FURTHER INNOVATIVE APPROACHES

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Data Analytics in clouds is really beneficial as well as challengeable. Cloud computing as a modern technology gaining many benefits with data analytics. The key intension of this paper is to introduce the advantages of implementation of cloud based data analytics. It is evident from the literature that many organizations have carried-out data analytics for a long time to fine-tune their methodologies with the aim of expanding their opportunities. Data analytics also tends to solve many crucial problem associated with attempting to understand clients, rather than following basic data patterns to build better business strategies and activities for the sake of discovering certain amount of possible vulnerabilities. Frequent data-analytics perceives existing behaviors in data to help better serve existing clients. It tends to figure out how to attract new clients which is really harder than setting up a new business. As with the existing literature, the sub-themes of data analytics includes "Technical", "Organizational", "Economical", "High-performance", "Efficiency and Security advantages" that encompasses the following categories : "Specific capabilities", "Technical support", "High-level capabilities in the Organizational area", "Organizational cost reduction", "Relative benefits in Economic field" and "Security Opportunities". This whole process based on cloud data analytics helps to make businesses more successful. Further the literature giving some evident for union of cloud computing with analytics helps client organizations to store, decipher and measure their huge bundle of data to address their client's issues in a more accurate and efficient manner. Significant part of the advantage of data analysis comes from its capacity to recognize patterns in a set and make predictions with respect to the past encounters. Typically the interaction is suggested as data mining that is simply a findings of designs or patterns in data somewhat medium or large data sets with respect to the size. Considering the novel approach of data analytics in cloud computing environments, leads to improve the benefits and opportunities in a vast scale, that significantly improve the efficient use of Cloud Computing Technologies.

***Keywords:** Cloud computing, Data analytics, Implementation, Data Analyzing, Efficiency, Patterns, Opportunities*

ACTIVITY BASED VIRTUAL LEARNING PLATFORM FOR PRIMARY EDUCATION SECTOR

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Activity-based learning facilitates more engaging learning methods that can motivate primary school children to be active in a virtual learning platform. This research project focuses on this matter while providing student progress data for parents and teachers with more analytics. The platform gives teachers the facility to design different educational activities relevant to the subjects. At the end of every lesson, there is an activity-based activity. Students can log in to this system and they will be able to attend lessons on a particular subject. After completing the lesson materials, the student must complete game activities in order to complete the module successfully. When students are doing their game, it will automatically record their working process. This system facilitates a sentiment analysis-based chat platform for the parents and parents can track game activities by going through the process of how the student did the exercises. By doing this, parents can identify what are the challenges faced by their child during learning activities. Teachers can track this process and identify what are the questions most students cannot answer, and the teacher can provide further explanations about that particular matter. Finally, the teacher can analyze the marks based on the games. If any student does not meet the expected marks, the teacher can categorize them into groups and the teacher can give other activities to improve their knowledge.

Keywords: *Virtual learning platform, Primary education, Parents and teachers, Different educational activities, Primary school children*

ANTHELMINTIC ACTIVITY OF LEAVES JUICE OF *MOMORDICA CHARANTIA* L: AN IN VITRO STUDY

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Anthelmintic resistance is a crucial interference in controlling the intestinal worm infestation. We aimed to determine the anthelmintic effect of tender, matured, and dried leaves of *Momordica charantia* L. (*M.charantia*; *Paagal*) with various concentrations (100%, 50%, and 25%) on earthworm, since its anatomy and physiology resembles the human intestinal roundworm. Eleven groups of adult earthworms (*Lumbricus rubellus*) (each group consists of 3 earthworms) were selected. Albendazole (20mg/mL) and distilled water were used as a standard and control respectively. Time of paralysis (TP) and time of death (TD) of the earthworms were obtained. The TP and TD were significantly ($p<0.05$) lower in 100% tender (TP; 12.7±3.9,TD; 55.1±13.3 minutes) and mature (TP; 18.6±6.1, TD; 63.0±8.7 minutes) leaves compared to Albendazole (TP; 59.8±9.1, TD;113.2 ± 5.9minutes). However, there is no significant difference in TP (38.3±10.2 minutes) and TD (105.9±17.5 minutes) of 100% dried leaves with Albendazole. When comparing the juices with 50% concentrations, the tender (TP; 22.2±7.3, TD; 69.2 ± 3.8 minutes) and mature (TP; 28.8±5.0**,** TD; 88.7±3.9 minutes) leaves have shown a significantly ($p<0.05$) lower TP and TD while the dried leaves had similar TP (69.1±15.4 minutes) and TD (125.4±17.8 minutes) with Albendazole. Minimum TP and TD was noted in 100% tender leaves.In conclusion, different developmental phases and the concentrations of *M. charantia* have shown different anthelmintic properties. Concentrated tender leaves (100%) juice exhibits a significant anthelmintic activity as shown by minimum TP and TD. Insightful studies on anthelmintic activity of *M. charantia* leaves will improve the treatment of worm infestation.

Keywords*: Anthelmintic, Momordica charantia* L.*, Earthworm, Albendazole*

COMBATTING CYBER HARASSMENT: IMPORTANCE OF COLLECTIVE AND MULTI-FACETED STRATEGY AS A SUSTAINABLE REMEDY

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The exponential growth of the Internet interconnections has led to a significant growth of cyber harassment incidents worldwide, often with disastrous and grievous consequences to victims, their families and society at large. Despite the lack of proper statistics, it is evident that cyber harassment is on the increase in Sri Lanka too. However, the country is inadequately equipped on all fronts to successfully combat cyber-harassment; not only does Sri Lanka lack targeted laws on cyber harassment, it also suffers from a lack of specific policies and strategies on this issue. Furthermore, law enforcement agencies and regulators in the country lack the necessary powers/authority, technical expertise, resources and inter-institutional coordination required to effectively tackle cyber harassment. Moreover, private sectors' contributions in this regard is minimal. Jurisdictions which are serious about combating this issue have taken a holistic and collective approach with the integration of several aspects such as enhanced government coordination; multi-stakeholder co-operation; strengthening the legislative and policy framework; reinforcing law enforcement and monitoring mechanisms; formulating mechanisms to strengthen offender management and victim empowerment etc. In this context, it is imperative for Sri Lanka too to develop a collective and multi-faceted cyber harassment defense mechanism. Thus, this paper probes into the measures taken at regional and international levels by various jurisdictions such as the USA, the UK, Singapore, Australia etc. to tackle cyber harassment in order to ascertain the lesson that Sri Lanka can learn in devising a collective, multi-faceted and sustainable strategy to tackle this issue. The paper concludes outlining the essential components of such a collective and sustainable strategy.

***Keywords**: Cyber harassment, Collective strategy, Multi-jurisdictional analysis, Holistic approach, Sustainable remedy*

A PILOT STUDY ON SIDDHA DIAGNOSTIC METHODS OF *SOOLAI GUNMAM*

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Soolai Gunmam (SG) is a disease classified under the *Gunmam* (gastrointestinal diseases) in Siddha system of Medicine while the signs and symptoms are overlapping with Gastritis. Studies are limited on identification of SG using siddha diagnostic methods. Hence, we aimed to diagnose the SG using Siddha diagnostic methods. Patients (n=18) aged 18-40 years, with SG and not on medications were recruited at Teaching Hospital of Siddha Medicine, Konesapuri, Trincomalee. Patients were examined using Siddha diagnostic methods including *Naadi* (vital force of body), *Neerkuri* (physical character of urine), *Neikuri* (oil drop urine examination method) and *Manikadai* (wrist circumstance). Nearly 56% of patients were identified with *Pitha vatha dhosha* using both *Naadi* and *Neikuri* examinations. *Pitha vatha dhosha* is the causal factor of SG. When following *Neerkuri* method, sesame oil colour was noted in 13 urine samples. However, we did not observe froth, odour, or sedimentation in any urine samples. Ten finger breaths *Manikkadai* was noted in the right hand of all the patients. In conclusion, *Neikuri* and *Naadi* could be serve as a diagnostic method to identify the affected *dhosa* while *manikkadai* could be serve as diagnostic method to identify the SG. However, detailed studies are recommended prior to clinical practice.

