



University of Colombo, Sri Lanka

Annual Research Symposium 2013

*Higher Education through the State Sector of Sri Lanka
in a Competitive Knowledge Economy*

PROCEEDINGS

Proceedings of the Annual Research Symposium 2013

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A University with a Vision

“Inspired by historic links to the first University College of the country and inherited intellectual traditions, the University of Colombo strives to be a world class institution promoting human development through synergizing knowledge, education, research and creativity, and entrepreneurship whilst upholding democratic values in a plural society”

Our Mission

“To be the benchmark setting seat of higher learning and scholarship with an uncompromising commitment and dedication to providing society with human capital of high ethical standards, a proven sense of social responsibility, innovative, independent and analytical in thinking and capable in becoming partners of socioeconomic, cultural and environmental development”

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Message from the Vice-Chancellor



With the understanding of the need of contribution and commitment for Research & Development (R&D) from the top level management of the organization, I issue this message to mark the Annual Research Symposium – 2013 of the University of Colombo. Any academic institution cannot be considered as a fully fledged University, if it has no research contribution to the society and not involved in postgraduate education where research is the main component.

University teacher, who is a facilitator for knowledge dissemination and new knowledge creation, is always a researcher, and I urge the young academic staff members of our University to be genuine researchers. Genuine and

committed researchers would definitely be respected as good academics of the university system, and they are not just ordinary humans those who collect points to receive higher salary with decorative titles.

We, Sri Lankan nation is rapidly developing through the globalized knowledge-Economy where the competitiveness leading to innovation is the key driving factor. In the competitive knowledge - economy, the University system in the country has to play the main role while the political-will and a peaceful environment free of terrorism are provided by the state. The development is tightly connected to research- as two sides of a coin.

We are familiar with the word or phrase ‘R&D’ which clearly indicated the development cannot be achieved without its research component. I request from our researchers to orientate your research towards the development component of the Sri Lankan nation in a globalized setting. We are mainly a public funded University and we have a greater responsibility towards the Sri Lankan public that funds the so-called ‘free education’. The total dependence on public funds and foreign donations/ grants is changing as the University community is not prepared to be ‘prestigious dependents’ in the developing knowledge-Society of Sri Lanka.

Research and Development has no local standards, and it has only international standards that need to be maintained in all aspects. Colombo University is rapidly changing towards achieving international standards while having resistance from few elements which is natural in any human society. In all the countries of developed and developing world, modern research needs its compatible modern management system and modern attitudes for its sustainability. Almost all developed countries get the maximum and sustainable research and development output only through corporate management background. We strongly need to establish the corporate culture in our management system which is essential for modern international standards. We understand that international standards of research mean researcher’s attitudes as well as living standards at the International level.

I earnestly hope that the Annual Research Symposium 2013 will become the forum in which we can identify the challenges we face as researchers in a state University, and find constructive and practical solutions to these challenges.

Let me take this opportunity to congratulate symposium organizers, and also the researchers who have actively involved in this year's sessions by making available their knowledge and experience at the sessions.

I wish the Annual Research Symposium 2013 of the University of Colombo every success.

Dr. W.K. Hirimburegama

Vice Chancellor, University of Colombo

Address by the Keynote Speaker

Higher Education through the State Sector of Sri Lanka in a Competitive Knowledge Economy



What should be happening in the state sector higher education to be more effective as a partner/stakeholder in bringing about a competitive knowledge-based economy in Sri Lanka?

I would like to share with you some ideas that are based on a long association with education and little shorter association with higher education. Seeing the system as a student, a teacher, a curriculum developer, a staff developer, an administrator, chief executive, a policy formulator, an executive and manager in industry, member of institution-building teams, a consultant to industry, and as a person viewing the entire education system from early-childhood development, through general education, on-the-job training to continuing professional education.

In this address we are making an approach that is a combination of psychological and sociological. Why psychological? Because as Sri Lankans we suffer from some complexes. One is that Sri Lanka is a small country and therefore should be condemned to have our people suffering and not enjoying the benefits accruing from the creation of wealth. If we check country population tables we find that: we are comparable in population to Australia and bigger than New Zealand both of which call the shots when we wish to migrate; we are bigger both in population and land mass than the Netherlands and bigger in population than Portugal both of which colonized us few centuries ago.

We have seen in the past four decades an expansion of both higher education and tertiary education. The main thrust in tertiary education is in Technical Education and Vocational Training (TEVT Sector). This sector produces the skilled workforce that is essential for creating national wealth. In the very recent past the country recognized the existence of two “educational pyramids” one having at its apex the conventional “academic” universities, and the second pyramid populated by TVET institutions topped by the University of Vocational Technology.

The second idea that bugs our minds is that developing the globe is the same as helping to develop the US, UK and some other rich European countries. As a result we plan to produce graduates and other professionals who are ready to work abroad tirelessly in a subservient manner, and for wages that are less than what their “original” citizens enjoy. If these graduates were to opt for living and working in Sri Lanka they would be able to help develop our own country which is also a part of the globe. They would also be paying a debt they owe to their own compatriots.

The academic pyramid has at its apex the conventional national universities that turn out graduates who are ready to be educated and trained to become, teachers, administrators, researchers and in a variety of professions. The graduates are usually given a “generic” education in arts and humanities, sciences, medicine, law and other disciplines that make them ready to receive the education and

training to fit them to a specific workplace. Every graduate has to go through this essential stage of internship, apprenticeship or other induction before they can be practitioners. In the creation of lawyers, doctors (healers), engineers, managers and other professional who enter their career with a basic degree, professional bodies play a significant role in ensuring that professional practices are “drilled” into the graduate through an established process.

The state sector higher education as found now is woefully inadequate to meet the demands and challenges of a Knowledge-based Economy. It has failed even as an education provider to a developing economy in the six decades after our Independence, to produce the qualified academics and other specialist personnel in numbers and capabilities needed for our own institutions. Due to a combination of factors the national universities and the graduates turned out by them have increasingly become dependent on “imported” know-how and expertise. This is in contrast to other Asian countries that are progressive and doing better economically and socially than us. While these successful nations do blend knowledge gained by their nationals studying or working in developed countries, what they bring is internalized and absorbed into significant bodies of practice of their own.

I shall use the time available to identify the role of Higher Education in supporting a more competitive knowledge based economy. This includes first and foremost changing the mind-set of academics and those who manage state higher education. Irrespective of our stage of development, knowledge is the key to dealing with issues related to satisfying national needs.

In the creation knowledge it is important that academics do not dissociate themselves from rest of the society. They should be sensitive to national needs, and not only view these from a distance. Academics have both a leadership and operational role in fashioning a knowledge-based economy. Knowledge is created in working contexts and what is found in books etc is information that is brought forward from other places and times and cannot be applied directly in the “here and now.” There no best practices that can be simply transferred to our country from elsewhere.

They should be motivated by a desire to increase and enhance the potential of the nation’s **knowledge** resources. Time and effort must be devoted to finding out **what** needs to be done in every part of the country to improve the living conditions and livelihoods of the people. Successful knowledge-based economies have evolved societies in which benefits are shared more equitably. Our nation has a long way to go in this regard.

Competitiveness is about how as a nation we Sri Lankans thrive in the global marketplace by giving better products and services. We should also try to carve out niches that give us an advantage. It is also necessary to arrive at agreements with other nations from a position of strength and not as one that is dependent on others. Academics could help in this regard by inculcating competences and values in their students that are conducive their performance in the knowledge economy.

Academics should be recognized and rewarded for their contribution to national wealth creation though their own contributions and through inculcating competences in the graduates. Academic’s working in isolation solely for their personal benefit is not what is wanted. Departmental boundaries should not confine them. For a concerted national effort boundaries of departments/disciplines should be only for administrative convenience. Collaboration across administrative boundaries should be encouraged and supported. The Uva Wellassa University is a good example of initiatives in this direction.

Contributions to development of other nations through collaboration with foreign researchers are not what Sri Lanka needs. Although this appears to be “glamorous” there is hardly any national benefit from such exercises. There have been instances when the Sri Lanka was irreparably damaged due to such unwise collaboration. Those returning after gaining research qualifications abroad should address issues and problems in Sri Lanka, making use of their respective discipline or specialization. Continuing tie-ups with foreign connections should be thoroughly and critically examined.

Technology is not only about using tools and processes of manufacturing. There are also technologies that help to feed the nation, use natural resources to advantage, entertain, educate, and to even “process” people. Considering that we have to devise and build our nation’s physical and social environments we must develop our own technologies for our industries and organizations. Recently we heard a story about how a Sri Lankan company developed software which was very advantageous to stock-markets around the globe.

Any technology that is “transferred” has to be appropriately internalized by the users. The national universities can give leadership and expertise in this regard. The universities, research and development institutions and the industry must be locations where Sri Lankan technologies are developed. The universities should not degenerate to being “tutories” where technologies are learnt by rote.

There must be a nexus of national universities with the industry, TEVT sector and the General Education sector. These four sectors form a continuum that enables the flow of know-what and know-how, and the synergy that comes about as a result. The teacher assessment and reward schemes in state sector universities should take into account how they give leadership to initiating and strengthening this nexus. The students in schools can be our partners in gathering information about the country. Getting them to help us will also add meaning to their education and make learning enjoyable.

There is an insidious spirit of competition among our national universities. This is wasteful and should be discouraged by the University Grants Commission. Collaboration in staff and facilities development, sharing of resources, communication across institutional boundaries, student exchange and student collaboration in projects, and inter-university project teams that appropriately draw on expertise available in groups should be the order of the day. Every form of collaboration among state universities should be promoted, recognized and supported.

The University Grants Commission should be faulted if it allows any university to slide down due to lack of personnel and resources, and does not take appropriate and timely remedial action. In a system that is totally funded by the state and operated in conformity with state imposed rules, the only criterion for judging performance is the contribution to national good by the academics and graduates, and not by counting the number of graduates who find employment abroad. For a developing knowledge based economy, the UGC has to go beyond using indicators such as numbers graduated, and numbers of papers published by academics in refereed foreign journals. The most meaningful indicators are the contributions of academics and alumni to the economy.

The state sector universities must be places where persons from industry, members of the state bureaucracy, professionals, politicians, academics and students freely interact to share their interests and insights. They must also be home to think tanks, policy study circles/groups and policy research teams. These should be considered an essential part of the mandates of universities. In addition there should also industry service units and business development centres that serve all segments of

business and industry. Of special interest should be small and medium enterprises, assistance to which should be supported by a special fund in all universities.

A weak area in state sector universities is the physical infrastructure and service personnel that supports teaching, research and development and consultancy efforts. The key to the strengthening this area is the development of personnel in this area as professionals. They should even be afforded opportunities and resources to acquire relevant professional qualifications and be adequately remunerated.

In a knowledge-based economy “knowledge” is not confined to what is found in books, journals and other repositories. It resides as “tacit” knowledge in all working persons, especially those at operational level. It is also found embedded or built into devices and systems, standards, codes of practice, technical procedures and manuals. Of highest importance is the ability of educated and trained persons to be able to create knowledge through insightful involvement. This is not the same as academic research but the ability to enter a “knowledge-creation process” as demanded in all human activities.

Finally I would like to address an aspect that might not be ‘palatable’ to some- the issue of the medium of instruction in state sector universities. When the graduates are educated in and practice in their own national languages knowledge and technologies diffuse to the operational levels, thus making every worker capable of contributing to the ongoing improvement of industries. If we are to transform our economy into a knowledge-based one, we cannot escape having to make a considered decision about this aspect.

In the literature there is a reference to a comparison of some Asian countries. Both India and the Philippines educate their graduates in the English medium. On the other hand China, Japan, Korea and Taiwan which educate to the highest level in the national language medium. India and the Philippines lose the best of their graduates through emigration, whereas the other named nations retain their graduates who work together thus enhancing their global competitiveness.

When graduates are educated in and practice in their own national languages knowledge and technologies diffuse to the operational levels, thus making every worker capable of contributing to the ongoing improvement of industries. If we are to transform our economy into a knowledge-based one, we cannot escape having to make a considered decision about the medium of instruction in state sector universities.

Professor Lakshman Jayatilleke

Chairman,

National Education Commission
National Institute of Business Management
National School of Business Management

Address by the Guest Speaker

Higher Education through the State Sector of Sri Lanka in a Competitive Knowledge-Economy: Walking the Talk



The competitiveness of the national economy depends on unlocking the talents of our youth to contribute to the knowledge economy. We have produced graduates through a process of silo based education, a colonial legacy, what was then needed for an industrial age. The industrial age comprised of working in functional silos, arms length transactions with customers, low cost standardized products and services, protected domestic markets, perceived long product life cycles, white collar manager and blue collar workers, and traditional financial accounting. We now live in an information age in the knowledge economy, where the skills needed are vastly different from what was needed in that bygone era. It is now required to have complementary skills to manage intangible assets that comprise the larger value of enterprises. This requires cross functional business processes, closer relationships for creating greater value to customers, integrated raw material supply, production and delivery based on customer orders, customized services and products even for small orders without loading additional costs, catering to global customers with equal sensitivity as for the domestic customers, knowledge workers, and new strategic management tools. The knowledge economy requires a major commitment from the higher education institutions to produce knowledge and skills in keeping with the times. Entrepreneurial skills are specifically needed for all students today. Therefore academic programs delivered through knowledge silos have to be made more interdisciplinary/multidisciplinary catering with a different value proposition for stakeholders.

Universities as independent higher education institutions have a great opportunity to work together to rationalize scarce resources to deliver in-demand knowledge and technology. This would require research to develop knowledge and technology innovations that can contribute to the economic wealth of the nation and protecting Intellectual Property Rights (IPR). The commercialization of IPRs in collaboration with the private sector should become an essential expectation from a university. World Economic Forum, Global Competitiveness Report 2012 (p.8) points out that a strong innovation capacity will be very difficult to achieve without a healthy, well-educated and trained workforce that is adept at absorbing new technologies, without sufficient financing for R&D or an efficient goods market that makes it possible to take new innovations to the market. Thus the state sector being the leading contributor to higher education could immensely help to take us to the next level of development in a knowledge economy by taking leadership to transform higher education and research to meet the needs of the hour.

Chandra Embuldeniya

Higher Education Consultant

Founder Vice Chancellor, Uva Wellassa University of Sri Lanka

FACULTY OF ARTS



Message from the Dean



The Annual Research Symposium of the Faculty of Arts is a significant event in the Faculty's academic calendar due to several reasons. I am therefore pleased and honored to send this message for such an event.

The Symposium is significant because it showcases the current research conducted by academic staff of the Faculty, and thus engages all university academics, undergraduate students as well as postgraduate students in a multidisciplinary forum where research findings are exchanged and discussed. These discussions undoubtedly strengthen knowledge bases which then contribute towards the production of graduates of high quality by enhancing the teaching and research capacity of the academic staff.

The theme of this year's Research Symposium is "***Higher Education through State Sector in the Competitive Knowledge Economy***" and the Symposium will feature related presentations from the subject areas of Demography, Economics, Geography, Journalism, Sinhala, Sociology, Buddhist Studies, Political Science and Public Policy, English Language Teaching, English Literature and Linguistics, History, and International Relations.

The Research Symposium 2013 of the Faculty of Arts was made possible due to financial support from the *University of Colombo* and the *State Mortgage Investment Bank (SMIB)* and we thank them with great appreciation for their financial assistance.

The organization of the Research Symposium was a team effort by the entire Faculty. I wish to thank and congratulate the organizing committee of the Symposium. I also congratulate the presenters and wish them all the very best in their future endeavours.

Professor Athula Ranasinghe

Dean, Faculty of Arts

Faculty of Arts

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Prevalence of poverty and alcohol consumption among Estate workers: Evidence from Kahawatta, Rathnapura District

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Numerous studies in different countries have focused on finding a link between prevalence of poverty and alcohol consumption. It has been frequently highlighted that alcohol and poverty have a serious impact on the poorest populations in many nations. This study explored the current relationship between poverty and alcohol consumption among the Estate sector in Sri Lanka. The respondents consisted of 253 males. Poverty was used as an independent variable measured by income, expenditure, number of family members, education level and employment status. Data for this study was obtained from males from 'Opatha Estate' in Kahawaththa Grama Niladari Division in the Rathnapura District. Quantitative data was collected through a questionnaire administrated by the interviewer. This data was analyzed using bivariate analysis. Descriptive variables were also analyzed and frequencies and percentages presented in a table format.

The findings revealed that consumption of alcohol has become an integral part of the everyday lives of the Estate workers and also prevalence of poverty among these alcohol consumers was relatively high. In addition, it was revealed that the highest prevalence of alcohol was common among the people whose monthly income is below Rs.5000. Furthermore, poor households tend to spend a greater percentage of their income on alcohol consumption. The monthly income of family, having an occupation, use of alcohol and the number of children are significantly correlated with the education qualifications of population. Majority of the male workers stated that the main reason of using alcohol was to gain relief from fatigue and pain. Consumption of relatively expensive beverages such as arrack and beer was higher than local, cheap breweries such as kassippu and toddy among the Estate workers. These findings suggest that specially designed programmes are needed for reducing alcohol consumption and poverty among the Estate population.

Bilingualism and Social Multilingualism of Sri Lanka Creole Portuguese

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Sri Lanka Creole Portuguese is a language spoken by a few thousands of Portuguese Burghers in the eastern coastal area of Sri Lanka. These Burghers, with an ancestry of Portuguese and Dutch, show moderate linguistic patterns in their language proficiency. Bilingualism therefore shows a significant importance in their language usage.

In a recent research, it is identified that these speakers who are proficient in Creole, Tamil, Sinhala and English, are stratified according to their age groups which created distinctive patterns of bilingualism. These patterns describe the social, economic, political and geographical connections which they have encountered during their evolution, while explaining their present social existence.