***Keywords: Soolai Gunmam, Naadi, Neikuri, Manikadai,** Gastritis*

A STUDY ON FACTORS AFFECTING CONSUMER PURCHASE INTENTION OF GREEN PRODUCTS AND SERVICES IN SRI LANKAN EVENT PLANNING INDUSTRY: FROM EVENT PLANNERS' PERSPECTIVE

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A qualitative approach was applied in this study to determine the underlying influences on event planners' perceptions about eco-friendly events in Sri Lanka. Additionally, the impact of the perception of consumers about the green concept related to the events was explored in this study from the event planners' point of view. The Semi-structured in-depth interviews were conducted among the 05 most reputed event planners in Sri Lanka to derive research data and the narrative analysis method has been adopted as the data analysis method in this study. The event planning industry in Sri Lanka is less concerned about the environment. Most event planners do not attempt to implement green concept as a strategy because it is not something to demonstrate prestige. The factors that influenced the perception of event planners in Sri Lanka were identified through the insights. Specially, these insights were depicted that awareness, environmental concern, green advertising, greenwashing, green product attributes, social norms and income were identified as key factors for generating the perception of event planners in Sri Lanka. Findings of the study show that awareness, environmental concern and green advertising mostly impact on the consumers' green purchase intentions. Further, social norms, product attributes and income were identified as factors which impact the green purchase intentions of consumers to a considerable extent. These insights will be fruitful to event planners to adopt more green marketing strategies to gain market share in the Sri Lankan event planning industry.

Keywords: *Green marketing, Event planning industry, Green concept, Green purchase intention, Eco friendly products and services*

OPTIMIZATION OF EXTRACTION CONDITIONS FOR *MORINGA OLEIFERA* LEAF POWDER AND DEVELOPMENT OF AN INSTANT COFFEE MIX WITH *MORINGA OLEIFERA* EXTRACT POWDER

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Development of instant beverages with health benefits has a great potential in the local and international market. Moringa has gained attention in many researchers as Moringa leaves are rich in vitamins, essential amino acids and antioxidants. Therefore, the objectives of this research project were to develop an instant coffee mix with *Moringa oleifera* leaf powder and investigate its properties. The research project was conducted in two main phases as optimization of the hot water extraction of *Moringa oleifera* leaf powder and development of the instant coffee mix which includes the extracted Moringa leaf powder. Optimization was conducted using response surface methodology with two responses: total phenolic content (TPC) and yield, and three factors: temperature, time, and solid-to-liquid ratio. Optimized conditions for hot water extraction were 60 ºC of extraction temperature, 25 min. of extraction time and 1 g/10 ml of solid-to-liquid ratio. The maximum TPC and yield values were 95.92 mg GAE/g of powder and 0.28 g/g of dry powder, respectively in the optimized conditions. The product formulations were developed with the combination of freeze dried powder of Moringa extract (2.5-10 %), sugar, milk powder and instant coffee powder. Sugar and milk powder were the most preferred sweetener and the creamer, respectively based on the sensory evaluation. The formulations which contain 2.5 % and 5 % of Moringa extract powder were the best formulations with respect to the physicochemical properties, sensory evaluation, and total phenolic content assay.

Keywords*:* ***Moringa oleifera*** *leaf powder, Antioxidants, Instant beverages, Sensory evaluation*

EFFECTIVENESS AND EXPERIENCES OF LIBRARY USER SERVICES DURING COVID 19 PANDEMIC IN THE LIBRARY RAJARATA UNIVERSITY OF SRI LANKA

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Libraries everywhere of the world have been facing lockdown challenges in providing access to its collections and services. The purpose of this study was to explore the university libraries' response during the COVID-19 pandemic and determine their working practices, services patterns, strategies applied, and role played. Sub objective is to make other university libraries aware of what the library has implemented with providing digital services to its teaching faculty and students during the pandemic. The approaches used are the authors' personal experiences working at Rajarata University library, observations of the library's responses with regards to its special services, as well as their reflections on what can be considered for development now and in the future. It highlights the current initiatives and best practices for library services throughout a public health crisis. The study also made recommendations for the advancement of libraries' role in such circumstances. Libraries face certain encounters and obstacles in their revolution from physical to digital. It also describes the encounters and suggestions for the library professionals working in remotely. In order to achieve these goal libraries need to be equipped with latest infrastructure, information communication technologies and skilled manpower. This study provides an overview on protective measures and present trends in libraries to play active role in the present and post pandemic situation. The study highlights the important initiatives taken by the libraries which can be monitored by others to encounter the post lockdown requirements.

Keywords: *Library resources, Information technology, COVID-19 Pandemic, Library services, Academic library, Pandemic and library services, Remote Services, Virtual Services*

IS GROUPING OF MANGROVES FLORA CONTROVERSIAL? A VIEW ON SRI LANKA

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Mangroves are unique and a heterogeneous group of plants that are defined ecologically by their occurrence in tidal zones along shorelines, estuaries, lagoons, river mouths and creeks. The plants are mainly grouped into "true mangroves" and "mangrove associates". However, no consensus is arrived at and this creates confusion among the mangrove workers. Hence, the present work grouped the mangroves mainly based on wide-ranging field observations on species-zonation patterns and experience of observers, as well as grouped some controversial species based on their landward transitional zones. The present work further analyzed various publications related to grouping of global mangroves focusing on Sri Lanka. In Sri Lanka, six mangrove species are considered under either category of "true/core mangroves" and "mangrove associates" such as *Acanthus ilicifolius*, *Acrostichum aureum*, *Excoecaria agallocha*, *Heritiera littoralis*, *Pemphis acidula*, and *Sonneratia caseolaris*. These species are "controversial species" that are still under debate. This issue can better be resolved by molecular approach. However, only few studies are available on molecular basis of grouping the mangrove species. This work calls for molecular studies in mangrove plant research and identification, in addition to the phylogenetic studies, which will also provide insights into the processes of speciation, extinction and migration.

Keywords*: True mangroves, Mangrove associates, Controversial species*

OPERATIONALIZING RESILIENCE THROUGH COLLABORATION IN THE SRI LANKA TEA SUPPLY CHAIN DURING COVID-19

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Resilience is a system's ability to return to its original state or a new, more suitable state within a reasonable period after being disturbed. Supply chain resilience has been assessed using different elements in previous studies. It has been found that there has been a theoretical gap of effects of sub components of collaboration (information sharing, connectivity, coordination, integration, and visibility) on supply chain resiliency. Therefore, this study determined the impact of sub-components of collaboration on the supply chain resilience by taking Sri Lankan tea industry during Covid-19 for empirical testing. The study adopted the positivistic philosophy with quantitative approach. The unit of analysis was Sri Lankan tea exporting companies and the sample size (n=134) was derived using the systematic random sampling technique. The instrument used to collect data was self-administered questionnaires. The data were analyzed using the multiple regression analysis techniques using the SPSS statistics 21.0 statistical tool. The study's findings suggest that there has been a low performance in the Sri Lankan tea industry during Covid-19 pandemic. Further, the identified subcomponents of collaboration have significantly impacted the tea supply chain resilience in Sri Lanka during Covid-19. Through this research study, the authors bridged the identified theoretical and empirical gap, in the current supply chain resiliency literature.