The absence of a written form for Creole has created a tendency to acquire a strong second language which they use as the social language in their day to day life. Therefore, at any stage of their life, bilingualism plays a vital role that is integrally bound with their social existence. Chronological circumstances they have passed have created a platform to experience a social multilingualism on which the speech community is based.

The purpose of this study is mainly to find the possible patterns of the bilingualism and social multilingualism of the Creole speakers which demonstrate the social behaviour of the language. Interviews and other sociolinguistic research methodologies will be used in this research. Stratification of the second and third languages in contrast to their mother tongue, i.e., Creole will be identified as the intended outcome of the research.

Therefore this research will be useful for the understanding the use of bilingualism and social multilingualism in similar creole communities which encounter a close contact with the adjoining dominant language communities.

Salinity, pH and turbidity changes of water in the Negombo lagoon

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The Negombo lagoon is a lagoonal estuary situated in the Gampaha district. It receives surface runoff water mainly from the Dandugam oya, Ja-Ela, Hamilton and Dutch canals. The present study has been carried out to identify the characteristics of salinity, pH and turbidity of water in the lagoon during October 2012- March 2013. Samplings were done in 20 locations.

The overall average salinity levels of water in surface and middle layers of the lagoon were varied between 15.34ppt – 15.53ppt and it was 17.23ppt at the bottom. pH of water in all three layers fluctuated between 7.68-7.75. The highest overall average turbidity of 24.99 NTU was recorded at the bottom, while average turbidity levels of surface and middle water layers fluctuated between 10.44 NTU -12.89 NTU.

Spatially water salinity was decreased towards the southern periphery of the lagoon from the outlet due to dilution. However, it was comparatively high in the South West region of the lagoon, apparently due to direct influence of the water influx from Hamilton canal. Water salinity of the lagoon increased vertically from top to bottom owing to density of water. In the northern half of the lagoon, a relatively high concentration of average pH has been observed. However a considerable increment of pH could not be identified from surface to bottom layers during the considered period. The turbidity of lagoon water had an increasing trend towards southern fringe from its northern outlet. The water in the lagoon is directly influenced by the sediment discharged by Dandugam oya, Ja-Ela and Hamilton canal. Thus the Negombo lagoon can be differentiated into two regions, based on the salinity, pH and turbidity of the water. On an overall basis, spatial distributions of salinity and pH levels of the lagoon have a negative relationship with turbidity of the lagoon water.

Higher Education for Twenty First Century (HETC) 2011 project is acknowledged

Community: A territory of freedom, security and government

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This paper presents a conceptual analysis of the concept of community paying close attention on how this concept has evolved in social theory in relation to the notions of freedom, security and government. Examining the theories of classical sociologists Emile Durkheim and Ferdinand Tönnies and later social theorists Benedict Anderson and Zigmunt Bauman, this paper attempts to understand whether communities in human social life are *real* or *imagined*. This textual analysis of governmental theories and sociological theories looks at the role of social research in solidifying the evidence for the existence of communities. With the assertion that the notion of community is already part of our *doxa*, it is argued that understanding how humans reproduce this phenomenon is essential in understanding human social life. Thus, looking at the emotional and affective aspects related the members' experience of belonging to a community, this paper tries to uncover the tensions that exist between the notions of freedom and control in relation to community life, and also attempts to understand the sense of security community provides for its members in the modern era. Along the ideas presented by Peter Miller and Nikolas Rose, this paper seeks to examine the implications of the emergence of a new form of community in the modern world on our understanding of 'the social'. Looking at the contemporary use of the term community within the present political rationalities of the world, it is argued that there is a shift in governmentality to 'government through community' from 'government through the social'. This paper closes with an examination of how the new form of community, while creating a new territory of self-governance, has also created a new territory which renders itself possible to be governed 'at-a-distance' by legal and socio-political mechanisms of current socio-political rationalities of the world.

Neuro-Linguistic programming: A competitive support for slow learners in the state education sector

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This paper is on a pilot study of a research on developing the second language skills of primary school students, based on the theoretical framework of neuro-linguistic programming in education. It hopes to help struggling slow learners who need a student centered approach to make them fit into the mainstream classroom (Blackerby 1996).

Neuro-Linguistic Programming was introduced by Bandler and Grinder as an 'art of communication excellence' and 'the study of the structure of subjective experience' (McWhirter 1992). NLP could be regarded both as a technology for communication and personal development, and a methodology or modelling process (Cameron-Bandler et al 1985; Dilts 1998a; Jacobson 1994).

Research problem: challenges faced by teachers on how to respond to individual needs of children with disabilities and special learning needs in primary classrooms.

Research question: could neuro- linguistic programming in education help slow learners in the primary classes improve 2nd language skills?

This is a Quasi-experimental research. Quantitative and Qualitative data was obtained through exam results, attendance, teacher / researcher observation and student feedback. Out of the identified 24 slow learners (n=24) 50% were the experimental group and 50%, the control group .

58% of the experimental group had an average improvement of 09 marks. 42% had an average 08 mark decreases. Attendance of 75% students was over 80%. Of the students 100% indicated enthusiasm and interest. All three teachers (100%) interviewed reported improved attitudes of students. Researcher observed a change of feeling and mood among students.

Control group - 58% had an average improvement of 13 marks. 42% had an average decrease of 07 marks.

Some quantitative findings are ambiguous, thus independent variables of both groups should be investigated. As the study is on-going, a further intervention in the experimental group is needed to reach a conclusion.

Attitudes of heritage learners toward heritage language preservation: A case of Sinhalese in Southern California

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A heritage speaker is someone who grows up with a certain family language in the home which is different from the dominant language in the country. The role of speakers' attitudes towards heritage language maintenance has been a core area of sociolinguistic research in past few decades. While the minority languages in any contexts seem to be at risk of extinction, it has been reported that the language shift or language loss is more common than the language maintenance among the immigrants' children (Fishman 1966; Ports & Rumbaut 2001). Some scholars argue that language maintenance among immigrant groups is viable than the languages of indigenous minority groups, as those languages are not necessarily minority languages at their home countries, and they can learn it through heritage language immersion classes or during visits to the homeland (Hinton 2001). Attitudes towards mother tongue and its maintenance have been the driving force for such efforts. Maintaining and upholding minority languages and cultures lie, among many other things, in the hands of the young generation (Letsholo 2009); hence, their attitudes of younger generation toward their mother tongue has a major importance in their language maintenance.

The current study investigates a sample of second generation Sinhalese children's attitudes towards their heritage language (Sinhala) in an English majority context. The main research question at investigation in this study is how Sinhalese heritage learners perceive their language and its maintenance in a context where the majority language and culture are different. It also investigates the socio-cultural motivations that influence their attitudes towards their mother tongue.

Road accessibility and its effects on rural poverty: A case study of Opanayake AGA division in Rathnapura District, Sri Lanka

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Widespread and persistent poverty is a continuous problem in Sri Lanka, especially in rural areas. The lack of road accessibility leads to geographical, social, and economic isolation of the population, especially of the poor people in the country. In other words, it can be said that inadequate road accessibility contributes to poverty indirectly stemming from broadly based economic development. Most of the direct poverty-targeted interventions (schools, health clinics, nutrition programs, and social services) depend on transport as a complementary input for their effective delivery. Therefore, it is desirable and timely to study the impact of road accessibility on rural poverty in Sri Lanka. The aim of this study was to analyse the effects of road accessibility on poverty in the Opanayake AGA division.

Three variables were considered to accomplish the aim of the study: primary and secondary data were used to analyze the effects of accessibility on rural poverty. Primary data were collected from questionnaires, surveys and using other qualitative and quantitative techniques. 20 questionnaires were distributed among Grama Niladari officers of 20 GN divisions. Secondary data were collected from Census and Statistic Department of Sri Lanka, (2002) and Road Development Authority of Sri Lanka (2007). Microsoft Excel, SPSS and Arc View GIS 3.2 software were used for the data analysis and mapping.

The key findings of the study are low efficiency of the roads and insufficient density and quality of the roads in the area have a direct impact on the monthly income of GNDs, Samurdhi householders and householders of low income (less than 3000 rupees per month) of the population. According to the considered variables, the Grama Niladari Divisions (GNDs) of Akarella, Meegahawela, Liyanagoda, Opanayaka, Malmeeekanda, Hunuwala South, Galkanda, Batadura, Madola, Dandeniya were identified as the positively correlated GN divisions between poverty and road accessibility.

The Rajapaksa Doctrine in the making: Sri Lanka's foreign policy orientation since 2005

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President Rajapaksa expressly provided in his election manifesto that he shall conduct a non-aligned foreign policy. Subsequent to the dénouement of the protracted conflict in 2009, Sri Lanka's relations with its neighbours and other actors in the international arena engendered features of non-alignment. However Sri Lanka had experienced diverse foreign policies since independence. Nevertheless President Rajapaksa's Independence Day speech at Trincomalee in 2013 cogently established that post war Sri Lanka is a country with a non-aligned foreign policy. Moreover given the fact that Sri Lanka has been the cynosure of international fora such as the United Nations Human Rights Council and the Commonwealth it is of cardinal importance for this island nation to adopt and maintain a non-aligned foreign policy. In addition, India's fear psychosis and threat perception on the "string of pearls" strategy, involvement of China, Russia and the U.S., Sri Lanka's growing ties and cooperation with the ASEAN nations, the non-aligned movement, and the Shanghai Cooperation Organization must also be taken into consideration in observing Sri Lanka's non-aligned foreign policy orientation.

This research intends to address contemporary issues contributing to the foreign policy making of Sri Lanka since 2009. In addition, such an analysis shall be conducted in the light of George Modelski's views on foreign policy. Moreover Geoffrey Stern's ideas on "foreign policy making" are used comprehensively to evaluate Sri Lanka's foreign policy. The author nonetheless intends to analyze "how post war Sri Lanka would benefit from a non-aligned foreign policy." The paper shall further look into the factors which distinguish neutrality from non-alignment.

Strategies to empower language proficiency of undergraduates in state sector institutions

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Access to education and knowledge in every field of study is currently available in English. However, the shift to English medium education from mother tongue education is a challenge to many students in the Asian context (Fan 2001). Although several attempts were made through educational reforms, policies and projects to facilitate English education in Sri Lanka, students entering the state sector higher education institutes do not possess a satisfactory level of English proficiency (Wijeratne 2008).

Studies in language proficiency in undergraduates have revealed that it can be enhanced through vocabulary development as they correlate significantly to each other (Fan 2001). Ilangakoon (2011) tested the significance of the General Service List of most frequent 2000 words in English and the Academic Word list of 570 academic words (Coxhead 2000) in academic texts and established their significance in vocabulary teaching.

Currently, there are no focused attempts in most English proficiency courses in building the word power of students. The theories proposed in vocabulary research such as implicit and explicit teaching of vocabulary, taking students from receptive knowledge to productive levels of vocabulary knowledge (Blachowicz, Fisher, Watts – Taffe 2005) activating prior knowledge are some aspects that have to be built into the strategies and activities that should be incorporated into the programmes for vocabulary improvement that will enhance learner language proficiency. It is felt that the identified vocabulary be taught in the language courses using strategies and theories suggested in order to ensure deep learning.

The study also attempted to analyze student perceptions on best strategies they themselves use or would like to be taught. The aim of familiarizing students with strategies is that they are empowered with tools for self-study and development that will take place in lifelong learning.

An economic analysis of the resettlement of IDPs in the post-war Eastern Sri Lanka

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This paper looks at selected findings of a doctoral research conducted on the livelihoods recovery of post-war resettled people in Sri Lanka. The researcher selected a war affected village that had received extensive housing and livelihoods donor aid, and conducted a series of quantitative and qualitative surveys in 2011 to measure the income recovery levels of the members. The main research question was “what is the impact of housing and livelihoods assistance on the economic recovery of former IDPs who had been resettled?” Sub questions looked at the role played by five livelihoods capitals, the relationships they have among each other and external processes. The theoretical framework for the study was drawn from the DfID Sustainable Livelihoods Framework (SLF) and the Impoverishment Risks and Livelihoods Reconstruction (IRLR) model, and the information was analyzed by way of triangulating case studies, quantitative data using graphs, and regressions that looked at income recovery along with housing and livelihoods aid and other influencing factors. The findings using mixed methods suggested that there was no significant or positive relationship between housing assistance and income recovery, while there were consistent results that livelihoods aid directly supported the recovery and economic sustainability of the people, in spite of the fraction of resources allocated for the sector. The regressions in particular showed a very significant relationship between livelihoods assistance and income recovery along with other factors such as the beneficiary’s sex and health. Further it was revealed that those who received larger housing packages ended up poorer, in the long term, than those who received more modest grants, implying that the resource weights currently allocated among housing and livelihoods needs reviewing by policy makers to increase aid effectiveness.

Re- reading the past: Debates on women's chastity in the nineteenth century Sri Lanka

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The nineteenth century life of Sri Lanka was determined by the domination of colonial powers and resistance against it. This phenomenon brought out profound changes in societal structures and is deep rooted in society even up to date. Determining the gendered identities of Sri Lankans and demarcating of ethnicity by means of that was a consequence of the said phenomenon. As a result, the idea held by society at the time about what is a man or a woman reshapes and appears as a determinant of culture and tradition of present day ethnic groups of Sri Lanka.

By the late nineteenth century, the people of Sri Lanka were debating about how a civilized society should behave. These ideas have had a profound impact upon the minds of the leadership of Sinhala cultural nationalist reformers. Thus, one of the main items on the agenda of reforms was to 'restore' pre-colonial Sri Lankan society based on Buddhist morality. Regulating sexuality became one of the central themes in this endeavour and many debates sprang up on women's sexuality and their role in society.

The aim of this research is to retrieve and re-read some the published documents (written by women) regarding women's chastity, their role and behaviour in society in order to understand how sexuality was constructed in the intellectual milieu of the nineteenth century colonial Sri Lanka.

This will be a library research by way of collecting data from the National archival documents and university library collections. This research aims to retrieve some rare documents of the late nineteenth century on women's chastity and behaviour in Sri Lanka. Therefore, content analysis and discourse analyses will be the methods of data analysis. Selected documents include *Pativurtavadaya*, *Anganagunadapana* and *Kevuldamaalaya*.

Factors affecting children's education in urban settlement communities in Colombo

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It is widely evident that parental socio-economic factors significantly contribute to their children's human capital investment and well-being. Parental occupation and education are two key factors in decision making towards their children's education. It is evident that the lack of parental awareness and a low socioeconomic environment lead children to engage in child labour without continuing their education. In addition, children's poor commitment towards education will create a lack of protection and vulnerability within the community. Therefore, this paper aims to examine the factors associated with children's decreased participation in secondary and tertiary level education in urban settlement communities. The study is based on both qualitative and quantitative data gathered from two selected urban settlement communities in the Colombo district. The sample size is 100 households with children of age 5-18. In addition, 10 case studies will be analyzed. Descriptive and multivariate analyses are applied for the quantitative data while content analyses are made for the qualitative data.

The findings reveal that more than 90% per cent of the parents had low levels of education (below G.C.E. Ordinary level) which had a significant impact on their children's schooling and attitudes towards education. In addition, a majority of children who were aged 15-19 responded that they had lower intentions to continue education due to their parents' lower economic background. However, younger children who were aged 10-14 had higher intentions to complete their education up to G.C.E. O/L. Young children's positive attitudes towards education were associated with the intervention programmes which are being conducted by the government organizations in these locations. Furthermore, results make it evident that parental occupation also negatively affected their children's intention towards higher education. The qualitative findings also discovered that several community and environmental factors such as poverty, drug addiction, lack of awareness and encouragement, lack of resources and facilities, and parental attitudes towards education largely contributed to school dropouts and children's decreased intention to continue education.

Financial assistance from the University of Colombo is acknowledged.

An evaluation of the dairy cattle farming of Monaragala District in Sri Lanka: A study with reference Pahalagama G.N. division of Buttala D.S. division

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In Sri Lanka a small proportion of farmers depend on animal husbandry for their livelihood. Monaragala, Hambanthota, Ampara, Polonnaruwa and Anuradhapura are the major districts important for livestock. The main livestock products in those districts are milk, meat and eggs. Animal husbandry plays an important role in the rural economy in improving the living conditions of farmers in the country.

Since 84% of the country's milk requirement is currently imported, there is an urgent need to develop the capacity for greater self-sufficiency in milk production. Milk affects the growth and development of the body during childhood and adolescence. Thus, milk can be used to educate the public on essential nutrition that contributes to a healthy, balanced diet.

However, there has been a significant drop in the number of cattle during the past two decades. Many years ago, in the study area, a large number of cattle was raised for milk production, and around 50% of families used cattle and buffaloes for agricultural work. At present, only a few families keep cattle and buffaloes for milk and agricultural work. This decrease in cattle is common in Sri Lanka due to various reasons. Consequently, Sri Lanka has to face serious problems in milk production and agricultural needs of the rural areas. Therefore, it is essential to increase dairy cattle farming in Sri Lanka to build a healthy community.

This study has three objectives: to find out the present dairy cattle population, dairy farmers and milk production in the study area; examine the reasons for the decrease of milk cattle in the area; and make suggestions to develop the dairy cattle farming in the area.

To achieve the above objectives, four villages in the Monaragala District will be studied. Two types of data will be used. Primary data will be obtained from a questionnaire survey, field observation and focus group interviews. Secondary data will be obtained from the Department of Livestock, resource development board, and from the relevant published reports.

The application of mind mapping as a technique to enhance collaborative, creative and innovative learning among Geography undergraduates

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Mind Mapping can be considered as a method that helps students to enhance and accelerate their learning capacity effectively in a creative and innovative manner. This method is also popular as an efficient brainstorming technique. Tony Buzan (founder of the strategy) pointed out that, it is an extremely effective technique for sharpening the thinking and learning process. It can be used in nearly every activity where thought, planning, recollection or creativity are involved (Buzan, 1989, cited in Mento *et al*, 1999). Thus the aim of this study was to apply the Mind Mapping technique to enhance collaborative, creative, and innovative learning among Geography undergraduates.

In this context, the technique was applied to the first year undergraduates who followed the Cartography Course unit (GYG 1102 / GYG 1202) at the Department of Geography, University of Colombo in 2012. All the students of the Cartography course unit were engaged with this practice (population = sample).

In the geographical literature, this technique has not been tried out with Geography undergraduates in Sri Lanka.

The resultant Mind Maps revealed that the students were able to think and analyze one aspect in different perspectives (angles) very creatively. This was the main benefit which they obtained from this practice. The technique was also identified as one of the best techniques that can be applied in many situations of a learning process.

The analysis of students' feedback revealed that 86 per cent of students identified Mind Mapping as an active, creative, and collaborative learning technique. The practice enabled students to be more innovative in their learning process. Some students stated that they can apply the technique successfully to another situation also and some expressed that they can relate the experience significantly in different contexts. Mind Mapping was identified as an effective practice that helped students to enhance their learning capacity.

How effective is the female headed household? A study with special reference to education poverty in the Eastern province of Sri Lanka

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This paper investigates the effectiveness of female headed households in comparison to male headed households in terms of economic wellbeing and vulnerability to poverty in a society where violent conflict is an ex-post vulnerability. Hence, this study is significant for the reasons of providing the empirical understanding into conflict affected societies where gendered statistics have so far been difficult to collect due to violence and captures a multi-dimensional reality of both horizontal and vertical inequalities of men and women of all ethnicities, and amplifies the need of conflict prevention through strengthening vulnerable groups and households that may otherwise provide causes for future conflict.

The study uses primary data collected from a sample of 120 households, in the Seruvila divisional secretariat division of the Trincomalee District and uses a Principal Component Analysis (PCA) to determine the important factors explaining household poverty. The principle component method identifies interpretable factors. Furthermore, interpretable factors are extracted to develop a composite poverty index to measure the disparities.

In conclusion, the findings so far indicate that education can act as a determinant of poverty in the rural eastern regions of Sri Lanka. Furthermore the deficiencies in adult literacy especially among the Tamil and the Muslim female headship can be seen as a major impediment to household welfare. The paper also finds that the conflict driven vulnerabilities and post conflict responses of women demand specific assistance, because assets and livelihood sustenance of female headed households are at risk compared to that of the male headed households. Thus, it is evident that level playing type post conflict economic interventions, ignoring gender, have failed to establish economic security of females, fathoming the socio-economic marginalization of female headed households.

Modernity, culture and the good: A reading of the work of Lester James Peiris and Gunadasa Amarasekera

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This paper analyses the work of Lester James Peiris and Gunadasa Amarasekera from the perspective of cultural modernity, taking such work as symbolic representations that portray Sri Lanka's encounter with Western modernity. It examines Charles Taylor's critique of acultural theories that consider modernity the outcome of the dissolution of false beliefs and institutional changes, thus glossing over the new conception of the moral order with its visions of the good that, Taylor argues, is the foundation of Western modernity. Central to this conception is the constellation of a sense of the self and its relation to society and the good as moral ideals that explain the processes of change in cultural materialities; the rise of new individual identity and the reconception of human society creates space for common action in profane time. It thus also creates room for the modern public sphere. The paper discusses how such a view comes into conflict with the expectation that encounters of non-Western cultures with globalising forces of science, technology, and industrialization would inevitably bring modernity to them. In this context, Wimal Dissnayake's theorising on cultural modernity, which treats culture as the site of contestation for ideological hegemony, assumes significance. Seen from the above perspective of Taylor, a view that takes power, domination, exploitation, and manipulation as key factors that determine cultural change needs to address concerns raised from the perspective of culture as representing moral ideals. This paper explores such tensions involved in the analysis of Sri Lankan cultural modernity. It develops an understanding of how Sri Lankan culture seeks to integrate the globalising forces of modernisation. Finally, it analyses textually the symbolical manifestations of the formation of the constellation of background understanding and the social imaginary, which place us in relation to others and the good.

**A sociological analysis of experiences of administrative and
environmental management aspects of Menik Farm welfare camp,
Chettikulam, Sri Lanka**

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Menik Farm was a welfare camp in Chettikulam, Vavuniya during and after the final civil war of North and East Sri Lanka. It was one of the largest welfare camps in the world with around 300,000 Internally Displaced Peoples (IDPs) who were physically and mentally affected during the war. Since this camp was maintained by a special administrative mechanism with the main intervention of military leadership, it became a subject of much concern and criticism all over the world and was closed in September 2012. The main objective of this study is to sociologically analyze the experiences of administrative and environmental management aspects of Menik Farm welfare camp. This study was mainly based on an explorative qualitative methodology. For this purpose, the key informants of IDPs, project officers (NGOs), state officers, and military authorities were interviewed and subjective and critical qualitative data of the welfare camp were collected by in-depth interviews. Informal discussions, direct observation and reviewing of relevant secondary documents were carried out for critical understanding.

The joint mechanism formed with SL army, SL government and international agencies (NGOs) was timely and useful to manage war related disaster even with some limitations and difficulties. This collective approach of handling around 300,000 of IDPs is a new experience to the field of disaster management. The grievances and psychological problems of IDPs were immense at the beginning and not properly addressed. However, IDPs were satisfied with the some basic fulfilments in the welfare sites. The IDPs were of the opinion that their culture and the future of their children were destroyed in Menik Farm. They were concerned about their independence, identity and returning to their native places.

While the drain and environmental services delivered to welfare site were generally a success, there were considerable weaknesses and problems due to structural issues (soil and topography) of the welfare sites and socio-psychological background of IDPs. These sanitary projects have paid less attention to women, children, cultural notions of dirt and ecological sanitation.

Demographic and socioeconomic changes in post -Tsunami communities in Sri Lanka: A case study of Habaraduwa

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On December 26, 2004, the Indian Ocean generated a Tsunami as one of the biggest natural disasters in modern history. The Tsunami disaster affected coastal areas of Indonesia, Sri Lanka, India, Thailand and also few other countries. Sri Lanka was also one of the highly affected countries and about two-thirds of its coastline was destroyed. The Tsunami affected not only on the lives of people, but also destroyed their houses and livelihoods and many other assets. As a result, during the recovery period, the government took steps to remove the people from in high-risk areas, and resettle them in to low-risk areas.

This paper attempts to investigate the demographic and socioeconomic changes in post-tsunami migration communities in Sri Lanka. Habaraduwa Divisional Secretariat (DS) in Galle district which was reported as one of the areas severely affected by the Tsunami was selected for the study. This DS includes the 16 resettlement communities which comprise 657 households. The sample size was 150. Data was collected using interviewer administrated questionnaires.

The results reveal that people who were severely affected by the tsunami were more likely to migrate than others. In addition, more than a half (55%) of migrants reported that their initial family size had reduced due to the deaths in the Tsunami. Furthermore, desired fertility among women who were in ages between 35 and 39 had increased during the Tsunami period. About 65% of women in that age group reported that they prefer to have an additional birth. Moreover, it was also found that livelihood activities of migrants had changed in post-Tsunami period. A significant proportion of migrants reported that they had changed their occupation from fishery related employment to self-employment and private sector employment.

These results suggest that the Tsunami disaster has had a positive impact on the socioeconomic development of the affected communities.

Partnering with non-state actors for higher educational enhancement: An analysis of UN contribution to Sri Lanka

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“Education” in every aspect is one of the most fundamental factors of development (Sri Lanka Human Development Report, 2012). Sustainable development in any aspect cannot be achieved without investing in human capital. Education enriches people’s understanding about themselves and about society. It improves the quality of life, raises people’s productivity and creativity leading to economic and social progress.

Sri Lanka as a nation which maintains a free education policy, has achieved tremendous progress in human advancement extending the literacy rate over 92 % (BTI Sri Lanka Country Report, 2012). Granting school education free for every child has created this victorious situation, upholding Sri Lanka equal to a developed nation in terms of its literacy rate. However there are numerous challenges to be met and overcome.

United Nations (UN) as the most prominent Inter- Governmental Organization (IGO) in international relations is working closely with Sri Lanka with the aim of facilitating Sri Lanka to achieve national and international educational goals. In general terms, UN has given increased attention to the educational sector, recognizing that education is one of the key elements of sustainable development.

The main objective of this research paper is to analyze the UN contribution towards the Sri Lankan higher educational sector, focusing on the UN general educational policies and its major collaborative programs in Sri Lanka.

Mainly, this study would be an archival based research that would focus on UN reports, UN Charter, Child Rights Convention, UNDP and UNESCO publications. In conclusion, this partnership has created many opportunities for the Sri Lankan higher educational sector by enhancing its position in the competitive knowledge market.

Women's education and contraceptive prevalence in Sri Lanka

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Sri Lanka has a great history of implementing successful family planning programmes. The contraceptive prevalence rates in Sri Lanka have shown a rapid increase after 1960's. One of the main factors which contributed to such an increase is the improvement of female education within the country. However, in Sri Lanka Demographic and Health Survey (SLDHS) 2006-07, a negative relationship between the level of education and contraceptive prevalence was found. Nevertheless a higher proportion of traditional contraceptive users has been observed among educated women. The main objective of this study is to examine the relationship between women's education and the contraceptive prevalence in Sri Lanka. It further attempts to examine the reasons for the higher use of traditional contraceptive methods among educated women in Sri Lanka. The study uses data from the SLDHS 2006-07 and qualitative in-depth interviews. Data from SLDHS show the recent pattern and differentials of contraceptive use according to women's education, while qualitative findings from in-depth interviews reveal the main reasons for the use of traditional contraceptive methods among educated women. The study found that there is a strong negative relationship between women's education and contraceptive use when modern methods are considered. Fear of the side effects of modern methods, communication and co-operation between husband and wife on sexual and reproductive health matters are found to be the main reasons influencing the use of traditional contraceptive methods. In addition, lack of time, reduced frequency of sexual intercourse, and confidence in traditional contraceptive methods were also found to be the other important factors. Since some misbeliefs on modern contraceptive methods among educated women were found, it is necessary to strengthen family planning counselling targeting educated women. The study claims the importance of disseminating proper education on contraceptive methods among married couples in order to maintain the low fertility rates of the country.

The effect of rainfall variability on rubber cultivation: A case study of Madurawala AGA division in Kalutara District, Sri Lanka

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Rubber (*Hevea brasiliensis*) is a major commercial crop for both the plantation sector and the smallholders in Sri Lanka. In general, more than any other sector of the economy, agriculture has always been vulnerable to climatic changes. According to the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC, 2007), South and South East Asian countries, where most of the world's natural rubber is traditionally grown, are highly vulnerable to the adverse effects of global warming and climatic change. In this respect, it is important to understand the impact of rainfall variability on rubber cultivation in Sri Lanka. Therefore, the study has focused on studying the rainfall variability and its impact on rubber cultivation in Madurawala AGA Division in Kalutara.

The present study has three objectives: to analyze the rainfall variability; its impact on rubber yield; and rubber cultivators' perceptions on rainfall variability and rubber production. Both primary and secondary data were used for the study and Microsoft Excel and SPSS were employed for the data analysis. Monthly rainfall data for the period of 1982-2011 were collected from Kalutara meteorological station and Geekiyanekanda rain gauge station. Monthly rubber yield data were collected from Midland state in Madurawala AGA division. A questionnaire survey was conducted to collect the information on rubber cultivators' perceptions.

The main findings of the study were that monthly rainfall values showed a slight positive trend for the period of 1982-20. It is also clear that higher variability of rainfall has been recorded in the most recent decade (2002-2011). There is an inverse relationship between monthly rainfall and monthly rubber yield. Rubber cultivators of the study area were informed that increase of rainfall variability and the increased number of rainy days adversely affect rubber yield and the condition of rubber trees. Finally, it can be concluded that from the three decades considered, the most recent decade (2002-2011) has shown a comparatively higher rainfall variability and it has significantly affected rubber cultivation of the study area.

Ageing and disability among institutionalized elderly in Sri Lanka

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Population ageing has become one of the key demographic concerns in Sri Lanka in this century. The country has experienced rapid demographic transition as a consequence of significant decline in fertility and mortality during the last five decades. It has an important impact on the increase of the proportion of older persons (age 60 and above) in the country. Between 1963 and 2012 the proportion of older persons has increased from 6 per cent to 12 percent and projections show it will continue to be 22 per cent by 2031. Though the issue of ageing and its implications are well documented, there is dearth of evidence related to ageing and health issues, particularly physical and functional disability among institutionalized elders in Sri Lanka. Therefore, this study investigates the disability status of the elderly population and factors associated with such disabilities. The study uses primary survey data which was collected from 350 elders who were in elders' homes in the Western Province of Sri Lanka in 2012. Disability status was measured by using reported Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL). The analysis employed descriptive data and logistic regression analyses to identify socio-economic factors affecting physical disability. The findings reveal that the occurrence of functional disability shows a consistent increase with age, and females had experienced disabilities in young old age (60-74) than males. Regression results also revealed that without controlling other factors females are more likely to falling into disability when compared to their male counterparts. In addition, age, chronic diseases, level of education, previous occupation and current marital status are significant predictors of likelihood of reporting disability. These results suggest that future health policies should focus on preventing and reducing chronic diseases as well as promoting healthy behaviour among the population to ensure a better quality of life for elders in Sri Lanka.

Water pollution study in Maha Oya river basin-upper catchment area

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The major problems in the upper part of the catchment area are soil erosion, unplanned settlements, land use, direct discharge of effluents from factories and urban waste to the river, and negative impacts of water tapping for mini hydropower projects which cause pressure on the Maha Oya. The collective pressure results in complex impacts on the river basin and water resources. This research aimed to identify and evaluate the groundwater distribution and pollution by agricultural practices and river sand mining in the upper catchment of the Maha Oya river basin in Kegalle and Kandy District. Maha Oya river commences in the central hilly regions and flows to the Indian Ocean through North Western Sri Lanka. The river drains a catchment area of 1528 km² along its total length of 130 km. The water quality of the Maha Oya stream that runs across the Dolosbage, Rahala and Aranayaka, was determined using water samples collected from twenty different locations along the stream. Dug wells in the catchment of the Maha Oya were selected to identify ground water quality changes due to water pollution in the river. GIS package ArcGIS10 was used to identify the spatial changes water quality in the river and as well as the ground water pollution area. Water samples were assessed for selected parameters, temperature, pH and Electric Conductivity during a period of five months in 2013. A sociological survey was conducted concurrently to study the impact of two communities (tea estate settlement and agricultural) living along the stream bank, on water quality. The lowest pH near the populated area (tea estate settlement area) is probably due to the large amount of household waste that is discharged directly into the stream at this location. Decomposition of organic matter produces CO₂, which dissolves in water as carbonic acid, thereby lowering the pH.

Household collective labour supply with pre-school children in urban Sri Lanka: Relationship between child caring and female labour supply

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The relationship between child care cost and female labour supply is complex, and research findings suggest mixed results. Empirical studies (Gordon and Chase-Lansdale 2001, Herbst and Barrow 2008, Kawabata 2012, Premaratne 2012, Presser and Baldwin 1980, Webster and White, 1997) indicate that when quality and affordable childcare centers are unavailable, many women with young children do not work or work lesser number of hours.

The paper focuses on the household collective labour supply with the presence of young children (age from 7 months to 5 years) in urban Sri Lanka. In the present study, the collective model¹ is employed over unitary model² since individual preferences are not considered in the unitary model. The theoretical foundation of the model relies on a utility-maximizing framework (Chiappori 1988, 1992, Connelly et al 1996, 2001). 200 households in Colombo, Sri Lanka, with at least one young child of age less than 5 years were surveyed for this study.

The results of the probit model show that the women's participation decision depends on factors such as their wage, household income including husband's wage and household non-labour income, levels of education, types of occupation, availability of adults in the family, and cost of formal day-care. Very significantly, the higher the probability of having adults in the family, the likelihood of the wife working was found to be higher. Women's non-market time does not depend on their husband's wage; both housework and child care of other adults-particularly female adults- respond positively to an increase in the wife's labour force participation. Quality child care services increase female labour force participation. Moreover, if child care is more affordable, more mothers would participate in the labour force. Quality child-caring is a good investment for a country. It is a public good that society as whole benefits from.

¹ Chiuri (1999) has developed this model for Italy.

² In the unitary model, the household is a unit that takes decisions together and no individual preference in the decision making process

Investment in the human capital portfolio of Sri Lanka: A case of university graduates in Sri Lanka

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With recent changes in labour and education markets in Sri Lanka, undergraduates' choice of human capital investment has become more complex: they can invest not only on degrees but on courses in different disciplines to diversify their skills to increase employability post-graduation. This paper explores their strategy of skill diversification adopted as a means of increasing future employability.

This study is based on a pilot survey, conducted among third years in the Faculty of Arts, University of Colombo. One specific question is included from the German Socio Economic panel "Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?". Responses are given on an 11-point Likert scale: 0 means "not at all willing to take risks" and 10 "very willing to take risks".

Majority of undergraduates responded as either risk averse or risk neutral (67%) to this question with regard to the labour market (their career). And indeed in practice, they have diversified investment on human capital: 94% have invested on the human capital portfolio beyond their degrees. Majority (58%) have invested on computer courses (48% in progress and 10% already completed). More than 30% have invested on language courses. A significant proportion (24%), have already qualified as Associate Accounting Technicians (AAT). 12% are currently following Human Resources Management (HRM) courses.

Courses followed by undergraduate can be divided into two categories. Computer, and language courses increase general skills so can be categorized as general portfolio. Courses like AAT, marketing and HRM that provide training in a particular discipline belong to the specific portfolio category. Both enhance employability after graduation. Often graduates who have specific portfolio options can find jobs that are not related to their university degree. Such courses can reduce risk of unemployment, increase choice and remuneration.