Keywords: *Supply Chain Resilience; Collaboration; Tea Supply Chain; Covid-19*

COMPARISON OF DIFFERENT CONVOLUTIONAL NEURAL NETWORKS FOR RIPENING AND DECAY STAGES CLASSIFICATION OF MANGO (MANGIFERA INDICA L.) CV. TOM EJC USING TRANSFER LEARNING TECHNIQUES

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The postharvest fruit quality monitoring is an essential requirement along the postharvest chain of mango especially for varieties like Tom EJC with high consumer demand and the high price at the local market. Typically postharvest grading is done arbitrarily in a labour intensive manner. Manual colour inspection and hand picking is laborious, time consuming and less efficient. Over time, imaging techniques are being used as an emerging scientific tool in non-destructive quality evaluation of fresh produce including mango. Therefore, in order to classify mango fruits efficiently and reliably, this work describes a classification system that uses imaging technologies to predict the ripeness quality of Tom EJC mango using CNN models for image classification. The accuracy of different pre-trained image classification models were compared to identify the level of ripeness. A dataset with 2550 images was developed by acquiring images of Tom EJC mango stored at AC conditions (25 ± 1 °C) over the period of 7 days. Images were manually classified into 4 categories according to their color referring to the level of ripeness and decay. Images were pre-processed and a basic CNN model with 8 layers was defined and used to train the four classes of classification. After identifying the level of accuracy different neural network models namely VGG16, Inception V3, ResNet50, ResNet101 and MobileNet were used to train the four classes of classification. The level of accuracy was compared. The performance accuracy of grading Tom EJC mango fruit is over 70% for InceptionV3, ResNet50, ResNet101 and Mobilenet models. Therefore a real time machine vision based grading system using CNN networks could be used to determine the level of ripeness of Tom EJC mango.

Keywords: *Mango; Image analysis; Fruit, Ripening, Classification*

COMMUNITY RESILIENCE TO FLOOD DISASTER IN PORATHIVUPATTU DIVISIONAL SECRETARIAT DIVISION, BATTICALOA

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Batticaloa is one of the most flood-prone districts in Sri Lanka. Most of the low-lying areas of the District are highly vulnerable to flood hazard. This situation brings an increased impact on the lives and livelihoods of the people living in those areas. In response to the increasing vulnerability to flood disaster, some initiatives have been implemented aiming at making the communities more resilient. However, the flood risk continues to increase at varying degrees in the recent years. Porathivupattu Divisional Secretariat division, being located in the southern part of the District, faces a high-risk due to the recent concurrent flood events. Thus, the study was conducted to evaluate the community resilience to flood risk in the Porathivupattu division**.** Three Grama Niladari divisions, namely Pattapuram, Periyaporathivu and Munaithivu, were selected for the study. This study applied a mixed-method approach, where empirical evidence was collected and analyzed using quantitative and qualitative methods. Household questionnaire survey and interviews were used for empirical data collection. Interviews were thematically analyzed through coding and ranking methods to identify the status of community resilience. The study found that community resilience shows different dimensions in each division depending on the socio-economic vulnerability. In terms of the spatial distribution of the flood impact; Pattapuram division is subject to more consequences. The study revealed that community resilience in the study area is moderate to low, while Munaitivu division shows a relatively better level of resilience. However, community resilience is imperative than before due to the increasing flood risk from the frequent occurrence of small and moderate-scale floods. Therefore the study suggests that community resilience should be prioritized in flood risk reduction planning for effective disaster response.

Keywords: *Community, Flood, Hazard, Risk, Resilience, Vulnerability*

EFFECTIVENESS OF ASSESSMENTS ON LEVELS OF LEARNING AND LEARNING OUTCOMES: A CASE STUDY IN ENGINEERING TECHNOLOGY EDUCATION

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Engineering Technology education programs are designed and developed incorporating attributes such as knowledge, skills and attitudes. Such programs have built in Program Outcomes (PO) which are direct measurements of the attributes the students should have at the completion of the program. The POs are linked to the program curricula through the Learning Outcomes (LO) of modules. Each LO incorporates action verb/s to indicate the expected level of learning achievements by students. Quantification of LOs achieved at the completion of a program is carried out by assessments.

The case study included a test module selected from an Engineering Technology education program. It was conducted to analyze the effectiveness of methods of assessments included in the test module to quantify the achievement of LOs by students. In the study, the connectivity between the expected LOs and assessed LOs with respect to the levels of learning was first established, which was followed by an analysis of the performance of students in the Continuous Assessments (CA) and the End Semester Examination (ESE).

The analysis revealed that the majority of students in the test group failed to obtain high marks for the ESE but performed well in the CAs, which indicates that student achievements were better reflected in CAs. Also, it was revealed that students performed better at achieving lower levels of learning. It may be concluded that an increased weightage allocated to CAs would lead to developing more appropriate assessment methods to promote the higher order levels of learning in teaching-learning activities.

Keywords: *Attributes, Program Outcomes, Learning Outcomes, Assessments*

A NETWORK SCIENCE BASED APPROACH FOR ORCHESTRATING AND GOVERNING MICRO SERVICES DEPLOYMENTS IN CLOUD ENVIRONMENTS

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Container based microservices approach is a rising architectural style which revolutionizes software development in the present industrial world. It has the ability to decompose an application into loosely coupled, unified components without breaking the integrity of the software. By adopting to it, engineers can develop several lightweight, versatile and self-contained components in geographically disseminated servers. To support the deployment of the architectural style, Container-based virtualization and container orchestration technologies were developed. Micoservices doesn't need a specific integration framework to deploy. The execution and deployment of microservices produces several networking problems as well. Solutions using technologies such as Network Function Virtualization (NFV) and Software Defined Networks (SDN) are used by the engineers for those network related areas. Microservices architecture is now emerging as a robust and efficient model of engineering enterprise level complex applications. Regardless of the usage of technologies related with the microservices architecture, it may be difficult to anticipate the resource usage of each service when the number of microservices deployed in the system, and when new business process workflows are continuously introduced. Currently local and rule based auto-scaling strategies are used to dynamically manage the quantity of microservice instances in a particular deployment. In order to optimally utilize the existing resources, it is necessary to have the global perspective of how each microservice is utilized. The purpose of this paper is to model a Microservices based system as a Self-organizing network which optimizes the resource utilization process by considering the holistic view of the system through application of some network analysis metrics.

Keywords: *Microservices, Network Science, Centrality measures, Graph theory, Google cloud platform, Kubernetes, Docker, Orchestration*

DEVELOPMENT OF IoT BASED TREE CUTTING WARNING SYSTEM IN FORESTS

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Deforestation is one of the big issues around the world causing global warming. Forests cover 30 percent of land area and they are disappearing at a rapid speed. The government uses several rules and regulations to prevent deforestation. However, smugglers find a way to cut down the trees in the forest area. There is a need for an independent system to monitor the tree cutting within the forest area to catch the smugglers. A monitoring device was developed with Raspberry Pi as the main controller and a solar-powered rechargeable battery to deliver the power to the system. USB mini micro audio adapter was used to record the sound and analyse the sound within a pre-developed algorithm using python. The wifi repeater and USB wifi adapter were used to provide connection around the set of select devices to identify the tree cut down in the forest. 55 testing sounds were used to train the algorithm to identify the tree cutting sounds and notifications were sent to the online website and messages were sent to the forest officers from the website. The accuracy of the devices was 81.88 percent out of the 55 sample tree cutting sounds.