Use of canonical regression analysis to characterize the input – output relationships in the learning process: A case study of a state university in Sri Lanka

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Educational practitioners and researchers traditionally consider the student as a unit of production which utilizes different inputs in their learning process. Thus, the learning process is conceptualized by a single output of education production function whereas educational processes jointly produce multi outputs. This research extends single output educational production assuming that cognitive achievements and formation of attitude sophistication are jointly arising. The multi output education production function of the learning process is characterized using canonical regression analysis focusing on education in the state university sector.

Questionnaire based primary data are utilized and Cobb – Douglas type production function is assumed in empirical analysis. The focus is on the economics disciplines since it is flexible to assess cognitive achievement and formation of attitude sophistication as joint products in learning. Two outputs and eight inputs are incorporated to evaluate the multivariate shared relationship. The analysis yielded two canonical functions with canonical correlations of 0.832 and 0.1534. The full model across all functions is statistically significant with zero p – value. The variance explained by the full model explained a substantial portion, about 71 per cent of the shared variance between the variable sets. According to the dimension reduction analysis, with Wilk's lambda criterion, only the first canonical function is considered in the context of this study.

Interpretation is totally based on canonical weights, canonical loadings and cross loadings. The student learning process is characterized as achieving more GPA than gaining knowledge in the particular discipline. First year performance is a prominent characteristic raising GPA while it is further improved by peers' influence. Formal studying, self-learning, leisure and sleeping hours and age of the student have no strong relationship in achieving higher GPA. Thus cramming may result in a higher GPA without gaining subject related knowledge. Therefore, evidence of this study suggests revising or changing the current evaluation system within the policy implication context.

Challenges to Sri Lankan Buddhist scholasticism to create Sri Lanka as a hub of education

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This article is for the purpose of examining the challenges that Buddhist scholars have to face when making Sri Lanka a hub of education. These challenges can be understood in two areas: challenge of language skills and challenge of subject knowledge.

The original Theravada Buddhist tradition is unique to Sri Lanka. Its sources have been preserved in Pali language, thus, the knowledge of Pali language was compulsory for the study of Buddhism. During the Anuradhapura period Sanskrit language came into vogue. So, study of Pali, and Sanskrit Languages and teachings prescribed by them is the challenge for the Sri Lankan Buddhist scholar tradition.

During the colonial period, English language influenced Sri Lankan Buddhist education. Today, as English has become more prominent as an international language, acquisition of fluency in English is the challenge faced by Sri Lankan Buddhist scholars. As an immense amount of research has been done in English, English language knowledge with Pali and Sanskrit is a decisive factor in Sri Lankan Buddhist scholasticism.

However, as Buddhist research stands at present, proficiency in English with a sound knowledge of Pali and Sanskrit is not enough. Since, Pali, Sanskrit, Chinese, and Tibetan are recognized as primary source languages for Buddhist studies, knowing these four languages and doing comparative researches on literature written in these languages is a new arena for Buddhist scholar tradition. So, the aim of this paper is to examine challenges faced by Sri Lankan Buddhist scholasticism in the past and present and try to discuss its path and direction towards building Sri Lanka as a hub of Buddhist education.

Examining the social bases of the UNP and the SLFP: Parties without bases?

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The relationship between political parties and their putative social base raises complex questions, even in the context of developed democracies and abundant information flow. Obviously, in the developing countries and countries with comparatively shorter experience in democracy, understanding the bases of the political parties is even more difficult.

This paper attempts to inquire the social bases of Sri Lanka's two main political parties, the United National Party (UNP) and the Sri Lanka Freedom Party (SLFP). Since independence, the UNP and the SLFP governed the country either as a single party or as the leading coalition partner. Even though there have been many analyses on the bases of the national and the regional leadership of these two parties, so far no scholar has made a systematic analysis on the social character of the support bases of the UNP and the SLFP.

The classical 'responsible government' model and the structural functionalist scholarship assume parties to represent the interest of communities and amass electoral support of those communities by making representation in the interest of those communities. Hence, the social cleavage- class, ethnicity, religion, caste, ideology, etc – based analysis almost dominant in the inquiry of bases of political parties. We too intend to employ the social cleavage model of structural functionalist scholarship to inquire the social character of the loyalists of the UNP and the SLFP. The data set of the 'State of Democracy in Sri Lanka' conducted in 2004 by the Social Scientists' Association (SSA) will be used to examine the social cleavages that are associated with the support for these two parties. In addition to the survey data, authors will use the data gathered from qualitative field interviews.

Contribution of social media in promoting democracy in Sri Lanka

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The main reason behind defining Media as the fourth estate ("fourth branch of government") is that it is expected from media to monitor and report democratic processes. Media scholars around the world have agreed that free and independent media is essential in the process of democratization. Both print and electronic media are under severe criticism since its establishment for being biased for governments and for their owners. Social Media was first developed as technologically advanced form which allowed users to have virtual relationships with their friends and followers around the world. Later, Social media developed rapidly during the last decade giving individuals and community groups the opportunity to discuss their socio- political issues with more freedom and independence compared to other mainstream media. This research is conducted to examine the contribution of social media in promoting democracy in Sri Lanka. Even though many studies have been conducted about the influence of newspapers, radio and television in raising issues pertaining to democracy, no study is conducted yet in order to examine the influence of social media in promoting democracy in Sri Lanka. The role of social media in public protests, campaigns and political movement is one of the leading topics in the contemporary political discourse. Facebook, Twitter and YouTube can be considered as the most popular forms of social media in the world and there is a rapid growth in the use of facebook in Sri Lanka as currently it has 1.15 million users around the country. The study is limited to Facebook and YouTube: online questionnaires to 300 Facebook users are distributed and YouTube content in two selected significant political incidents are analyzed in the study. The online political behaviour and political conciseness of the selected users are expected to be critically examined in the study.

Rewarding scholarly excellence: An outcome-based analysis of a graduate's ability to qualify for prestigious international scholarships

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As Spady noted, an “Outcome-Based Education [OBE] means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experience.” (Spady, 1994: 1). While most OBE programs focused on employment at the end of the learning experience, some students opted for further learning. This involves studying for Masters, MPhil or PhD within Sri Lanka or outside it. They resort to applying for prestigious scholarships such as the Chevening, Erasmus Mundus, Fulbright, Gates, Monbukagakusho (i.e. Mombusho), and Rhodes.

According to the University Grants Commission (UGC) records, 142,516 students became eligible to apply for the universities in Sri Lanka in 2011 and 14.31% of all those who were eligible were admitted as undergraduate to different universities. Of these, almost one-third or 7,064 were admitted to different Arts faculties within Sri Lanka. In 2010/11, 795 students were taken in by the Faculty of Arts (FoA), University of Colombo – the most number of Arts students taken in within the university sector (University Admissions 2012: 19)

The *objective* of this research is to analyze the different criteria in these scholarships to examine what they require from graduates. To come to the *conclusion* that only a select few have the ability to apply for the prestigious scholarships, the *research methodology* comprises utilizing primary including interviews with potential scholarship applicants (i.e. recent graduates) and those select numbers who received one of the above scholarships to conduct further studies. The exploration of scholarship criteria is also part of the research. The paper subsequently conducts a SWOT analysis of the skills and abilities of graduates – from the class obtained to their knowledge of English – through analysis of courses to explore a graduate student's chances of obtaining the requirements to obtain a scholarship.

Developing a cutting-edge IR graduate profile: an analysis of the OBE approach of the Department of International Relations

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The cutting-edge concept of ‘outcome-based education’ (OBE) is a student-centered learning approach that focuses on student performance. A clear idea of who is a successful graduate is at the heart of this approach. Examining the Department of International Relations’ (Dept.IR) attempt to develop a list of Graduate Attributes and the Graduate Profile is the core *Objective* of this research.

For the state sector-linked University of Colombo (UoC), developing an OBE curricular that provides graduates to the competitive knowledge economy entails focusing on the performance of the students whilst undergraduates and providing extra skills in order for them to find gainful employment once they are outside. For the Dept.IR, developing the OBE meant devising a list of ‘graduate attributes’ essential in creating a non-generic ‘graduate profile’ (Hager and Holland 2006). With a focus on subject-specific knowledge, “skill clusters that comprise lifelong learning” (Barried 2006: 162) and norms and ethics, the ‘attributes’ in turn helped present a graduate profile. The graduate profile in turn represents the outcome-based approach utilized by the Dept.IR.

The *Methodology* used for this research includes examining secondary data such as the UGC statistics and primary data including (a) questionnaires of current and past graduates as well as potential employers; (b) SWOT analysis conducted by current undergraduate students and academic staff of the Dept.IR; (c) minutes of departmental meetings; and (d) course syllabi.

The research findings present a cluster of attributes and a graduate profile. The clusters of attributes are linked through core values of integrity, honesty, personal responsibility, and work ethics, which the Dept.IR hoped the students would learn from both the syllabus and through activities and observations.

Competing political actors and their detrimental effect on civil war termination: An analysis of ‘spoilers’

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Civil wars ending in negotiated settlements have greatly increased since the end of the Cold War. However, the success rate of such negotiation agreements in the long term has been very low and two thirds of civil wars restarted within a few years of negotiated settlements. One of the contributing factors to the low success rate is the threat of spoilers. The concept of spoiling has led to a debate in the literature (Stedman 1997, Greenhill and Major 2007, Newman and Richmond 2006, Mac Ginty 2006, Zahar 2006). The concept of spoiling as it is currently employed surpasses its original meaning and has given rise to a number of uncertainties concerning its definition and empirical applicability; this lack of clarity with regard to some of the key aspects of the spoiler concept risks undermining the usefulness of the concept itself. Hence, this research within a growing research field, offered a greater conceptual clarity on a number of issues that are at the core of the spoiler debate for instance the relationship between spoiling, violence and competing political actors. This research was based mainly on theoretical findings.

This research concludes that spoilers who emerged through competing political parties had the potential to generate a crisis which had the capability of deeming the peace process a failure. Hence this research elucidates the vital importance of considering spoiling in a broader spectrum in the conflict resolution field.

Ground water quality distribution in agro-wells in cascade systems: A case study of Horivilla cascade in Anuradhapura District

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Groundwater is the main source of rural water supplies in many developing countries and good quality ground water is a prime factor for sustenance of rural life. However, it has become a major problem today as this water is used for drinking and agriculture by more than half of the nation's population. The groundwater is the main water source for agriculture and domestic purposes in the dry zone of Sri Lanka. In the last decade, many agro- wells were constructed for agricultural purposes and sometimes for domestic and drinking purposes. The study was conducted in the Horivilla cascade tank system in Palugaswewa DS division of Anuradhapura District. This study was carried out for a period of 3 months in 2011, and 25 randomly selected available agro wells' water samples were obtained from the entire cascade system. Groundwater quality monitoring has been conducted in the selected agro-wells with respect to pH, Electrical Conductivity (EC), salinity, Na, K, Ca, Mg, Fe, Cl and bacterial pollution. All water quality analysis was carried out according to Standard Methods. The study helped to prepare hydro geological map and the distribution of Electrical conductivity (EC) and pH maps using the Geographical Information System (GIS) package ArcMap 9.3. Hydro geological maps help to identify recharge and discharge areas of the study area depending on the seasonal atmospheric precipitation. Results of the study revealed that the electrical conductivity in well water is varying all over the area. It was in the range of 80 μ S/cm and 7390 μ S/cm. Most of the wells showed high conductivity and there was a high salinity problem. All these concentrations were high in the upper part of the study area. The study identified that groundwater quality has become the major problem in this area.

Bridging the gaps: Disparities between education and employment in the state sector in Sri Lanka

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Higher education in the state sector in Sri Lanka is currently facing some issues with regard to the mismatch between skills that are gained through the education system and the skills required by the labour markets. Extensive research shows that the content of higher education in the state sector in Sri Lanka should be re-evaluated and that new methods should be introduced to bridge the gap between the two. Research also shows that the secondary and tertiary education should be improved so that it is on par with all developing nations. The government development policy framework- 'Mahinda Chinthana', Vision for the future has identified five focus areas: naval, aviation, commerce, energy and knowledge where it aims to reposition Sri Lanka in the global arena as a country with a strong knowledge base.

As observed, education moulds a country's social, cultural, economic and political development. Hence, the curriculum should be such that it would promote and enhance job opportunities for the graduates and thereby minimize unemployment.

In the competitive knowledge-economy, the competencies and capabilities should be structured and promoted to suit the changing demands and requirements of the world. This research was carried out to see if an overall change in the education system is needed in state sector education. Primary data were gathered from a group of individuals who are related to education and employment to collect latest data relevant to the research. The research proved that the curriculum of the secondary education in Sri Lanka should be rephrased to match the requirements of the employment sector and to take the state education system to higher paradigms thereby creating positive international relations. These relationships would in the long run take Sri Lanka to be a strong and powerful competitor in the knowledge-economy sector.

Anti-prejudice lessons in the university: The educative role of straight romance in the Sri Lankan campus novel, *The Iron Fence*

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This paper is broadly concerned with how Sri Lankan Anglophone writing represents contemporary Sri Lankan higher education. It focuses on the depiction of university students unlearning prejudices of race and class which is the central theme of Neluka Silva's campus novel, *The Iron Fence* (2011). Arguing that this text provokes the question of how anti-prejudice lessons are learned in formal higher education, the paper investigates the problem of the teacher-ly role facilitating this learning. It explores two possible educators in this novel—the institutional apparatus of higher education, and the straight campus romance. While the physical context of the *The Iron Fence* is Colombo University's Arts Faculty, the formal system of university education is largely ignored in the novel's thematic focus. Instead, the educative function is fulfilled through the experiences of two female students who, from the difficulties of being in cross-class and cross-race relationships, are pushed to learn how to identify and deconstruct social prejudice. The objective of this paper is to analyse to what end straight romance is tasked with educating about prejudice. Its approach draws on both the critical literature on campus novels and queer theoretical frameworks on heteronormativity exemplified by Warner's (1991) work. The paper makes the conclusion that the novel favours a non-prescriptive and questioning approach to anti-prejudice learning, the possibility of which is figured as the romance of intersectionally situated straight relationships.

FACULTY OF EDUCATION



Message from the Dean



It is with great pleasure that I write this message for the Annual Research Symposium of the University of Colombo 2013. The Annual Research Symposium is a very valuable opportunity for the senior as well as junior academics of the Faculty of Education to share their knowledge and research findings with the rest of the academic community at the University of Colombo.

This will indeed be an immense motivation and encouragement for the junior academics and postgraduate students to develop a research culture at the Faculty.

This year's theme for the symposium, *Higher Education through the State Sector of Sri Lanka in a Competitive Knowledge Economy*, has direct relevance to the Faculty of Education because of its main focus on education in strengthening the economy of a country in a competitive global economy.

I am thankful to the contributors who submitted their abstracts and the reviewers who did a wonderful job in reviewing them and thereby giving useful advice to the contributors. I must also thank the team who worked relentlessly at the Faculty of Education to make this event a success.

Finally, I wish all participants a very thought-provoking and interesting experience at the Annual Research Symposium, 2013.

Professor Chandradasa Wannigama

Dean, Faculty of Education

Faculty of Education

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The influence of practicum component for the enhancement of B.Ed students self-concept as a competent teacher

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Practicum component of the Bachelor of Education Degree programme focuses mainly on developing necessary skills of B.Ed students to be a competent teacher. Students are also expected to develop a positive self concept regarding their abilities to be a competent teacher. Research conducted on this area (Thomas R.G, 1988; Lawrence A.R and Marsh, H.W,2000; Venung, 2004; Alaouat,T, 2013) proves the importance of self concept development of teacher trainees. Accordingly the main objective of the present investigation is to study how practicum component of Bachelor of Education Degree programme of the Faculty of Education University of Colombo is effective for the formation of appositve self concept among students. English medium and Sinhala medium final year students of 2012 B.Ed programme were selected as the sample. Likert type self concept scale was administered to measure their self concept as a competent teacher before and after the practicum. Mean and standard deviation were calculated for the total marks as well as for eight sub areas. Mean differences were calculated and t tests were used to test the significance. Contingency tables, percentage values and chi square tests were used to test the association between self concept changes and nature of the school to which students were attached. Findings show a significant increase in self concept measures after the practicum period. No significance difference has occurred in two areas namely self concept of ability to manage the time and self concept of ability to manage the classroom. Significant but low increase was found in two areas. They are self concept of ability to select subject matter and self concept of ability to conduct lessons successfully. In the two areas of self concept of ability to plan a lesson and self concept of ability to conduct a lesson successfully, there is moderate positive increase. However a considerably high positive change has taken place in self concept of ability to identify objectives of a lesson and to select relevant subject matters.this implies that weak areas of the self concept of students has to be attended by the lecturers of the faculty.An association between the change of the self concept and nature of the school attached for teaching practice was found showing that students who are attached to popular high schools tend to develop a positive self concept about their abilities as a teacher. This implies that students should be attached to proper schools for teaching practice.

Current practice of Bilingual education in Sri Lanka

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This paper focuses on how bilingual education has been implemented and practiced in the Sri Lankan classroom today. Bilingual education is practiced in many countries around the world with different perspectives. It was introduced in Sri Lanka in 2003 with the objectives of improving the English language proficiency of all students with a view to improving economic and higher education opportunities as well as developing social harmony and social cohesion. Yet very few researches have been carried out to identify the strengths and weaknesses in the practice of bilingual education in Sri Lanka.

Therefore, a survey was conducted on a sample of teachers and students in the Western province who were involved in the bilingual education. The implementation procedures of bilingual education in other countries were examined and compared with the practice of bilingual education in the Sri Lankan state schools. Furthermore, seven classrooms where bilingual education was taking place were observed and the teachers were interviewed to identify the strengths and weaknesses in the teaching and learning process. In addition, five lecturers from the University of Colombo and Colleges of Education who were involved in the training and supervision of bilingual teachers were interviewed to obtain their ideas and views.