Keywords: *Warning system, Tree Cutting warning, IoT based system, Sound analysis*

RADIO FREQUENCY ANTENNA DEMONSTRATOR KIT

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We have developed a radio frequency antenna demonstrator kit as a microcontroller based wireless equipment. This system is a hybrid combination of software and hardware. This study focuses on the demonstration regarding transmitting and receiving the radio signals using the nR24L01 device in conjunction with the PCB Antenna which are inverted F antenna, nR24L01 connected with small piece of wire (8.5cm) and AN043 antenna.

To analyze the performance of this PCB antennas, a transmission rate test analysis were carried out at various distance. By changing the distance, transfer the data was measured by receiver device connected with ODLE display.

The AN043 PCB antenna has the optimized distance about 70 m communication device compare to other PCB antennas. The results obtained are allowed to conclude on the benefits and possibilities that the nRF24L01 device together with the PCB antenna are able to function as a transceiver.

Keywords: *PCB antenna, nRF24L01*

A NOVEL DEEP LEARNING BASED ENSEMBLE MODEL FOR PREDICTING THE BIRTH OPTION TYPE

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Conveyance is one of the most significant occasions in women's lives and having a healthy infant is a typical want. The neonatal period is the most susceptible time for an infant. Confusions can emerge during any phase of the labor process that may need immediate attention. For obstetricians, sometimes it is a very sensitive and complicated decision to select the birth option type whether Normal Vaginal Birth or C-Section. Usually the decision is taken based only on the obstetrician experience and manual reading of the CTG signal which might lead to cause labor complications. Through this research it has been introduced a Novel Deep Learning Based Ensemble Model to predict the Birth Option Type. The novelty compared to the other studies because of the forecasting CTG signal, aggregating with clinical obstetric risk factors and final prediction based on ensemble learning approach. As the data set, 552 CTG signal data used from PhysioNet's, CTU-UHB Intrapartum Cardiotocography Database. Proposed model scored with Accuracy (ACC) = 0.8763 (~1.0), Error Rate (ERR) = 0.1237 (~0.0), Sensitivity (SN) = 0.83(~1.0), Specificity (SP) = 0.9228 (~1.0), Precision (PREC) = 0.9151 (~1.0), False Positive Rate (FPR) = 0.0076 (~0.0), and for quality measurement Mathews Correlation Coefficient (MCC) = 0.7559 (~1.0) and F-Measure, F (2.0) = 0.8705 (~1.0) and ROC / AUC gives 0.92 (~1.0). For the forecasting models, accuracy tested with MAE, RMSE, shows considerable outcomes (<1.0). Finally, declare the Null hypothesis tested using p-Values. With that outcome, this work concluded aggregating the forecasted CTG signal components with obstetric factors using the hybrid model and predicting Birth Option Type is hypothetically accepted.

Keywords: *Cardiotocography, Fetal Heart Rate, Uterine Contraction, Deep Learning, Ensemble Models, Birth Option Type*

A NOVEL FACE RECOGNITION AUTHENTICATION SYSTEM BASED ON ONE-DIMENSIONAL STATISTICS

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In today's authentication biometric technologies, face recognition is the most popular and widely used technique. It is the most acceptable since it could be used without requiring object coordination. However, during the acquisition of the photograph, face recognition is vulnerable to variations in lighting and changes in the orientation of the face. The grayscale representation of the facial image is commonly used as an input function of face authentication systems. However, we suggest a new approach for improving the efficiency of these schemes based on one-dimensional statistics of the face picture and the use of color representation. For the transformation of the RGB colorimetric components of the original images, we evaluated many colour spaces. The findings from the various spaces and colorimetric components are coupled using a nonlinear fusion for classification with a single RBF type neuron network. This novel facial authentication strategy that achieves a 95.85% success rate using nonlinear fusion of the colorimetric components of the YCrCb color space and a 91.75% success rate while using grayscale. As opposed to the use of grey scale photographs, the rate of effectiveness has increased by 5%. The findings reveal much interest in developing a new solution that reduces processing time due to its flexibility and robustness when dealing with a vast database and that color information improves the efficiency of this face authentication scheme. We checked these methods on frontal photographs from the XM2VTS collection using the Lausanne protocol to back up our findings.

Keywords: *Face Recognition, Authentication, Gray-scale, Color Representation*

IDENTIFICATION OF ASSOCIATION BETWEEN NEIGHBORHOOD STREET ELEMENTS AND CHILDREN'S PLAY ACTIVITIES IN NEIGHBORHOOD STREETS: LOW – INCOME SETTLEMENTS IN MORATUWA MC AREA

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With the rapid development of cities land uses has been changed and fewer open spaces are remaining for children to use as playgrounds. In city environments one of open space type is streets. Streets are not just spaces; it has potential as places for children to engage in play activities. There are several street elements shaped street corridors and all those elements stimulate children imagination, creativity as well as behavior also. This Study focus on identify how quality of street elements motivate children's play activities in low-income residential neighborhoods streets. This study conducts in two low – income settlements in Moratuwa MC Area in Sri Lanka. These two settlements selected after considering about availability of street elements within these neighborhood streets. For the data collection, researcher used observations, structured questionnaire surveys, semi-structured interviews and cognitive mapping exercise. Descriptive statistical analysis, Relative importance index, narrative analysis and cognitive maps used to analyze those data. In the end of this study, researcher identified that green space is the most influence and supportive street element for children's play activities in neighborhood streets and traffic congestion, unhygienic roads, unavailability of street furniture, insufficient street width is the key barriers for street play activities.

Keywords: *Cities, Neighborhood, Cognitive maps, Unhygienic roads, Street furniture*

ROLE OF ARTIFICIAL INTELLIGENCE IN COVID - 19 ERADICATION PROCESS: COMPREHENSIVE REVIEW FOLLOWED BY FURTHER INNOVATIVE CONTRIBUTIONS

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Artificial Intelligence (AI) is a major sub set of Computer Science. It's beyond simulation of the Natural Intelligence that a human being having. It is merely a trending technology that leads to boost-up the power and capabilities of many other technologies. AI has a large range of its own sub domains such as Artificial Neural Networks (ANN), Machine Learning (ML), Fuzzy Logic (FL), Natural Language Processing (NLP), Robotics, Big Data Technology, Internet of Things (IOT) etc. Many recent innovative technologies being developed must be having a back-up from AI. Starting from Manufacturing, Agriculture, Medicine, Food Science, Management, etc. there are some AI backups, which leads to increase the technological efficiency rapidly. Health Science or Medical Science is a significant area that needs some critical contribution from the AI domain to up-lift its quality and to increase the efficiency. As we all know at the moment there is a Covid – 19 pandemic, that is extremely harmful to the mankind. The key intension of this paper is to discuss the contribution that can be made from the domain of AI, in Covid - 19 pandemic eradication process. First it would make some awareness on AI to the reader. Then the key sub areas such as ML, Big Data, on AI that can make significant contribution to the Covid scenario will be discussed. This discussion is based on a critical review from existing literature on many aspects, how AI scientists have contributed to get-rid from this pandemic. Afterwards further possible innovative contributions, that does not in the literature is identified. Possible difficulties and bottlenecks of applying AI based novel contributions will also be discussed. Finally the paper is concluded by identifying the significance of the role of AI in Covid - 19 pandemic eradication process from this globe.