Data obtained from the above sources revealed that the performance of bilingual students is generally high in all the subjects. Yet opportunity for bilingual education is available only for a small percentage of students in a few selected urban schools. This opportunity should be extended to other schools as well. Opportunity should be provided for content teachers to develop their English language proficiency. A link between English Language teachers and content teachers should be established to facilitate the English language teachers and content teachers to work in collaboration in the teaching and learning process in the bilingual classroom. Bilingual students should be encouraged to work collaboratively with first language medium students.

Determining the impact of cooperative, problem based learning on critical thinking and scientific practices

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The potential for improving professional practice through reflection and critical enquiry has been in the foreground in recent literature on teachers' continuing professional development (Burton and Bartlett, 2005; Campbell *et al*, 2004; Dadds, 1995; Dadds and Hart, 2001). Critically thinking teacher will effectively internalize the teaching learning process, face numerous challenges, and make informed judgments (Myer, 2009). The present study examines the impact of exploratory design process of an intervention on critical thinking and scientific practices of teachers in the teaching learning process. This study includes a purposive sample of 31 students following the Bachelor of Education (BEd) degree and 17 students enrolled for the Postgraduate Diploma in Education (PGDE) program using one group pretest posttest design related to quasi experimental design. Both qualitative and quantitative methods are used for data collection and analysis. The BEd and PGDE students' performance in critical thinking and scientific practices was low with mean scores of 34.55 and 38.76 respectively (SD (BEd) =10.66 and SD (PGDE) =14.36) at the investigation phase. PGDE group was the best performing group before the intervention. Yet its mean value was 38.76. Analysis of posttest scores revealed that students' performance in both BEd and PGDE programs was very high increasing the mean values to 70.03 and 70.82 respectively. The mean difference between the pretest and the posttest for both BEd and PGDE was significantly different at 0.005 alpha level (t (BEd) =0.137, $p>0.005$ and t (PGDE) =0.168, $p>0.005$) indicating a positive impact of the utilized intervention on development of critical thinking and scientific practices of the participants in relation to teaching learning process. Future research studies need to investigate the effect of different variable in the CL process in relation to teacher education.

Current practice of open schooling programme in Sri Lanka

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Open schooling is a community based alternative educational movement which is initiated to provide basic educational requirements for those who have missed their educational opportunities due to various reasons. Currently there are a significant number of Sri Lankan citizens, outside the formal education system, belonging to various socio-economic and cultural groups without the minimum basic education. As mentioned in the report of education sector development framework programme (2007) around 18% of children have dropped out of the formal education before the completion of Grade 9. Furthermore, nearly 9% of adults are illiterate in Sri Lanka. Though, various initiatives have been taken to address these issues during the previous decade, they have not been able to reach the expected outcomes. This reveals that, there exists a considerable challenge to meet in ensuring free and compulsory education for all and achieving 100% adult literacy rates in Sri Lanka. Therefore, a viable educational approach that can be equally accessed by all is needed to overcome these challenges. The aim of this study was to develop the most suitable methodological strategic plan for ongoing open school programme by identifying existing issues and challenges and to present an implementing procedure. 27 individuals were purposively selected as the sample in this study representing both administrators and participants of the open school programme. The data obtained through the interviews and observations were qualitatively analyzed. The absence of national level policy statement in relation to the OS in Sri Lanka is a major obstacle for the effectiveness of the OS. Although the acceptable solution for the educational issue such as incompleteness of compulsory basic education and adult literacy can be obtained through the Open Schooling movement, that should be strengthened in collaboration with the other educational agencies in the government.

Computer usage as a learning aid in secondary classrooms in Sri Lanka

Jude Nonis

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Secondary school is a period of intense physical change and formation of identity. It is also the period of intense vibrancy and energy. The ability for abstract reasoning and logical thinking emerges, allowing children the possibility of deep engagement with both understanding and generating knowledge. A critical understanding of the self in relation to society also emerges during this period. The introduction of microcomputers into schools has brought about a dramatic increase in the proportion of teachers who use computers for teaching learning process. Most of the schools equipped with computer laboratory facilities encourage teachers and students to use laboratory for enhancing their learning and teaching. This paper focuses on current practices in computer technology usage in secondary schools for enhancing teaching learning process. It examines how teacher attitude toward the use of computers for their teaching and learning. It is also aimed at studying how student interest on Information Communication Technology (ICT) is integrated into classrooms for their learning. Data were collected from 10 schools, where computer laboratory facilities are available, by observing classrooms, interviewing teachers, students, principals in secondary schools.

Results revealed that current practices in ICT integrating for lessons cannot be seen in the school system. Among several affecting factors such as situations, scarcity of available resources, teacher training, teacher attitude and inappropriate integration of curriculum were identified as most prominent. Furthermore teacher confidence has also affected the use of ICT in classroom practices.

**Social capital: Achieving academic success without rupees:
A study on the impact of home and school social capitals on educational
achievements of Grade 4 students of state schools of Sri Lanka**

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Social capital which is comparatively a rather novice concept, can be simply defined as connections between individuals. It could alleviate negative impacts on student academic achievement caused by reduced financial capitals simply by making more connections and support systems within and across communities. For example children who are financially poor have a better chance of continuing education if they attend schools that have high parent-teacher relationships (Coleman et al. 1988). This study on primary school children in state schools in Sri Lanka ascertains that social capital places a positive impact on students' educational achievements. The availability of parents, their marital status, whether they are living with the child and their attitudes towards child's education show a significant influence on academic achievement. Especially, when the relationships between family members are close, it seems to improve the language abilities of children. For example, when the members of the family get involved in a child's schoolwork, it seems to make a significant impact on language achievements. Furthermore, if a child helps the mother after school for day today chores, it has a positive effect on language achievement. This again is an intuitive finding as the more time the child spends with the mother, the more language the child will acquire. This is also true with the close relationship a child has with the neighbours as the time a child spends with the neighbours shows a significant impact on language achievement. The findings of this study conclude that though the emotional distance between parents and child affects the academic achievement of the child, various aspects of social capital in school tend to increase his/her academic achievement. For example, students did well in schools where the student-teacher bond was high. Hence, it seems that if schools increase social capital, which is not a financial constraint on the state or the school, they could reduce the number of failures in the education system.

Utilization of soft skills among the Bachelor of Education undergraduates: Evidence from literature review

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Strengthening soft skills among the undergraduates in the Higher Education institutes in Sri Lanka has become a major importance for workforce. This study is an ongoing research. It is based on four objectives. They are identifying the principles, perspectives and practices in soft skills among the private organizations, assess the nature of the current implementation in relation to soft skills taking place at the undergraduate students, examining how soft skills are incorporated in higher education curriculum, suggesting possible measures and strategies for the enhancement of soft skills. Methodology of the study is based on qualitative approach. Interviews, questionnaires and documents were used to collect data. Bachelor of Education undergraduate students and academics of the Faculty of Education, Colombo University, were used as a sample of the study. Through the study, it is aimed at identifying the theoretical bases for soft skills in undergraduate students following the Bachelor of Education programme at the Faculty of Education, University of Colombo. It is based on literature survey of educational reports, as well as research papers. Three models in the use of soft skills were identified. A number of definitions in soft skills were also found out. Considering the definitions, common characteristics were found. Following such findings a working definition was formulated. Limited research was undertaken in relation to teaching profession of soft skills. Under these frameworks, this paper discusses most suitable soft skills for the Bachelor of Education at undergraduate level. Therefore, the incorporation soft skills into the Bachelor of Education curriculum is an essential initiative in our university system in Sri Lanka for the success of the teaching workforce in the 21st century.

International schools and private tuition: Theory and practice

Lakshman Wedikkarage

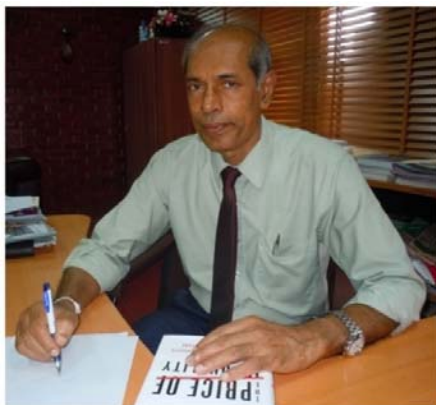
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Private tuition is an issue of growing concern and is practiced in both developed and developing countries. Although it has certain positive effects, it imposes a considerable financial burden on parents and often gives rise to abuses (Foondun, 2002). Private tuition is particularly gaining momentum everyday because of the highly competitive nature of the national examinations in Sri Lanka (de Silva, 1994). However, recent discourses have shown that private tuition has become highly sought after among students who attend international schools which prepare them for British examinations. In the Sri Lankan context, an international school is one which adopts an international curriculum using English as the language of instruction. Private tuition is generally understood as extra teaching given to students for examinable subjects outside school hours for a fee payment (Bray, 2007). Since gaps in teachings are not generally supposed to exist in the context of international schools, understanding why some students attending such schools require private tuition becomes significant. The present study addresses several key questions, such as the nature of the practice, its repercussions, the various forms that it takes, attitudes towards it, why children take private tuition and why teachers provide it to students attending international schools. The study was conducted using documents and interviews as the main sources of data collection. A number of documents were used to establish the nature of private tutoring, its history and its development to the present. Documents were also used to determine the history of international schools in Sri Lanka. Data also revealed that private tuition is received by students in several forms such as individual, small groups and large groups. One of the interesting findings of the study was that some teachers cajole their own students to attend private classes conducted by them ensuring better grades. Parents need to be informed of the quality of the school and the impertinent intentions of some teachers who sway their own students to attend classes conducted by them. Some form of English proficiency must be made mandatory before admitting children to international schools.

FACULTY OF GRADUATE STUDIES



Message from the Dean



It is indeed with great pleasure that I write this message for the Annual Research Symposium 2013 of the University of Colombo. The FGS, the winner of Asia's Best B-School award for three consecutive years from 2011 to 2013, is a key contributor to the human capital development of Sri Lanka. Its mission is to foster excellence, creativity and value innovation in postgraduate education and research at the University of Colombo.

The Annual Academic Session of the Faculty of Graduate Studies will also be held separately which is an important annual academic event. It provides an opportunity for the academics and colleagues from private and NGO sectors, members of the public and postgraduate students to exchange views and engage in discussions on a wide variety of topics portraying the multidisciplinary nature of the FGS. This year's Sessions will have 10 presentations representing themes from Social Sciences, Humanities and Para-Medical Sciences.

I am thankful to all those who worked hard to make this event a reality and I wish the presenters, discussants and participants a fruitful time at their respective sessions.

I wish the Symposium great success.

Professor Sunil Chandrasiri

Dean, Faculty of Graduate Studies

Faculty of Graduate Studies

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Security of land tenure, investment and productivity: Evidence from Sri Lanka

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The critical argument debated by many economists in defense of property rights is that secured rights enhance higher investment incentives. Majority of the related empirical investigations concentrated on the effect of tenure security on investment and productivity. On theoretical grounds the positive link that secured tenure enhances investments is backed by three arguments such as ‘collateral effect’, ‘assurance effect’ and ‘realizability effect’. The central issue brought forward in this study is that the initial equal sized land holdings have been replaced by a varied size distribution and consequent tenure arrangements in irrigated settlements in Sri Lanka. It is therefore, observed differences on land productivity. This paper assesses the extent in which tenure security influences land investments and land investments influence land productivity. The specific objectives are (i) to examine the impact of tenure security on investment (ii) to analyse the relationship between investment and productivity. The sampling unit was the plot of land and data used from 339 low land units, drawn from three clusters, according to systematic random sampling. A self administered structured questionnaire was used to collect data.

The key outcomes of regression results presents investment i.e. proxied by total days is positive and significance. Secured tenure i.e. the availability of a document is positive and insecurity in tenure i.e. the fear of losing land is negative. The results conclude that an increase in tenure security promotes investment. The negative and significant sign of the insecurity in tenure indicate that they are always demoted on investment. Therefore, the findings reinforce the significance of tenure security on investment. It is also concludes that there is a positive and significant effect of investment on productivity. The major policy implication is that ensuring the security in tenure encourages investment whereas insecurity in tenure discourages investment.

SME Internationalisation: The role of top management team characteristics, entrepreneurial orientation and learning orientation of the firm

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This paper presents a conceptual framework based on a review of extant literature, and relates the antecedent effects of top management team (TMT) characteristics on the entrepreneurial orientation (EO) and learning orientation (LO) of a firm and its resulting effect on the propensity to enhance its cross boarder activities, in the context of Sri Lankan SMEs engaged in internationalisation. The conceptual framework explores the relationship of EO, LO and performance of SMEs in its effort to accelerate the propensity to increase its cross boarder activities. It further investigates how EO and LO relate to each other, which in turn could enhance the internationalisation intensity (II) of the firm. Five propositions are put forward with a view to understanding the antecedent effects and consequences of EO, LO on the II of SMEs. Decisions regarding entry into new markets entertain a high degree of uncertainty; entails greater risk; requires innovativeness to discover/exploit opportunities; requires a degree of proactiveness to take initiatives in anticipating and pursuing new opportunities; and competitive aggressiveness to intensely challenge its competitors to achieve entry or improve position. (1) *A firm's EO will positively relate to its II*; (2) *A firm's LO will positively relate to its II*; (3) *The TMT characteristics will enhance the firm's EO*; (4) *The TMT characteristics will enhance the firm's LO*; and (5) *A firm's EO and LO will interact with each other, and lead to greater II*.

The interrelationships among a firm's TMT, EO, LO and performance are an important research area for investigators in the literature of SME internationalisation, management. An empirical study can offer both theoretical and managerial implications.

Gender dimension of remittance behavior: Towards a new remittance estimation method

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Gender dimension of labour migration and remittance behavior has become a center for discussion in labour emigrating countries like Sri Lanka. Since the social cost of female labour migration is relatively high, proper evaluation of the costs and benefits of migration is important in designing an appropriate foreign employment policy to the country. However, lack of comprehensive data of remittances prevents us studying the gender dimension of remittance behavior.

Remittance theories suggest that migrants send remittances for different purposes. We identify two limitations of Ratha and Show (2007)¹ estimation method. First, it does not consider the gender of the labour migrants in remittance estimation. Second, it's ignorance of the skill disparity. Objectives of this study are in two folds. First we identify the limitations of Ratha and Show (2007) estimation method of bilateral remittances in examining the gender dimension of migration and remittances. Second, we extend the Ratha and Show method to overcome from those limitations. Our estimation method can be used to estimate the relative share of remittances, sent by the male and female labour migrants.

In countries like Sri Lanka, where the gender and skill disparity among labour migrants is significant, this estimation can be misleading due to these two limitations. Our proposed model can be used to estimate the relative contribution of male and female labour migrants to the remittance flow. Further it provides information on remittances sent by migrants in different skill levels. Results of the study are important in examining the remittance behavior and designing appropriate policies to maximize the benefits of labour migration.

¹ Ratha Dilip and W. Shaw (2007), South-South Migration and Remittances, *World Bank Working paper* No.102, The World Bank, Washington, D.C

Linguistic variation on popular Sri Lankan media: features and perspectives

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The objective of the current paper is to examine the degree of linguistic and attitudinal differences between the emerging pattern of code-mixing on popular Sri Lankan radio and the conventionally practiced code-mixing, in order to understand the hitherto un-researched area of 'code-overmixing' on popular Sri Lankan FM radio.

The audio samples show an abundant mixing of lexical items from English within a Sinhala matrix. Nouns stand out as the most code-mixed category of words. Next in the order of abundance are phrases from English. Some of the code-mixed English words which have Sinhala equivalents seem to be gradually losing currency in the colloquial usage of the FM radio presenters. In the hands of FM media personnel, code-mixed speech becomes no more the language of the informal sphere but a legitimized language of public discourse. The study further reveals that a majority of FM presenters have a favourable attitude towards English as the language of sophistication. By overdoing the mixing of codes, these presenters seem to give out the impression that they are at home in both languages, though the significant factor that has to be taken into account here is that they engage only in code-mixing, and not code-switching which is practiced by stable bilinguals. The youth who admire media personalities as their role models expressed their preference for over-mixing of codes to fulfill their desire to be identified as sufficient bilinguals. The popular FM media, on the other hand, seem to make the best of this desire of young FM audiences by, like in advertising, making use of the English language for commercial purposes.

To conclude, the predomination of English code-mixes in domains/genres such as fashion and cuisine, elements of which people use to express a social identity, foregrounds this symbolic alliance people perceive to exist between the English language and power in its diverse aspects. The trend of 'code-overmixing' is subject to the control of those who own media institutions, and also fulfill the requirements of advertisers. The popular FM radio audiences willingly imitate the patterns of heavily code-mixed speech set by the radio stations concerned, particularly for reasons of social recognition.

Influence of green marketing strategy flexibility on sustainable competitive advantage of the hotel industry in Sri Lanka

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As firms note that gains can accrue through environmentally friendly marketing strategies they adhere to a triple-bottom line performance evaluation, a concept coined to reflect the growing tendency of stakeholders to evaluate organizational performance based on economic prosperity, environmental quality, and social justice. Some hotels adopting a mainstream route to competitive advantage and performance, however, do not show signs of sustainable competitive advantage and superior performance on a constant basis. Firms having distinctively flexible green marketing capability are likely to out-perform competitors in creating superior value in their selected target markets in highly dynamic green product-markets.

The objective of the study is to identify the present level of strategic flexibility in relation to green marketing mix strategies and to examine its influence on green based sustainable competitive advantage of the hotels in Sri Lanka. The Study is based on the quantitative research approach with a sample of 100 hotels randomly selected and a self-administrative questionnaire consisting of 5 point -Likert scales used.

The study highlights that the hotels in the sample have average level of strategic flexibility in adapting their marketing mix strategies in terms of new product development, pricing, selling skills, advertising, marketing planning and marketing implementation as a way of quickly responding to changing demands from green market segments (mean value of 4.06 on a Five point Likert scale). As per the regression coefficients (Beta values) it is evident that green marketing strategy flexibility has a positive impact on financial performance, market place position and inimitability of capabilities. The findings support that Sri Lankan hotels exercise strategic flexibility in developing their marketing mix strategies in relation to green market segments. They are mainly concerned on adapting marketing mix elements in order to respond to the changing requirements of the green market segments.

Momentum in stock returns: Evidence from Sri Lanka

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The momentum in stock returns is a pattern of stock returns where past well performing stocks or winners continue to be winners and poorly performing stocks or losers continue to be losers, hence, buying past winners and selling past losers generates returns over next twelve months holding periods. It has become a widely debated anomaly across the globe and the same trend in Colombo Stock Exchange (CSE) has been supported by empirical evidence particularly for periods before 2005. Although evidence is found in respect of Europe and emerging markets in Asia such as Malaysia, China and India, there is hardly any published evidence on the CSE since 2008. Nonetheless, the existence of this feature in the CSE is yet undecided. Hence this paper attempts to ascertain it.

The objective of the study is to test whether the momentum in stock returns in the CSE is still evident. All stocks listed on the CSE from October 1991 to December 2012 are used for the analysis. The momentum in stock returns is tested for immediate effect and one month after the lagged returns are measured for portfolio formation. The computed difference between the average returns of the winner and losers' portfolios, are tested for its significance. .

The study confirms the presence of momentum in stock returns, which performed well after adjusted for lagged reactions. All momentum strategies excluding six-three and twelve-three are continuously profitable in the CSE since 1991. Aligned with global, the momentum in stock returns is evident in the CSE. Sub period analysis indicates continuous profitability of the momentum strategies since 1991 in the CSE. In general, returns from winner minus loser portfolios are positive and significant over all momentum investment strategies. Therefore, investor can earn zero cost returns simply by taking long position on winner portfolio while short on loser portfolio.

Selection mechanisms for university admission: Issues of equity in student selection and performance quality of medical students in Faculty of Medicine, University of Ruhuna

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Advanced Level results have frequently been used as a means of predicting the academic performance of medical students while factors such as proficiency in English are used as a predictor of outcomes in medical school examinations. The significance of relationship between the selection criteria used for university admission and degree performance at the final MBBS examination of students has not been examined, although admission procedures have come into place to ensure fair access to university educational opportunities. Critics have voiced their concern over the quality of undergraduate students, especially Medical undergraduates, selected through the present selection procedure.

The objective was to determine the correlation between selection criteria and examination performance of medical students, to examine whether it ensures equity in access and to understand associated factors affecting performance quality of medical students.

The study sample consisted of 392 students selected to the Faculty of Medicine, University of Ruhuna based on their performance at the GCE A/L examination held from 2004 through to 2006. Performance at medical school was measured in relation to the classes obtained at the Final MBBS examination

The findings revealed a significant association between the category through which students entered university and the performance at the Final MBBS examination; students with high z-scores perform well at university and those with low points perform poorly; English language ability as a significant factor that could moderate the relationship between selection criteria and performance quality of medical students. Overall, the selection criteria used for selection of medical students in Sri Lanka is a significant predictor of performance quality at the degree level.

The process of value creation in strategic human resource management: A human capital perspective

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The effective management of human resource is crucial to succeed, since that enhances the human capital towards strategic business objectives. The main objective of this research is to address the dearth of comprehensive explanations of the mechanism through which HRM practices link with firm performance.

This research finds direct relationship between HRM practices and firm performance is in compliance with the RBV at a higher level of significance ($r = 0.72^{**}$). The main features of this relationship are being performance appraisal, pay, health and safety, communication, and benefits management practices respectively. The linear regression also reveals that the relative contribution of employee job commitment in the prediction of firm performance is 87% and highly significant ($\beta = 0.870$ and $\text{sig} = .000$) while it has been 7.4% and not significant ($\beta = .074$ and $\text{sig} = .120$) for employee job competence. Most strikingly, employee job competence in concert with employee job commitment reported the highest significant correlation with overall firm performance ($r = 0.98^{**}$) and its contribution as per the linear regression has been 95.9% (adjusted $R^2 = 0.959$). Firms' performance appraisal, communication, and benefits management practices are found more influential on both employee job competence and job commitment.

Responses from managers reveal that the effectiveness of almost all HRM practices in terms of their design and implementation is moderate among the entire sample of firms ($M = 3.43$), which however denotes a bit higher in listed firms ($M = 3.58$) than non – listed firms ($M = 3.29$) and the difference is found statistically significant ($P = .005$). In support, the majority of non – managers (80%) reveal that they are fairly satisfied of the current practice of HRM in their firm while 5% being very satisfied and 15% being not satisfied at all.

The overall findings of this research reveal that the effective adoption of HRM practices in contemporary organizations is a very powerful internal resource that can enhance overall firm performance through employees' productive outcomes. However, the combined effect of employee job competence and job commitment is relatively more powerful than their individual effects in the process of value creation.

Female participation in the decision making process of community development projects of local authorities: A case study of Ampara District, Sri Lanka

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Females, being the majority of the population, the role they play is significant in attaining development outcomes, mainly at village level. Local Authority is the primary entity through which women are provided with many opportunities to represent their voice in the process of community development.

The women in the Ampara district comprise 51 percent of the population (Department of Census and Statistics- Sri Lanka, 2007) but their representation in the Local Government is approximately 2% making their participation insignificant. The main objective of this study is to examine the participation of women in planning, implementation and monitoring of community development projects.

The study found that women participate in community development projects of local authorities in several stages in the process. A significant number of respondents, regardless the ethnicity agrees that women are consulted in the designing and planning phases of projects. The study also found that 46.0 percent of respondents from Sinhala community agree that women involve in the fund management process of community development projects. Only 19.5 percent of respondents confirm that women engage in the implementation process.

The study also found that at a superior level and in an indirect way there is a relation between women taking part in local authorities and good governance. It also found that in comparison to the other two ethnicities, state of empowerment of the Sinhala-female is at a positive level. Regardless of the ethnicity, the key factor that hinders women's political participation is the prevailing violent political culture.

Overall, the study found that women are consulted before implementation of projects but hearing their voice in the implementation and monitoring stages is very low. Despite the ethnicity, all women are strongly optimistic towards their participation in the decision making process over community development projects initiated by local authorities.

Government support policies and incentives for SME development: SME owners perspective

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The available literature on SMEs shows that SME development policies and economic growth are positively related to each other. The enterprises in the SME sector are less dynamic and underdeveloped compared to large-scale enterprises in the national economy. Yet, weak linkages with external market, weak technological innovation, and limited SME financing have limited SMEs' growth. Although several studies have been conducted on SMEs, they have not given adequate attention to examine the policies for developing the SMEs in Sri Lanka. The objective of this paper is to examine the public policies on the SMEs in Sri Lanka's manufacturing sector and their impact on SMEs. There is an ongoing debate in the literature on the SMEs in less developed countries on two issues: the survival of SMEs in the course of economic development and the importance of government policies for SME development. Policies in support of SMEs may broadly be categorized according to their objectives: broad macroeconomic objectives, social or equity objectives, market failure or efficiency arguments, and dynamic efficiency arguments.

This study extends previous work by contrasting small business owners' perceptions of the general policy regime with the actual effects on business regulation. Primary data is collected through the sample survey and for this purpose a structured questionnaire is used as the research instrument. Data for this study collect from 500 manufacturers using in-depth interviews and survey in Kalutara and Galle districts.

The study finds that there is a vast prospect for Sri Lanka to harness the opportunity by developing this vital sector. The study further identifies the policy changes necessary for enhancing the role of SMEs. This study concludes that the SMEs with effective use of networks, associations and government supports become more sustainable and make a greater contribution to the economy.

FACULTY OF LAW



Message from the Dean



The role of universities and the responsibility of the State in facilitating such role to be played in a very effective manner still remain as a point for discussion for all those who are concerned about the current status of higher education in this country. The Annual Research Symposium of the University of Colombo continues to provide the necessary forum for academics to gather and share their thoughts on many vital issues including the future direction of higher education in this country.

As we are living in the age of information, it is not only essential that knowledge be current and relevant but also that it be competitive. In today's context, without the vibrant sense of enthusiasm that leads to empirical research it is not possible to be in the 'market'. There lies the real challenge. Matters relating to development and sustainability cannot be considered in isolation of basic human values which defy any time or geographical barrier. Of course, research is needed for the enhancement of knowledge by being current and marketable but the means adopted for gaining such knowledge should remain *humane*, whatever the circumstances.

Those who are in the discipline of social sciences should contribute towards guarding the parameters within which this very knowledge is to be sought and gained. For this purpose, it is essential that certain standards should be adhered to while engaging in empirical research. These standards cannot be set without having a clear idea of the values which make the society cohesive and tolerant.

At the Faculty of Law which always proudly encourages sustained debate and constructive criticism among teachers, peers and students, the Symposium brings together another group of people who have excelled in the field of law to interact and argue salient points of law in the light of its latest developments. Critical reflection of what we are doing and whom we are teaching would be the theme for the Faculty's Symposium this year.

I thank all those who worked hard to make this event a reality and I wish the presenters, discussants and participants a fruitful time at their respective sessions. May the power of our minds and the strength of our imaginations come together to create new and meaningful knowledge and modes of thought focusing on nothing but justice!

V.T. Thamilmaran

Dean, Faculty of Law

Faculty of Law

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Devolution of land powers or demarcation of land powers: A critical reflection in light of the 13th amendment to the Constitution of Sri Lanka

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The 13th Amendment to the Sri Lankan Constitution was brought as a political solution to the ethnic conflict. However, even after the implementation of the Amendment, the civil war continued for more than two decades. Now, while the bitter memories of the war fade away from public memory, discussions on the necessity of continuing with the 13th Amendment or rather the land and police powers which have been delegated to the Provincial Councils by the Amendment have emerged.

It is a proven fact that land was a key factor that contributed to the ethnic conflict. In an era, when the country and its people do not want repetition of the bitter past, it is important to have a better understanding of the land powers that have been delegated to the Provincial Councils by the 13th Amendment.

Main objective of the 13th Amendment is to devolve selected powers from the Central Government (CG) to Provincial Councils (PC). While some powers over lands have been listed under the PC list, CG reserves to be the owner of all state lands and CG could alienate them according to its discretion to the PCs or any other body or person. In most of the other matters relating to the state lands, CG retains the powers to take the final decision. In addition, the decision-making powers of the PCs on matters relating to lands depend on the financial resources as well. Furthermore, use of the lands entirely depends on State Land Policy. In short, reality of delegation of land powers hangs on the string of political patronage.

Important point to realize is that devolution of land powers under the 13th Amendment was only a white elephant and as of present, PCs have no powers relating to state lands that the CG can take back. But, if we want a meaningful peace building in the country, it is time for the CG to delegate actual land powers to the PCs. This paper aims to discuss the devolution of land powers in detail with the objective of finding whether it is absolute devolution of powers or demarcation of powers. This paper will also look at ways of delegating land powers and addressing current issues relating to state lands while preserving the unitary character of the state.

Trade union rights in Sri Lanka: A critical assessment in light of balancing the interests of workmen, employers and the State

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This paper discusses the extent to which the State has succeeded in providing a legal framework relating to trade union rights to balance the interests of workmen, employers and the State. The findings establish violation of trade union rights in the government sector becomes violation of fundamental rights and in the private sector becomes an unfair labour practice. The right to strike is not expressly provided for, but impliedly recognized in Sri Lanka by the legislative provisions. Collective bargaining also has been legally recognized as a means of settlement of industrial disputes. However, the workmen or trade union in the private sector cannot independently file an action in a court for unfair labour practice or anti-union discrimination. The Minister has power to refer an industrial dispute for compulsory arbitration and make the continuance of the strike illegal. The Minister also has power to declare any industry as essential industry and make 21 days prior notice is a mandatory requirement to embark on strike action. The Minister could abuse these powers to curtail right to strike of the workmen. The President could declare the services essential to the community as essential services. But, there are no guidelines to decide what would come under essential services. Sometimes, the courts also issue enjoining orders to restrain strike actions even though the strike actions are not illegal. The question arises whether such interventions are in consonance with the intention of the Legislature. Hence, it is argued that the limitations may surplant the rights of the workmen. The question arises as to the extent to which the interests of the employers are protected in Sri Lanka. The provision for compulsory recognition of trade unions for collective bargaining by the employers violates the ILO principle of voluntary negotiation. The legislation does not deal with unfair labour practice by workmen or trade unions. Hence, the trade unions may embark on unfair labour practices and also resort to wild cat strikes unless the industry has been declared as an essential industry. Employers also have to depend on the intervention of the State to impose limitations on strike actions. Hence, the lacuna in the legislation and the unguided powers of the State which may be abused by arbitrary action or inaction may tilt the required precarious balance.

Restraint of trade in the music industry in Sri Lanka - Sterilization after limelight?

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In recent years, the music industry has become a rapidly-growing lucrative field, as a result of the booming reality show culture. However, potential artists do not remain in the field for years, except for few successful cases. One of the possible reasons for this phenomenon is the agreements these performing artists have to enter into; either with the reality media or the recording firms which restrain their personal freedoms. Little is known, however, about the validity and enforceability of such contracts. In this context, this paper aims to examine this issue from the perspective of contract law relating to restraint of trade in Sri Lanka.

The underlying rationale of contract law is to support and promote the public policy of trade, freedom of contracts and competition. Therefore, restrictive covenants are *prima facie* void, unless the restrictions contained are justifiable as illuminated by Lord Macnaghten in *Nordenfelt v. Maxim Nordenfelt Guns and Ammunition Co.*¹ Furthermore, in view of the relatively unequal bargaining power of the parties, the duration of the contract and the exclusivity of the services, it might also be argued that such kinds of contracts are void as judicially examined in *ZangTumb Records Ltd and Another v. Holly Johnson*.²

Interestingly, however, as reflected in *Silverstone Records Ltd. v. Mountfield and Others (The Stone Roses Case)*³, the court has been sympathetic to the fact that recording and publishing companies hesitate to invest huge sums of money in an artist without some form of protection on any future return. Thus, it is a matter of balancing of competing interests involved between the recording or the media company and the artist.

This study finds that the performers in the music industry in Sri Lanka are particularly vulnerable due to the restraint of trade contracts. In dealing with this scenario, the emerging case law jurisprudence from other jurisdictions may be used as a guide for Sri Lankan courts. Furthermore, there is evidence that an artist, who is in a relatively small sized market like Sri Lanka, would not choose the path of litigation since such a step would no doubt add a negative reputation to an up-coming artist. The research findings indicate a need for a legislative intervention, even though an introduction of a new law alone would not be the *panacea* for the problem.

¹ [1894] AC 535 at 565

² [1993] EMLR 161

³ [1993] EMLR 152 at 156 per Humphries J.

A need to ensure participation rights of children in Sri Lanka

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This paper examines the current policy and practice around children's participation in decision making process in Sri Lanka. Participation rights are considered as one of the basic principles of natural justice '*audial terampartem*', which requires that all parties involved in the dispute should be heard before reaching a decision. Participation rights of children in the decision making process has gained increased attention and support internationally since the adoption of United Nation Child Right Convention. UNCRC outlines child's participation in decision making in Article 12 and 13. Sri Lanka has ratified UNCRC and accepted its commitment to protect child rights guaranteed in the convention. In Sri Lanka social, cultural and legal norms favour protection and provision rights of children more than promoting participation rights of children in decision making process. The procedural and substantive laws of Sri Lanka do not recognize participation rights of children in the areas of right to education, health, religion and family. The legal system of Sri Lanka has been influenced by both Roman Dutch Law and English Law. Furthermore, the concept of the child's best interest entered in to Sri Lanka through combined influence of Roman Dutch Law and English Law. Therefore, South African and English law development on participation rights of children are studied with making recommendations to enrich the participation rights of children in the decision making process.

Gender inequality in personal laws of Sri Lanka: A critical study on intestate succession rights of women in the plural legal system

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This study mainly focuses on gender based discrimination in relating to intestate succession rights of women in personal laws of Sri Lanka. International instruments, in particular Article 16(1) (h) of CEDAW and Article 2 read with Article 17 of UDHR have emphasized gender equality in respect of the succession to property. Moreover, Sri Lanka has agreed to achieve the targets of the UN *Millennium Development Goals (MDGs)* relating to “promoting gender equality and empowering women”. On the other hand, Article 12(1) and 12(2), as well as Article 27(6) in the Constitution of Sri Lanka have recognized the norm of “gender equality”. Nevertheless in the Sri Lankan context, intestate succession rights of women in personal laws are affected by the gender discriminatory statutory laws, male - dominated traditions and customary law principles from the pre-colonial era. The main objective of this research is to identify the appropriate legal reforms to eliminate gender inequality in the law of succession, while ensuring core elements and customary values of personal laws in the legal system of Sri Lanka.

In the Kandyan law of succession, the *diga* married daughter loses her inheritance rights in relation to the *paraveni* property. Further, Section 11&12 of the Kandyan Law Declaration Ordinance can be recognized as gender discriminatory statutory provisions. In relation to the *Sunnite* law of inheritance which is applicable to Muslims in Sri Lanka, a female is given half the share of a male.

This study also demonstrates that a successful combination of the active involvement of the legislature, and a social transformation should be part of the process to eliminate the inequality regarding women’s succession rights in personal laws. This analysis shows that, Sri Lanka has a legal and moral obligation to take positive legal measures to ensure formal equality and substantive equality by respecting international standards. This is a qualitative research mainly based on the secondary sources.