Keywords: *Artificial Intelligence, Covid – 19, Pandemic, Machine Learning, Big Data*

SURVEY OF HERBAL PLANTS IN SURROUNDING OF DISTRICT SIDDHA HOSPITAL NARUVILIKULAM, MANNAR, SRI LANKA

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Medicinal plant survey was carried out in surrounding of District Siddha Hospital Naruvilikulam, Mannar, Sri Lanka for the express purpose of discovering the distribution of herbs and aware the public to fulfill the medicinal requirement and leads to a healthier life through medicinal plants. Ancestors named the village by using abundant herbs habited on this area. *Cordia dicheatoma* (*Naruvili*) plant abundantly distributed in this area. For the reason that, this village named as Naruvilikulam. There are 153 species belonging to 57 families were recorded. Family Fabaceae ranks at the top having 14 medicinal plants species. Around 27 species can be use as Spinaches and 15 species can be use in diabetic management. Habits such as Herbs(59), Shrubs(19), Torn Shrub(09), Creeper(07), Tree(18), Moderate tree(04), Climber(22), Grass(5) , Torn climber and Aquatic plant. Arid zone families that are Euphorbiaceae and Cucurbitaceae (09), Laminiaceae(08), Asteraceae and Amaranthaceae (07), Malvaceae , Arecaceae and Solanaceae (06) , Acanthaceae and Verbanaceae (05) , Zingiberaceae , Apocynaceae and Poaceae (04), Rutaceae, rubiaceae, Araceae and Capparaceae(03) are commonly distributed in this area. *Vernonia zeylanica* is medicinally important endemic plant species abundantly distributed in this area. The present investigation revealed that the medicinal plants still play a vital role in the primary health care.

Keywords: *Naruvilikulam, Fabacea, Arid zone, Spinaches, Plant Survey*

INFLUENCE OF PESTER POWER OF YOUNG CONSUMERS' ON PARENT'S BUYING DECISIONS WITH A FOCUS ON THE SRI LANKAN FAST MOVING CONSUMER GOODS INDUSTRY

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Pester Power is a growing trend in the global food and beverage industry. Many studies have explained that the adolescent plays the most important role in the family unit. Today's Fast Moving Consumer Goods (FMCG) market has made the shopping process for families even more social, enabling families to buy goods together. This family unit purchasing activity has provided a forum for young consumers to pester their parents about goods, even though it is not a requirement. Children under the age of eighteen are constantly targeted in advertising and promotions. Most businesses use child-targeted marketing campaigns to increase brand recognition and create a customer base with a higher customer lifetime value. As technology advances, companies have benefited from digital marketing tools like social media, which enable them to target their goods and brands to particular customer segments. Using naive theories such a theory of reasoned action, and consumer socialization theory, this paper represents a concept indicator model of factors that impact the genesis of pester power. The model was created by analyzing previous literature and indicating three key variables: demographic, psychographic, and informative. To summarize what has already been said, this research study will inform the reader about the type of phenomenon that exists in the Sri Lankan Fast Moving Consumer Goods (FMCG) industry, as well as the factors that have influenced its emergence.

Keywords: *Fast Moving Consumer Goods (FMCG), Pester power, Nagging behavior, Advertising, Marketing, Parent's purchase decision*

PRELIMINARY *IN – VITRO* STUDY OF ANTIMICROBIAL ACTIVITY OF TRADITIONAL MOUTHWASH PREPARATIONS

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Antimicrobial agents administered systemically or locally can help suppress periodontal pathogens. In *Siddha* medicine *Padikkaraneer (PN), Pancha thuvarpi kasayam(PT)* and *Mayakaai neer(MN)* have been used as a mouth wash as a general treatment for oral diseases . In this study, the herbal mouthwash preparations (HMP) were tested for its anti-microbial activity (AMA) against oral ulcer causing pathogens *viz, Candida albicans*(Fungus), *Escherichia coli, Pseudomonas aeruginosa* (Gram-negative) and *Staphylococcus aureus* (Gram-positive). Recommended guidelines in the *Siddha* texts were used to prepare mouthwashes. AMA of each HMP were checked using agar well diffusion method. Each experiment were done in duplicate and repeated thrice. The significance of differences among HMP were analyzed using mean values and one- way ANOVA. The model is significant ($p<0.001$), adequate (R square=0.994), interaction is significant ($p<0.001$) (HMP act differently in different organisms). It was observed that *PN* was the most effective between the three HMP and positive control tested. It showed a zone of inhibition (ZOI) against tested. *MN* showed a ZOI against *E.coli, P.aeruginosa,* and *S.aureus.* Whereas there was no activity against fungi. *PT* was found to less effective against both gram +ve, gram-ve bacteria and fungi. Study showed potent *in-vitro* activity of a HMP oral ulcer causing pathogens.

Keywords*: Anti-microbial activity, Oral ulcer, PT, PN, MN*

KINEMATIC ANALYSIS OF MEDIUM BOWLING

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The purpose of this study was to find out whether there was a difference in speed of release among Front-on, Side-on, and Mixed-on bowling techniques and determines which of the technique was most important for attaining high ball release speed. The purpose of the study Ten (10) male cricket bowlers each action namely side on- 10, front on- 10, mixed on- 10) were selected randomly from Northern Cricket Association Division players. Their age ranged between 18 to 28 years. The bowling performances of the subject were captured by a video using Sony (HDR-XR 55OE) camcorder and then the data were collected on the speed of release using KINOVEA motion analysis software. The obtained data were analyzed using the ANOVA (Analysis of variance) among side-on, Front-on, and Mixed-on techniques. From the result, it was concluded that Side-on action was the optimal technique for attaining high ball release speed compared to Front-on and Mixed-on action. These results are likely to be useful in both the coaching and choose proper bowling action in the early currier to medium bowlers.

Keywords: *Medium bowling, Side-on action, Release speed*

SOCIODEMOGRAPHIC, AMPUTATION AND REHABILITATION STATUS OF TRAUMATIC UNILATERAL LOWER LIMB AMPUTEES IN SRI LANKA

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Traumatic injuries are worldwide the main causes of limb amputations; South and East Asia having the highest prevalence. Sri Lanka has about 160,000 amputation patients as mere result of 30 years of civil war. We focus here on sociodemographic, amputation and rehabilitation data of a study sample of persons with > 6 months traumatic unilateral lower limb amputation, as part of a broader study. An observational cross-sectional study under 48 patients (70.8% male) from the Kandy Centre for Handicapped. Stump condition was good. Occupational engagement was reduced from 81% to 54% after amputation; 34% continued the original job but 67% worked less hours. Nine participants (19%) were engaged in forces before amputation; their monthly income was significantly higher (P=0.000) than those who had civil occupations and they also had got significantly longer rehabilitation (P=0.01). Thirty-three persons (69%) suffered from phantom pain, but there was no significant relationship with time since amputation or functioning. Thirty-four persons (71%) are using their prosthesis 'always'; 69% with high level of satisfaction. This was significantly associated with below knee amputation, as were mobility hours per day. Twenty-six persons (54%) were using predominantly crutches for mobility. This study sample concludes 27% job reduction, and in 67% less working hours. In general, a below knee leg amputation was related with higher mobility, more satisfaction with prosthesis and more prosthesis usage than above knee amputation. The subgroup of 9 military persons was better off than the civil persons in income and rehabilitation program.