Theories or rules: A critical evaluation of the approach taken by the Sri Lankan judiciary towards Constitutional interpretation

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As the supreme law of the country, Constitution holds a unique position in the Sri Lankan legal system. Interpretation of a unique document of this nature requires special attention to be given to methods, approaches and principles to be used for such interpretation process. The methods, approaches and principles used by the judiciary in constitutional interpretation have a momentous impact on the protection of rights, fundamental freedoms and other constitutional safeguards as guaranteed by the Constitution. Presently, the statutory and constitutional interpretation in Sri Lanka is based on the traditional methods and rules of interpretation received at the time of British occupation. The contemporary studies in relation to constitutional interpretation have resulted in questioning and re-evaluating the traditional approaches, methods and understanding as to constitutional interpretation. Therefore, it is intended in this paper to analyse the recent decisions of the Supreme Court of Sri Lanka to identify the general approach taken by the Supreme Court in terms of constitutional interpretation and to ascertain whether such approach reflects the contemporary methods, approaches and principles of constitutional interpretation. As the general approach taken by the Supreme Court of Sri Lanka indicates a reluctance to make use of the contemporary knowledge and the resultant modern approaches to constitutional interpretation, this study also emphasises on the reforms which need to be effected in order to ensure the reflection of contemporary knowledge in the process of constitutional interpretation in Sri Lanka. For such purpose, this study also intends to look into the role to be played by the public educational institutions in tertiary education as visionary leaders who must not only impart the contemporary knowledge, but also ensure that the attitudes of the recipients of such knowledge are moulded in order to encourage the application of the knowledge that they have received.

Age of majority and evolving capacity of the child in a plural legal system

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This paper explores whether there should be any exceptions to the general rule of age of majority. Children as human beings are entitled to all human rights. However, the *'ideas of childhood are frequently used as control mechanisms'*. Therefore, children are considered as a distinct group which lack legal capacity and are only entitled to enjoy certain rights. This stance of the society is reflected in the positive laws. In Sri Lanka under the Age of Majority Ordinance No. 7 of 1865 (as amended by Act no 17 of 1989), the age of majority is eighteen years. Hence, the law clearly distinguishes the legal personality of a child and an adult. However, this paternalistic notion of the need to protect children as a vulnerable group is challenged today, mainly because of the evolving capacity of the child as recognised in United Nations Convention on the Rights of the Child (UNCRC). Though there is no dispute as to the fact that children need protection, the question remains as to what kind of protection, by whom and through which means protection should be provided. It should not be forgotten that protection of children does not amount discrimination. The dependency of children should not be a reason to deny them their rights. Moreover, it cannot be argued that the state does not have a responsibility to protect its citizens who are above the age of majority. Hence, having a fixed age in order to determine child's competence in enjoying his or her rights is itself a violation of child's rights. This study identifies that there are certain exceptions to this general rule recognized in the legal system of Sri Lanka. It also suggests, that balancing the protectionist approach and recognizing evolving capacity of children is vitally important in today's context for their full development. Within this context, the state has to balance the concept of age of majority and evolving capacity in many spheres of rights of the child. Giving consent to medical treatment, adoption, custody, education as well as economical rights including employment rights requires a balance between protection and participation of the child's best interests are to be ensured. Norms emanating from the plural legal tradition will be examined to see if this balance has been achieved.

Towards a re-vision of human development through gender equality in land law

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Notwithstanding Sri Lanka being a party to many international standard setting conventions that urge states parties to ensure gender equality in law and policy and despite the right to equality guaranteed in the national Constitution, women are discriminated in respect of land rights. The gender bias prevalent in the relevant laws, customs and institutional mechanisms obstructs a rights-based approach to development, which is crucial to sustainable development of the nation.

The prevailing bias against women in relation to land rights is based on paternalistic notions in law and practice and corresponds to a situation where individuals dominate over life chances and opportunities. Ownership and control of land provide opportunities for economic development, political empowerment and social recognition within and outside households and communities. The dominance of men in opportunities in development in the Sri Lanka land law regime is retained through state policy, laws, customs and institutional mechanisms that place them at an advantaged position over women in access, ownership, inheritance and other rights in relation to land. Consequently, women are disadvantaged and disempowered vis-a-vis men.

Development is a universally recognized human need and a pre-condition to the realization of a number of other human rights and also one that correlates with them, and access to basic requirements including economic opportunities and assets is a necessary pre-requisite of development. Denial of rights relating to land on grounds of gender deprives women's development. In order for women and men to realize their development as individuals, the land law regime needs to be changed to a system where circumstances and chances dominate over individuals rather than a structure where individuals dominate over opportunities of development.

Focusing on the link between land rights and the rights-based approach to development, this paper argues that substantive equality between men and women in land rights is an urgently needed legal reform in the process towards sustainable development in Sri Lanka.

Extended employer's liability for employee's intended acts:

A critical evaluation

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The concept of vicarious liability explains that the employer who has not committed a wrong may still be liable for another's delict or tort.⁴ This requires a proof of a special relationship between both parties involved. With regard to the employer-employee relationship, it is needed to be shown that the employee's delict takes place within the 'scope of employment'. However, determining the 'scope of employment' is rather complicated in intentional delicts than delicts based on negligence. In line with the long standing test introduced by Prof. Salmond; presently, more emphasis is given as to whether the act or the omission done by the employee is 'so closely connected' with his normal duties so that the employer could be held vicariously liable.⁵ This trend is clearly apparent in intentional wrongdoings that involve sexual abuse, fraudulent acts and assault cases in other jurisdictions.⁶ Based on the standard test, even the Minister/State would be vicariously liable in South Africa as they emphasized the fact that the 'accountability is ultimately the responsibility of the employer'.⁷ Comparatively, in the English law, the liability of the employer is determined on policy grounds and tries to keep the concept within the confined limits.⁸ Sri Lanka has also recognized the 'close connection test' very recently to determine the scope of employment by the Supreme Court in an intentional wrongdoing of a private employee.⁹ In effect, a fear of limitless liability against unauthorized intentional acts of the employee may occur among the groups of employers generally. Therefore, this study examines how the above test could be applied in Sri Lanka to obtain a value judgment without damaging the legal norms of vicarious liability. This will be a comparative analysis which compares similar situations in the South Africa and English law.

⁴Thus, it is a concept which is a derivation of the norm of strict liability.

⁵ The test considers if the act was authorized by the employer or an unauthorized mode of doing the act authorized by the employer. See, J.W. Salmond, *The Law of Tort*, Stevens & Haynes, 1907

⁶The employers will not escape liability merely because the conduct is fraudulent, unauthorized and the employee is in his frolic action. See, *F v Minister of Safety and Security* [2011] ZACC 37,

⁷MonaryMarsellus Botha, Daleen Millard, *The past, present and future of vicarious liability in South Africa*, De Jure, 45 Volume2, 2012, p225

⁸However, with regard to intentional wrongdoings, the English court has developed the scope of liability if the act is closely connected to the services of the employee. Moreover, the court concerns whether it is fair and just to hold the defendant vicariously liable. See, *Bernard v Attorney General of Jamaica* 2004 UKPC 47, *Gravesend Grammar School for Girls and Adventure Life Signs Ltd* [2012] EWHC 575(QB), *Lister v Hesley Hall Ltd*. [2000] 1 AC 215, *Weddall v Barchester Health Care Ltd*. [2012] IRLR 307, *JGE V The Trustees of the Portsmouth Roman Catholic Diocesan Trust & Another* [2012] 1 All ER 723

⁹*KrishanNalindaPriyadarshana v KandanaArachchigeNilminiDammika Perera and others* (S.C. Appeal No. 67/2012, decided on 14. 06.2013)

The impact of British colonial policy on marriage and divorce: Internalization or indifference?

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This paper examines the impact of British colonial policy on marriage and divorce. With some exceptions the colonial policy remains relatively unchanged. The study identifies the following as being the main ingredients of colonial policy on marriage and divorce. Firstly, the formalizing of a 'loose tie' into a binding relationship. Secondly, that of 'standardizing' the consequences of marriage and introducing the concept of a predominant partner in the marriage. Thirdly, that of replacing or modifying community of property concepts and concepts of family property with separation of property and lastly, that of entrenching fault as predominant criteria in the law of divorce. These influences are more marked in the General Law but the Special laws too have been subject to such influences. The paper will establish that the binding nature of marriage in Sri Lankan law was ensured by the introduction of various formalities as a precondition to the validity of the marriage or as a part of the best evidence rule. It will also establish that the standardization of the consequences of the marriage took the form of making a husband liable to maintain his wife and children. This established a clear hierarchy within the marriage with the husband being the predominant partner. The paper will further argue that the separate property regime introduced into the General Law led to disempowerment of the wife. Freedom of testation further increased the married woman's vulnerability. Finally the paper will examine the consequences of the entrenchment of fault as the basis for divorce. The study will substantiate the hypothesis that the law of marriage and divorce currently prevailing in the country has been heavily influenced by British colonial policy.

Transnational nature of maritime issues in South Asia: The role of regional cooperation in the governance of maritime zones

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The objective of this paper is to highlight the transnational nature of maritime issues in South Asia and to consider the role of regional cooperation in the governance of maritime zones to address the issues. The maritime issues have direct and indirect impact on the coastal and landlocked States of the region. However, the States have an interest in the Indian Ocean for political, security, economic reasons and maritime resources. The rich resources – fisheries, off-shore oil and gas, and undersea minerals – are also of interest to the great powers beyond the region. The efforts by major global powers to get a position in the waters for their economic, navigational, security and strategic necessities are not only regional in nature, but those transcend beyond the region too. Moreover, the maritime route of the region is also used for human smuggling and drug trafficking, movement of refugees, illegal fishing and activities. The issues such as security challenges, maritime threats posed by States and non-State actors, navigational issues, the political and social dimensions of fisheries distresses, marine pollution, and coastal degradation are the serious threats not only to the individual state, but to the peace and security of the region too. Absence of appropriate framework for the delimitation of the maritime zones and deficiencies in the policy, legal, and institutional frameworks for the governance of the maritime zones are the major obstacles in the region. Thus, regional cooperation and a regulatory mechanism will have a direct impact on most of these issues in the region and it may perhaps be the only option through which South Asian States could achieve order in the governance of their maritime zones.

Right to tertiary education: A constitutional possibility

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Higher education has been a focal point in the recent past due to the concerns that were raised by many interested parties especially regarding the budgetary allocation for education in Sri Lanka. The private universities which are mushrooming all over the country, pose, albeit necessary, a precipitous challenge to the universities of the state-sector which lack the resources to compete with the private-sector tertiary education. This is an ever-increasing crisis that demands immediate attention.

Right to education has not been recognised in the Fundamental Rights Chapter of the Sri Lankan Constitution as a right that requires enforceability. Although Directive Principles of State Policy theoretically recognise '*the right to universal and equal access to education at all levels*', there is no accepted mechanism of enforcement of right to education. In this context, many issues that have an impact on all aspects of tertiary education can emerge. The percentage of students who gain access to state universities out of those who are eligible is alarmingly low. The non-enforceability of the right to education could perhaps be the reason for restricted accessibility of state-sponsored tertiary education which has a bearing on the competitive knowledge economy of the country.

This paper analyses arguments in favour and against state-sponsored higher education in Sri Lanka in a Constitutional perspective while exploring the possibility of introducing the right to education, if not as a fundamental right, as an enforceable right. The first part of the paper focuses on the status quo of state-funded higher education in Sri Lanka while the second part of the paper focuses on the possibility of introducing a culture of rights taking into example, provisions of international covenants and best practices of comparative jurisdiction to implement state-funded higher education to correspond to the requirements of the growing competitive knowledge economy.

A critical analysis of the use of a teleological approach to the interpretation of WTO agreements

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The interpretation of a WTO Agreement depends primarily on the text of the treaty and the application of Article 31-33 of the *Vienna Convention on the Law of Treaties* (VCLT) by the dispute settlement bodies of the WTO. Yet, it has also been commented by scholars that in interpretation of WTO Agreements, Article 31 of the VCLT (the 'text-context-object and purpose' approach) can be seen as balancing both the literal and teleological elements. The main objective of this research is to assess the use of a teleological approach to the interpretation of WTO Agreements. This research is an analysis of the rules and approaches to treaty interpretation, with special focus on the interpretation of WTO Agreements. It is based on library sources.

A teleological approach to interpretation of WTO Agreements may not be suitable for several reasons. Firstly, it is doubtful that the *telos* of the WTO includes or balances the wider concerns of sustainable development and economic social rights with trade liberalization. Second, if this is so, those who wish to retain flexibility for choosing the end (e.g. sustainable human development) and the means (national policy) may actually prefer to keep teleological approaches out of the reckoning, as it could also be used to advance one particular type economic policy and governance and lessen space for alternative economic policy. Thus it is commented that a teleological approach is more relevant to situations such as National constitutions - or the European context where there is supposedly greater socio-political and economic policy commonality than the WTO.

The VCLT suggests a holistic approach to text-context-object and purpose, and the WTO dispute settlement bodies have recognized a textual-evolutionary approach. A restrained teleological approach to interpretation could be applied if there was greater clarity and agreement on the goals of the relevant WTO Agreement being interpreted as well as on the *telos* of the WTO system. Thus teleological interpretation is not as promising as it may seem at first with regard to the balancing of conflicting interests and values in the WTO system.

Internalizing public law values in the Faculty of Law: A reflective exercise using the metaphor of ‘Faculty as a State’

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This paper is primarily inspired by a Faculty of Law (hereinafter ‘Faculty’) meeting on the research symposium where the issue of internalizing values in the teaching and research done in the Faculty was discussed. This paper is a reflection on the internalization of some basic values of the public law subjects using the metaphor of the Faculty as a State as a tool for analysis. If *completely ignoring* the wider context in which the Faculty is placed, the metaphor used can be “Faculty as sovereign State” – but if placing it in the context of the University of Colombo and broader University system, it can be seen as “Faculty as a State/Province or Local Government” within a legal system of devolution of power.

The intention is that this basic study can be a foundation for future reflection and research – and a more conscious and effective internalization and institutionalization of public law values in the Faculty of Law.

This initial study is desk-based. A metaphor is used as a tool of for reflection, which is considered as suitable to this context as metaphors are often used to illuminate legal discourse and persuasion. The approaches of James B. White, Michael R. Smith and Linda L. Berger in analyzing the role of language and metaphor in legal discourse is the main basis for the method used.

Thinking of “Faculty as a State” and applying the values taught in the LL.B course (particularly with regard to public law topics) to this ‘State’, *can and ought to* go beyond being a merely an intellectual exercise. It can be a practical exercise linked with the structures, policy and procedures of the Faculty as well as to the teaching and training of future lawyers and the research output of legal academics. It also provides a basis for a critical analysis of the relationship of Faculty to University (and to University Grants Commission and the Ministry of Higher Education) and the wider context of autonomy, responsibility and decision-making in the University System.

There is scope for further in-depth study extending this metaphor in both intellectual and practical levels. It is also hoped that this paper can be a basis for further research that could include both qualitative and quantitative surveys on the support for the internalization and institutionalization of public law values in the Faculty of Law and in the University System.

Citizenship and identity issues of Indian origin upcountry Tamils after the citizenship act of 1948 of Sri Lanka - A critical study

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Indian origin upcountry Tamils were brought to Sri Lanka in British colonial period. They were brought into Sri Lanka as a result of opening up international market for migrant labour in the 19th century. The Citizenship Act No 18 of 1948 indeed redefined citizenship of Sri Lankan population, but it particularly affected the citizenship status of nearly one million people who were of recent Indian origin. The franchise amending legislation passed by the legislature of that period made the Indian origin upcountry Tamils ineligible to vote in periodical elections of Sri Lanka. This led to another significant consequence, namely, the upcountry Tamils lost their proper representation in Parliament which is an essential requirement to protect minority group rights. At last, citizenship issue was resolved in 2003 with the progress approach from 1986 through the Grant of Citizenship (Special Provisions) Acts passed in 1986 and 1988, but that did not approach the issue from the minority rights perspective. So this paper seeks to examine the citizenship and identity issues arose as a consequence of the Citizenship Act passed in 1948 and the present difficulties in the identity issues of the upcountry minority Tamils in Sri Lanka. This paper also examines the status of the upcountry Tamils who got the status of Citizens of Sri Lanka under this Act, but enjoy a status as second standard citizens because of lack of effective administrative process to enhance their democratic citizenship rights to enjoy citizenship and their identity. The Author of this paper seeks to examine all the above mentioned issues in minority rights perspective. The relevant provisions of the Citizenship Act and the comparative study would be dealt with in this theoretical research exercise.

‘The responsibility to protect’: Is it a legal norm or a political doctrine?

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This research focuses on the scope and the nature of the concept of ‘Responsibility to Protect’ (R2P). The doctrine posits that each State has the primary responsibility to protect its population from mass atrocities. When States fail in this responsibility, the international community has a residual responsibility to protect people from such serious violations. The need to craft a new and more measured doctrine differentiating the idea of humanitarian intervention led to the initiation of ‘R2P’. The research problem of the study is whether the ‘the Responsibility to Protect’ is a legal norm in international law or rather a political concept? This problem is based on the puzzle that arises recently as to why ‘R2P’ was invoked in Libya but not in Syria, despite the striking similarities of systematic human rights violations occurred in both territories. This problem is examined under the ensuing research questions: Is ‘R2P’ an established norm of international law? If not, would it be able to acquire eventual legal recognition? If ‘R2P’ is not a legal principle is it a political doctrine, and if so, how this political commitment is practically implemented without no legal obligation? The research is based on the following hypothesis: “since the ‘R2P’ is not yet received international legitimacy either through a treaty or as a customary international law principle it is not a norm in international law.” The research reveals that the implementation of ‘R2P’ highly depends on domestic and international politics; feasibility, and will. Although ‘R2P’ sounds legal it is fundamentally a political act. The contradictory application of ‘R2P’ between the Libyan and Syrian crisis proves the aforementioned hypothesis of the study.