Keywords: *Unilateral, Lower limb amputation, Traumatic injuries, Rehabilitation*

SECURE STEGANOGRAPHY IN BLOCKCHAIN

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Conventional steganography conceals secrete message inside an acquitted cover object such as text, image and video. The resultant stego file will be transferred to the receiver via insecure channel. Though the channel cannot be differentiate between cover object and stego object that contains secrete message, the adversary has the ability to interrupt and alter the objects in order to break down the secure communication. The shortcoming of this issue regarding the steganography inspires to introduce steganography in blockchain since an attacker cannot alter blockchain data once a block was created in the chain. A receiver will be able to completely retrieve the secrete message with respective secrete key. The proposed application presents the four layer of security mechanism to secure steganography. Digital image is used as a cover object. First, the original message is encrypted with RSA algorithm and encrypted message is embedded in image using LSB technique. The stego image is further encoded into long string using Base64 encoding mechanism. Finally, the miner embeds the encoded stego message into the transactions within a block. Data hiding in block is highly secured with encryption techniques. The proposed application combines cryptography and blockchain to prove extra layer security to steganography. To secure the data embedding process within a block, the method selects a part of transactions in a block according to the secret key, and embed the secret data by repeatable-address arrangement. Further, the application simply modifies and presents a new consensus algorithm to verify the file format in the block that means the algorithm will check the data string whether any alterations happened or not in the block. The results demonstrates that, it is difficult for an attacker to extract the embedded data since the miner collects normal transactions for generating a block and does not generate abnormal transactions, the data embedding process will not arouse suspicion, providing a high level of security.

***Keywords**: Blockchain, Steganography, Cryptography, LSB, RSA and Base64*

DERIVING INSIGHTS THROUGH OCRED JOB ADVERTISEMENTS VIA NLP

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One of the major problems in the Sri Lankan labour market is lack of availability of demand side information. This lack of information has created a gap between supply and demand of labour. This novelty approach of using Job advertisements would provide a wide range of real-time information about aspects, such as skills and qualifications that are in demand for Sri Lanka. The objective of this research is to create a structured dataset of job vacancies in Sri Lanka using publicly available job advertisements and derive insights. A total of 3500 images of job advertisements were scraped from Sri Lankan English newspapers and job websites and converted into text form using Optical Character Recognition (OCR). Next, a structured dataset was created by extracting information, applying a combination of rule-based and deep learning approaches in the Natural Language Processing (NLP) domain. The created structured dataset was then used to derive insights by using visualizations. This kind of insight would provide huge value to employers, job seekers and policymakers, providing an inside look into the current standpoint of the labour market.

***Keywords:** Natural Language Processing (NLP), Optical Character Recognition (OCR), Information Extraction, Labour Market Intelligence, Named Entity Recognition (NER), Bidirectional Encoder Representations from Transformers (BERT)*

HATE SPEECH DETECTION IN SOCIAL MEDIA USING TRANSFER LEARNING BASED LANGUAGE MODEL

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Social media is a huge platform for millions of users around the world to spread messages or content which make impacts on society. Hate speech in social media evolved into a serious issue as it spreads toxicity in the society and encourage racism, sexism, hatred or offense. Detecting hate speech in social media can help avoid spreading the toxic content. This has become a serious issue that is actively being addressed. We require not just an effective automatic hate speech detection model based on natural language processing and machine learning, but also a big enough amount of annotated data to train a model. In this paper, we proposed a framework that may be used to provide an effective solution for hate speech detection. To meet these demands, we bring a unique transfer learning approach based on BERT (Bidirectional Encoder Representations from Transformers), an existing pre-trained language model and Natural Language Processing (NLP). We evaluate the different fine-tuning strategies on the performance of this model. The performance was evaluated with different classifiers such as Naïve Bayes, and Support Vector Machine. To learn the misclassification, the manual annotations are used. We utilize publicly available datasets that have been annotated for racism, sexism, hatred, or offensive content to test our proposed approach. Finally, by doing extensive experiments, we were ultimately able to achieve the excellent performance on these datasets.

***Keywords**: Hate speech, Social media, Natural Language Processing (NLP), Fine-tuning, Transfer learning*

DISTANCE DETERMINATION OF NITRATE AND NITRITE IN GUNSHOT RESIDUE BY SUPPRESSED ION CHROMATOGRAPHY

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Gunshot residue (GSR) is commonly analyzed in forensic criminal cases and important to solve issues related to forensic caseworks. The quantity of this cloud is deposited on a target varies with the distance between the target and the muzzle end. The residues found around a hole of clothing is used to investigate the muzzle-to-target distance. Nitrate and nitrite ions is used as screening tools for investigating residues. Distance determination using nitrate and nitrite concentration in gunshot residues by suppressed anion exchange chromatography was developed. The test samples were prepared by firing into white fabric with different distances. Same square portion was removed from the target material using the bullet hole as the center. When increasing the muzzle end to cloth distance up to 2.0 feet, both nitrite and nitrate ion concentrations were decreased. For all extracted samples, nitrate concentration is much greater than nitrite concentration and there is no high difference of nitrite ions between zero and 0.5 feet from muzzle to target distance (1.28 and 1.22 mg/L respectively). Nitrate and nitrite ions between 0 to 2.0 feet from muzzle end, vary from 5.5 to 2.4 mg/L and 1.3 to 0.5 mg/L respectively. Test fires beyond 2.0 feet, nitrite and nitrate ions are not significant in target material. This method was carried out with 0.38 Special Arminius HW38 revolver with Federal 0.38 special, non-jacketed, lead bullet cartridge. Therefore, that is suitable for determine muzzle to target distance within 2.0 feet.

***Keywords**: Gunshot residues, Anion exchange chromatography, Muzzle-to-target distance, Nitrate, Nitrite*

EXTRACTING INFORMATION FROM REAL ESTATE HOUSING ADVERTISEMENTS OF E-NEWSPAPERS & WEBSITES IN SRI LANKA VIA OCR & NLP

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Real estate business is a major business area in Sri Lanka. Here housing property businesses are much popular. Advertisements of these housing properties can be found in new papers, magazines and in different online platforms. But there are no such sources, where the information about houses is extracted to a one place and given in a structured way. Further there is no proper analysis has been done in Sri Lanka about these real state housing properties. The purpose of this study is to provide information about real state housing properties in a structured way for real estate owners, brokers and property buyers. Furthermore, a proper visualization insight about the extracted information is also given. Here a structured database was created using Optical Character Recognition (OCR) and Natural Language Processing using images from the advertisements in various platforms. Web scraping was also used for scraping data from the internet. Finally, a descriptive analysis and statistical modeling was performed for deriving insights from the extracted information.

Keywords: *OCR, NLP, NER, Regular Expressions, Real State, Housing Properties, Web Scraping*

CONVERTING HIGH RESOLUTION MULTI-LINGUAL PRINTED DOCUMENT IMAGES IN TO EDITABLE TEXT USING IMAGE PROCESSING AND ARTIFICIAL INTELLIGENCE

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Optical character recognition (OCR) technology is used to transform printed or hand written text in paper materials into an electronically editable foam by the computers. Some well-developed OCR technologies are available for Latin based languages like English but not for languages like Sinhala or multi-lingual context. It is evident from the literature that lacking of a proper method to recognize multi-lingual text is still leaving as a problem that the present research community has to address, which has been identified as the key problem/research-gap for this research. The key objective of this research is to develop a multi-lingual character recognition system for printed Sinhala and English scripts, with the use of character image geometry features (CGF) and Artificial Neural Networks (ANN). It is expected at least to improve the solution to support three mostly used languages in Sri Lanka, including Tamil and so forth. Initially a large database of Sinhala and English character images were formed. Thereafter all the images were logically divided in to a number of horizontal and vertical zones. Then in each and every such zone, remained line particles belongs to character skeletons were classified in to some categories such as “horizontal lines”, “vertical lines”, etc. Then for such each and every zone, a “feature vector” was formed. Such feature vector consists of a number of elements such as the total number of horizontal lines, total number of vertical lines, etc. The ANN was trained based on these features. As such an every image contains a number of zones, it could go up to a significantly higher number of features for the purpose of training the ANN. Currently a success rate of around 80%, has been achieved with a database containing a well mixture of two thousands Sinhala and English character images. Finally the recognition of whole text from printed multi-lingual documents is experimented after extracting individual character data from such printed text documents and feeding them to the system.

Keywords: *Optical Character Recognition, Image Processing, Artificial Intelligence, Artificial Neural Network, Character Geometry Features*

A STUDY CONDUCTED ON THE PROBLEMS FACED BY THE PRIMARY MATHEMATICS TEACHERS WHEN MAKING AND USING TEACHING AIDS

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This research explores the Teaching Aids used in the 21st century Primary Education sector in Sri Lanka: Identifying problems faced by the primary mathematics teachers and providing solutions, as well as a broad idea on teaching aids and it needs for students. To accomplish the aim of the research, the closed ended questionnaires were used to collect the required data and Questionnaires were given as Cluster sample: from grade 1 to 5 sections in a private school in Sri Lanka. The information gathered via online questionnaires, online interviews and online observations. The collected data analyzed and represented in the percentage distribution of pie and bar graphs. The analysis of the data indicated that the majority of the primary mathematics teachers had positive perceptions on Teaching Aids but faced difficulties when making and using teaching aids.This finding will help to get an idea on the fact that mathematics is a vital subject and its teaching and learning as well as students' poor academic performance has become a source of concerns to all stakeholders. The problem of the study has investigate the effects of using of teaching aids to enhance the both primary school mathematics teachers and students' performance in order to provide a quality primary education. Teaching aids are an integral component in any classroom. The many benefits of teaching aids include helping learners improve reading comprehension skills, illustrating or reinforcing a skill or concept, differentiating instruction and relieving anxiety or boredom by presenting information in a new and exciting way.

Keywords: *Teaching Aids, Academic Performance, 21st century education system, Primary mathematics teachers, Teaching learning process, Perception and Problems faced by Primary mathematics teachers*

ERROR ANALYSIS OF WRITTEN ENGLISH ASSESSMENTS; THE CASE OF WRITINGS OF FIRST YEAR UNDERGRADUATES OF THE FACULTY OF MANAGEMENT STUDIES AND COMMERCE, UNIVERSITY OF SRI JAYEWARDENEPURA

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Error analysis has been considered as one of the major themes in the field of language teaching and learning J. Richard et al. (2002), Fang, X. & Xue-mei, J. (2007). The primary aim of the error analysis is to examine second language learner errors to identify the process of learning. This study presents the language errors done by a group of first year undergraduates, who are currently following the compulsory Business Communication courses (BCC 1340 / 1341), at the Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Sri Lanka. The students were required to write an official letter and a paragraph writing assignment on a topic given by the course coordinator, for which they were given marks. Based on the writings of students, the main objective was to identify the types of errors they commit and the various reasons causing errors. The research methodology involves both qualitative and quantitative strategies of collecting data. The qualitative data will be gathered through online interviews with the students and lecturers on the relevant Business Communication programmes and the quantitative data, through a questionnaire circulated among the students. The study intends to explore the manner the learner's acquisition of basic rules in English which will be beneficial for the teachers in general to develop their curricular.

Keywords: *Error analysis, Second language learner, Language errors, Error types, Acquisition*

THE BARRIERS TO THE SUCCESS OF ONLINE EDUCATION IN THE PRIMARY GRADE STUDENTS

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The entire world had to undergo a paradigm shift to face educational challenges due to the Covid 19 pandemic which hit the world since December 2019. Online education became the only solution to provide an uninterrupted educational service from Pre-school to tertiary education. This research is conducted to identify the barriers to the success of online education in Primary grade students, to identify good practices and what subjects' students mostly enjoy in the virtual school. A case study method was used to conduct this survey to get a comprehensive and in depth understanding of the topic discussed. The primary section of a leading Girls' International School was used for the study. Data collected through three surveys, focus group discussions, interviews, artifacts, and observation were analyzed quantitatively and qualitatively based on the nature of data. The research results revealed that lack of Students-teacher interaction, peer interaction, motivation, emotional imbalances, and schedule changing, device and network connectivity issues were identified as major barriers for the success of online education in the primary grade students. The good practices followed by the school were analyzed based on teachers' and parents' perspectives and the subjects that the students enjoyed in the virtual school was identified by comparing their performance, survey results and observations. There was clear evidence to state that maximum administration support and a well-organized training programme for teachers on digital literacy, designing, planning and preparation is essential to minimize the barriers for the success of online education in the primary grades in a pandemic like Covid-19.

***Keywords**: Online Education, Barriers, Primary Grades, Student Motivation*

NEXUS BETWEEN ASYMMETRIC INFORMATION AND STOCK MARKET VOLATILITY: EVIDENCE FROM SRI LANKA

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Stock price volatility is an essential phenomenon in equity valuation, derivatives markets, risk management, and portfolio investment decisions. The right measurement of stock volatility is a demanded task among the equity investment community. Volatility clustering and volatility persistence are successful assumptions on stock volatility modeling and forecasting. These two volatility assumptions are mainly driven by the impact of market news on fundamental factors of equity securities. However, there may have differences in distribution of information between market participants. As a result of that stock price volatilities may exhibit irrational behaviors which cannot be explained with fundamental market news. Therefore, fundamental volatility determinants deliver inconsistence empirical research findings irrespective of the market and its size. This study has examined the impact of asymmetric information in modeling the stock price volatility with relating to the Colombo Stock Exchange (CSE) market. In addition to that the role of macroeconomic variability has been examined for determining the CSE price volatilities. The EGARCH statistical method was undertaken to identify the impact of asymmetric information behavior in modeling the stock price volatility; whereas the Gross Domestic Production (GDP), inflation, interest rate, and money supply have been modeled as explanatory control variables with different Auto Regressive (AR) lags. The study has identified that the CSE market shows significant asymmetric information distribution behavior with negative volatility leverage. The inflation and money supply have significant influence on CSE volatility, however, GDP has little explanatory power. Furthermore, it was found that CSE price volatility has taken few weeks for responding to the macroeconomic variability based on lag interval results.

***Keywords:** Stock Volatility, Asymmetric Information, Macroeconomics, EGARCH*

ASSESSMENT OF EFFECTIVENESS OF THE PROCUREMENT SYSTEM IN THE UNIVERSITY SYSTEM IN SRI LANKA WITH SPECIAL REFERENCE TO THE UNIVERSITY OF MORATUWA

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Although the Public Procurement has increasingly become prominent in the public sector expenditure in Sri Lanka, very limited scientific research has been undertaken to examine the factors that influence the procurement performance in the Public Sector institutions. Since, the state sector universities of Sri Lanka are also run by the government expenditure measuring and reporting the effectiveness of procurement has become a very important aspect, mainly because, complaints exists insist that the public procurement processes are characterized by delays, poor quality and non-cost effective delivery. This study sought to analyze the procurement processes in achieving effectiveness of public procurement in university system in Sri Lanka with special attention to University of Moratuwa.

This study gives the reader an example of an approach on how to measure and report the effectiveness of the procurement process as the dependent variable through different independent variables namely procurement policies, competency of the staff and available resources. The selected sample for answering the questionnaire was the administration officers of the University of Moratuwa. Data collected was quantitative and was analyzed using descriptive statistics. Data was presented using tables and charts.

The results showed that there were positive relationships between effectiveness of the procurement process and the procurement policies, competency of procurement staff and procurement resources available. The most significant result was the strong positive relationship of competency of staff which mostly affect the effectiveness of the procurement process.

The study recommends that initiating a proper policy framework, enhancing the competency levels of the procurement staff and assurance of the availability of resources are essential for increasing the effectiveness of the procurement process.

Keywords: *Public procurement, Procurement performance, Government expenditure, Effectiveness*

Virtual Participants

KNOWLEDGE AND ATTITUDES OF FARMERS TOWARDS SYNTHETIC PESTICIDE USAGE IN VEGETABLE CULTIVATION: A CASE STUDY IN VAVUNIYA DS DIVISION, SRI LANKA

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The use of synthetic pesticides plays a crucial role in agricultural practices in many developing nations. Although in Sri Lanka, the agriculture sector is the backbone for generating revenue. Therefore, most of the rural householders are relied on agricultural activities to boost their economical standards. The objective of the study was to investigate the knowledge and attitudes of farmers in pesticide usage practices in the cultivation of vegetables in Vavuniya DS Division. Around 80 respondents were randomly selected to collect the required data through questionnaire survey and field observations. The probit, logit, and ordered logit regression models were performed to analyze the data using the statistical software R. The results revealed that around 68% of the farmers were males. About 63% of farmers were preferred to apply synthetic chemicals to obtain more income. Conversely, around 30% of farmers used personal protective measures to reduce pesticide contamination and 53% of farmers knew about pesticide toxicity. The average annual agricultural income and the average cropland size were 13,867 Rupees and 5.2 hectares, respectively. Farmers had an average experience in agriculture was around 14 years. The regression results showed that when land size increased by one hectare, agricultural income was increased by 2,187 Rupees on average. However, experience in farming and landholding size had a significant effect on agricultural income while farmers' age was reflected a negative effect on income with no marginal effect. Since there was the substantial influence of age, education, knowledge of pesticide toxicity, and experience on farmers' health status, usage of protective measures, and pesticide use acceptance levels. This study recommends that to conduct awareness programs regarding the use of personal protective measures and pesticide handling practices to enhance the farmers' knowledge and attitudes to prevent health impacts and to boost income by smart and sustainable agriculture practices.

Keywords: *Attitudes, Farmers, Knowledge, Synthetic pesticides*

OUTERWEAR WITH EMBEDDED SHAPEWEAR ELEMENTS: WHAT DO SRI LANKAN FEMALE CONSUMERS THINK?

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Since ancient times women have been using shapewear designed to be worn underneath the outer garment to reshape their bodies in a bid to have a fashionable figure. Many clothing brands have now introduced outerwear with shapewear properties that were previously available only with innerwear. However, these novel product types have not become popular in the Sri Lankan market yet. Therefore, this study focuses on finding out exactly what Sri Lankan female consumers think about outerwear with shapewear elements embedded in them. A questionnaire survey and shop visits were the main data collecting methods employed in this study. The findings showed that 50.8 percent of respondents used tummy tuckers, while 44.3 percent used high waist briefs. However, 80.3 percent of participants were not satisfied with the available shapewear products due to low comfort, poor breathability, and high compression level. Though outerwear product types with embedded shapewear elements are not available in the Sri Lankan market yet, 68.9 percent of respondents expressed a preference for office wear with shapewear qualities, while 65.6 percent preferred occasional wear with shapewear functions, and 59 percent preferred casual wear with shapewear functions. The findings of this study will prove beneficial for strategic planners as it will guide them to devise strategies to deal with the new product type. Fashion designers would also be able to design better outerwear with shapewear qualities and cater to the potential demand. The retailers too will be able to expand their product lines by introducing this novel product.

Keywords: *Consumers, Female, Outerwear, Shapewear, Shapewear elements, Sri Lanka*

EFFECTS OF CURRENT WELFARE AND BENEFIT PACKAGE ON THE JOB SATISFACTION OF THE DIFFERENTLY-ABLED EMPLOYEES IN APPAREL INDUSTRY IN A SELECTED SRI LANKAN CONTEXT

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The welfare and benefit package given to the differently-abled employees have become a point of contestation in the Sri Lankan apparel industry, because it is suggested that it should be improved to suit their actual needs and requirements. In this study, data is collected from such employees and their employers. This data is analyzed in order to assess the effectiveness of the existing welfare and benefit package and what improvements should be made to make it more helpful for the employees. The results of the study suggest that though most of the differently-abled employees are satisfied with the financial benefits that are given to them, they still feel the need for proper training, career guidance, career advancement opportunities, monthly/weekly meetings and special welfare activities. Especially, the employees feel that the companies had hired them to fulfill the required quota of differently-abled employees but not for the actual contribution they could make. However, when this issue was presented to the employers, it was denied. This paper discusses the reasons for this misunderstanding and methods of eliminating it, while raising the level of job satisfaction of the differently-abled employees. Primary and secondary data for this study are collected through questionnaires and from the reports of absenteeism and turnover of 2019 respectively in three selected companies in the apparel industry. The data analysis is done using the simple average system. Thus, this study proposes that the management should properly evaluate the sensitivities and vulnerabilities of such employees regarding their physical differences individually.

Keywords: *Apparel industry, Employees, Differently-abled, Welfare benefit package, Job satisfaction*

AN EMPIRICAL ANALYSIS TO IDENTIFY THE MAJOR FACTORS AFFECT THE HOUSEHOLD INDEBTEDNESS IN SRI LANKA (WITH SPECIAL REFERENCE TO KANDY DISTRICT)

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Households play a vital role in an economy and over the past few years the overall Sri Lanka's household debt portfolio has seen a sharp increase. The main objective of this study is to investigate the major factors associated with household indebtedness in Sri Lanka with special reference to Kandy District. For this purpose, primary data was collected through a structured questionnaire. All households who have obtained loans in Kandy were selected as the population while 200 households were selected as the sample by using quota sampling technique. A quota was given for each divisional secretariat division in Kandy District and simple random sampling method is used to select the desired number of households from each division for the sample. This study employs multiple regression analysis to explore the determinants associated with household indebtedness in Sri Lanka. The results revealed by the data analysis, identified that the most influential factor affect the household indebtedness as an intention of maintaining the social status by borrowing durable and luxurious goods. Furthermore, the study found that low-income families, financially illiterate, unemployed households and women-oriented households are living at higher risk for accessing to credit. Therefore, based on the empirical finding of this study, it could be recommended to formulate the policies to empower the poor to rely on their own income with the help of community development programs.

Keywords: *Household Indebtedness, Low Income Families, Unemployed Households, Women Oriented Households*