University – Industry collaborative research: A critical analysis on inventions made in contract of employment and the concept of joint ownership

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In an overall analysis of the university- industry interface on research activities, it is important to answer the question as to what extent the researchers/ employees of universities can be motivated to engage in more *industrial friendly* research activities through collaborative research efforts. In order to achieve this, a careful examination of the application of two intellectual property concepts, namely **inventions made by an employee** and **the joint ownership** is also noteworthy. While many industrial countries and some developing countries like India have established their own laws over the application and scope of these two notions for effective utilization of university researches through series of case law and legislative clarifications, Sri Lanka is still attempting to determine the scope of these two concepts in a patent law perspective. This paper attempts to examine the possibility of expanding the meanings given under section 69 and sub-section 67(2) of the Intellectual Property Act which describe the ownership of an invention made by an employee and the concept of joint ownership respectively. This research identifies the insufficient nature of these two sections in explaining the underpinning concepts of these very important intellectual property related areas which have a direct relevance to the issue of determining the patent ownership and benefit sharing of the patented products made in collaboration of universities and the researchers in the private sector.

In the research, after having a comparative analysis on joint ownership, it is found that *a person who has merely assisted in the creation of an invention but has made **no contribution of a creative nature** shall not be deemed to be the creator or a co-creator of such invention.* Further analysis is made to identify on what basis *this creative nature of an invention* be decided in the university- industry interface.

This paper analyzes that vague and insufficient nature of some case law decisions in Sri Lanka, which provide neither guidelines nor directions for future courts, demands the urgency of expanding the statutory meanings of the concepts to meet with international standards.

Second-tier patent protection: An appropriate option for incentivising domestic innovation in Sri Lanka?

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Intellectual property protection is one of the central public policy pillars on which the knowledge-based industries and global markets of the 21st Century rest.¹⁰ Today, it is hard if not impossible to imagine achieving sustainable economic growth without the protection and promotion of innovation. The term ‘second-tier patent’ (STP) is used as a generic label encompassing utility models (UM), petty patents, and other modern regimes such as innovation patents. Empirical studies from East Asian countries, especially from South Korea and Japan, indicate that a STP regime can encourage greater innovation in developing countries as it provides legal protection for simple technological advances that do not qualify for full-fledged patents because they fail to satisfy rigorous patentability criteria.¹¹ As observed by commentators, there seems to be a shortage of home-grown creativity in Sri Lanka. Viewed through the innovation landscape, Sri Lanka has not been able to make significant strides in terms of innovation and technological progress in the past six decades. Thus, the aim of this paper is to investigate whether from a legal policy perspective it is desirable for Sri Lanka to foresee a specifically designed STP regime such as UM or a petty patent system, in addition to the existing patent regime.

Undoubtedly, Sri Lanka needs to promote innovation at all levels to develop a culture of innovation. The finding of this study supports the view that an adoption of a STP regime would be the first step in paving the way for an innovative country and a stepping stone for technological development. Nevertheless, there is no guarantee that any UM or petty patent would increase domestic innovations unless the country provides the other necessary conditions for innovation to happen viz. appropriate institutions, education and IP awareness. Most importantly, the benefit of a STP regime in any country would depend on the specific design of the legislation. The policy space left by multinational legal framework can be used to design a most appropriate form of a second-tier patent protection that suits the specific needs of the country. Even though the STP regime would not be without its critics, there are compelling reasons for Sri Lankan policymakers to consider a new legal instrument for incentivising less technically advanced domestic innovation in the country.

¹⁰ Business and Industry Advisory Committee (BIAC) to OECD, Discussion Paper on ‘Creativity, Innovation and Economic Growth in the 21st Century: An Affirmative Case for Intellectual property Rights (Paris, December 2003)

¹¹ Yee Kyoung Kim and Keun Lee and Walter G Park and Kineung Choo, ‘Appropriate Intellectual Property Protection and Economic Growth in Countries at Different levels of Development’ (2012) vol 1 (4) Research Policy 358-375, 360

Food safety in the context of trade liberalization: An analysis of the Sri Lankan law and WTO rules

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World trade has been growing continuously due to a number of factors. The liberalization of trade restrictions and advent of WTO (World Trade Organization-which is in the process of expanding the trade between the international communities) can be cited as two major factors. Importantly, liberalization of trade in agriculture ensures global food security by balancing the demand for and the supply of food items across the globe. This process is supported by the WTO. This particular development has benefitted consumers because trade liberalization and the role of the WTO have expanded consumers' access to food at lower prices, good quality, variety of food and endless supplies. Unfortunately, food safety, food quality and trade related concerns are becoming more pronounced than before given their negative impact on the health of millions of consumers in the globe, especially infants and small children who consume unhealthy milk products. Milk contaminated with chemicals such as melamine and dicyandiamide were discovered by the Sri Lankan authorities recently can be cited as examples to highlight the growing problematic nature of food safety in the current national and international market setting. These developments demand effective measures to eradicate this hazardous growing phenomenon and to protect infants and small children from being exploited. One of such measures is the development of an effective regulatory framework nationally and internationally.

In this context, this paper argues that the existing legal framework applicable to food safety in both Sri Lanka and WTO is not sufficiently developed to ensure the safety of milk products. This argument is supported mainly referring to the relevant Sri Lankan legal authorities and WTO rules on food safety. Thus the objective of this paper is threefold; first is to explore the scope and objectives of these legal frameworks; second is to identify their deficiencies and third is to make appropriate recommendations to improve the exiting legal frameworks. The methodology adopted in this research paper entails two research methods: literature review and comparative legal analysis.

Competition law and policy for protection of consumer welfare in Sri Lanka – A comparative analysis

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With the implementation of the “Free Open Market Competitive Economic Policy” in 1977 the political, social and economic patterns of Sri Lanka have enormously transformed. There has been a widespread shift in Sri Lanka’s policies towards liberalization, privatization, globalization and deregulation of access to markets. Due to the far reaching changes brought about by the open economic environment, the challenges faced by the consumers have been accelerated. Further, with the dawn of peace, Sri Lanka has become more receptive to FDIs and the country’s trade and investment regimes are further liberalized. In result, the inflow of foreign products and companies creates far greater challenges to the consumers. Thus the international dimensions and challenges of competition are becoming more prominent day by day.

Therefore adoption and implementation of new measures and safeguards to protect consumers are crucially important. Different legislation on consumer protection in Sri Lanka shield the consumers from being exploited by unfair trading practices. There is a growing recognition that competition law is closely connected with consumer welfare. While seeking to protect and promote effective market mechanisms, consumer welfare is one of the key objectives of competition policy as well. It is said that consumer sovereignty exists in a robust market economy. However, in the absence of perfect competition environment suppliers and manufactures always try to maximize their profits in a modern economy. At the same time consumers too have not been able to play a significant role in the economy due to poverty and various other reasons. This is where competition law has a role to play in safeguarding the interests of the consumers. It seeks to preserve the competition process so that consumers will receive the benefit they are entitled to.

The current Law as to consumer protection in Sri Lanka is primarily found in the Consumer Affairs Authority Act No. 9 of 2003 (hereinafter referred to as ‘the Act’). The Act has established the Consumer Affairs Authority (CAA), the apex government organization authorized to protect consumers’ interests and to ensure that there is fair and effective market competition within Sri Lanka. The Act laid down the consumer protection rules empowering the CAA to take necessary actions to safeguard the interests of consumers from sellers’ abusive trade practices such as collusive price fixing, dumping, predatory pricing, monopolies etc. by ensuring a level playing field and promoting consumer welfare in order to deliver the best results to consumers, while maintaining effective competition among suppliers of goods and services.

Eastern use, western control: Harmonising divergent norms of intellectual property ownership to protect community rights

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The old notion of property as an indivisible unit has been challenged by contemporary thinking on the subject. It has been argued that property encompasses a bundle of rights that change with the shift in the balance of utilities. This “bundle of entitlements” is said to encompass both control and income rights. Within this bundle the Western property system focuses on the income rights that refer to the commercial and economic potential of these assets, rather than on the control rights favoured by the East, that refer to the actual use and management of the physical substrate.

The divergence between the Western and Eastern systems is seen in the international instruments that govern intellectual property, particularly the TRIPs Agreement¹². It focuses heavily on the Western notion of ownership. It is argued that this is the reason that Eastern forms of ownership have been ignored, which allow for control over the asset, but do not exploit its economic features. In the Eastern world, there is a large amount of intellectual property owned by groups or collectives. These cannot be registered under the formal intellectual property system as there is no mechanism to do so. As such, they are vulnerable to piracy, leaving traditional communities with no redress.

This study identified the key differences between Western and Eastern forms of ownership as a possible reason for the lack of protection for community rights. Having analysed the TRIPS Agreement and the local laws on the subject, it proposed meaningful steps that would allow community rights to be protected within the legal framework.

¹²The World Trade Organisation’s covered Agreement on Trade Related Aspects of Intellectual Property Rights.

Is the law protective of vulnerable migrant workers? A critical study of the law relating to foreign employment law of Sri Lanka in the context of the law of agency

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Law of agency seeks to ensure that a fiduciary relationship is created when a third party enters into contracts with a person who acts on express/implied or actual/apparent authority of a person who is called the principal. In the context of foreign employment the companies who carry on the business of recruiting labour for and on behalf of a foreign person come within this legal category of 'agent'. It is a question whether the established presumption of fact that when an agent acts for a foreigner the agent assumes personal liability to the third parties and has no authority to establish privity of contracts between the principal and the third party, is valid for foreign employment or not. By virtue of Civil Laws Ordinance the law prevailing in England applies to Sri Lanka with regard to law of agency. Bureau of Foreign Employment Act No. 21 of 1985 tend to provide protection to migrant workers which is evident from its objectives. The Bureau licenses all agents and there are 1294 licensed agents. However, the statutory verification on the conduct of the agents are inadequate. The outflow of labour during 2011 was 267,500 which brought in SLRs 569,103 million foreign exchange. This is 48% of the total foreign exchange of the country. It is alarming that each year there is a high number of complaints. There were 14,704 complaints during 2010 and 9994 in 2011. Out of this there were 2073 and 1533 harassments during 2010 and 2011 respectively and 331 and 302 deaths respectively. All migrant workers pay a fee to the Bureau. Despite collecting a fee from all migrant workers and licensed agents, the Bureau call for donations and runs a Lucky Draw. An average of 6 deaths and 250 harassments per week is not to be neglected. Law should be amended to impose reprimands, punishment or penalty on errant agents and their license should be cancelled when they continue to enter into agreements with principals who do not comply with legal requirements.

Effectiveness of the regulatory approach adopted by online arbitration providers: A case study of Net-Arb

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International Commercial Arbitration (ICA) has been evolving steadily for a long period of time as one of the effective dispute resolution mechanism for addressing international trade-related disputes. One major reason behind the success of ICA is that it has been regulated by a set of conditions which include national arbitration laws, international legal instruments and self-regulatory frameworks. With the development of electronic transactions internationally, disputes and challenges have emerged out of and posed to the exiting legal and institutional frameworks due to the offline design base, and this includes the ICA. Internet-Arbitration (Net-Arb), which is a private online arbitration provider, can be cited as an example to reflect this transformation. Most importantly, as far as regulatory approaches adopted by this provider are concerned, this OA provider does not possess its own enforcement mechanism regulated by self-regulation, but has a link to the Enforcement of Foreign Arbitral Awards of 1958, commonly known as the New York Convention (NYC) as its enforcement mechanism. The reference to the NYC attracts ICA-related legal frameworks and adoption to the government sponsored court mechanism is mandatory.

The adoption of the NYC raises two concerns: Firstly, whether NYC is technologically neutral and secondly, whether the enforcement court is technologically equipped with or not. Taking into consideration these concerns, this paper specifically addresses the question: is Net-Arboperated within an effective regulatory framework? This question is addressed by contending that the regulatory approach adopted by this online arbitration provider in the enforcement of its final outcomes is not absolutely effective without appropriate reforms are brought to the exiting NYC and technologically equipped national courts established. An empirical research on Net-Arb and legal analysis of the ICA-related framework have been used to support the argument put forward in this paper.

FACULTY OF MANAGEMENT AND FINANCE



Message from the Dean



I would like to congratulate the paper presenters of the Annual Research Symposium of the University of Colombo-2013. As the premier university of the country, we have been able to provide this opportunity to all the academic staff members of the university this year as well. This is a very important opportunity, especially for young researchers to present their research outcomes on time and share their findings and views with eminent academics in various faculties of the University of Colombo. This years theme of the symposium is “Higher education through the State Sector of Sri Lanka in a Competitive Knowledge-Economy”. Under this overall theme, the Faculty of Management and Finance has organized its presentations under the sub-theme of “Globalization and Localization of Systems and Competencies”. Research papers were called for from the faculty academic staff members and after scanning and reviewing we selected six research articles to be presented in this conference. These research papers are in the areas of corporate social responsibility, Balanced Score card, budgeting, financial reporting and regulations, Project management etc. Once again, I would like to congratulate all the authors of the papers and the participants of the symposium. I hope this will be a good forum to discuss Management, Business and Finance related issues and research findings of the academic staff members.

Professor H. D. Karunaratne

Dean, Faculty of Management and Finance

Faculty of Management and Finance

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Adoptability of the Sri Lanka financial reporting standards (SLFRS) by small and medium scale enterprises (SMEs) in Sri Lanka

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A standard that prescribes the basis for preparing and presenting the financial statements of the SMEs was initially introduced in year 2003 by the Institute of Chartered Accountants of Sri Lanka (ICASL) and then a revised standard was issued recently, which is effective from year 2012. The study focused on identifying the nature of the accounting practices the SMEs are using and on identify whether the SMEs are adopting the introduced standards when reporting their financial/non-financial information to the users. Further efforts were made to examine the possible causes for not adopting the standards introduced, which is not been researched in the Sri Lankan context, and the researcher expects that this study would fill that knowledge gap.

The study was conducted at two stages where initially ten SMEs and ten audit managers were interviewed to collect the preliminary data. Thereafter fifty four respondents from SMEs were interviewed using a structured questionnaire. In the conceptual model the non-adoption of the standard is the dependent variable and six independent variables were tested.

The researcher could reveal that 90% of the respondents were not complying with the standards introduced for the SMEs and further it was due to the high cost that needs to be incurred in adhering to accounting standards, lack of knowledge and competence of the owners, inability of involving qualified employees in SMEs, knowledge on application of standards, and unavailability of parties interested in the financial reports other than the owner. The application of SLFRSs being not mandatory to the SMEs has not shown a relationship with adoption of SLFRSs.

Further, research can be focused on taking a larger sample as well as considering on a sector wise comparison of factors.

Management practices and state regime change; A study of the state budgeting system in Sri Lanka referring to Sri Lanka railways department

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This study demonstrates that management practices can become rituals if they do not recognise the evolution of the underlying socio political and cultural context. Hoque and Hopper (1994), Uddin and Hopper (2001), Wickramasinghe and Hopper (2005) and Hopper et al. (2009) show how management accounting practices interplay with wider socio, political and cultural context. Uddin and Hopper (2001) identified that approaches of organizational level control change corresponding to changing state control regimes. This research furthers on this finding to see how the regime change influences the operation of organisational level management controls. This is a historical study conducted in relation to the state budgeting and accountability system with special reference to Sri Lanka Railway Department. Archival data and data generated from an ethnographic study at the Sri Lanka Railway Department were used and the data were analysed drawing on the hegemonic analysis of Gramsci (1971). Hegemony explains how the ruling group of a society exerts domination over others with their consent. Findings reveal that the state budgeting system emerged in Ceylon in 1840s to fulfill needs of 'minimal hegemony' prevailed under the British colonial ruling. The term minimal hegemony indicates the rule where only the consent of a certain higher social group and not of the general public is considered in establishing ruling over the society. In 1931 when the universal suffrage was granted to Ceylonese, still minimal hegemony continued but a separate state budgeting system emerged to control public service expenditure. By 1948 when independence was granted the hegemony changed as an 'integral hegemony' where general public had the full consent for the ruling. This created a political interest among ruling politicians in order to sustain in their ruling power going beyond the interest in controlling public service expenditure. However, the local ruling group adopted all British colonial systems and practices to the post-independence Ceylon. As a result the colonial budgeting system came to practice in the post-colonial state. The broader socio-political context and its ruling interests changed but the budgeting system continued to remain unchanged. As a result the state budgeting system has become a ritual at public sector organizational settings as being demonstrated at SLRD. The study concludes that management accounting systems such as budgeting should embrace prevailing socio-political and cultural context and otherwise they fail to serve their intended purposes and finally become mere ritual practices.

Stakeholder relationships in post-disaster housing reconstruction and the *Stakeholder Circle*TM: A project management perspective

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This paper reflects relationships of stakeholders based on power, legitimacy and urgency, in a post-disaster housing reconstruction (PDHR) setting. A literature review and synthesis enabled identifying stakeholders and exploring the factors of salience. Seven experts who contributed in Tsunami, 2004, housing projects formed the primary data collection protocol. Interview findings added practical flavour to the literature review findings and assessed the engagement of each stakeholder based on their power, legitimacy and urgency to the project. *Stakeholder Circle*TM software aided analysing the data. It is important to identify the relationships of stakeholders in order to minimise the expectation gaps of post-disaster housing reconstruction projects. This paper paves the way to investigate the degree of power, legitimacy and urgency of the stakeholders in a PDHR scenario where the influence and the decision making power are rested upon. The findings could be applied to future housing reconstruction projects to achieve time, cost and quality objectives.

The influence of Coercive Isomorphism on corporate social responsibility reporting

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Corporate Social Responsibility (CSR) is gradually becoming a leading issue in a business. Prior research into factors which are influential in determining the extent and nature of CSR reporting has been concerned with the impact of internal characteristics. Whereas, the purpose of this paper is to analyze the impact of coercive isomorphism on CSR reporting in a company.

The study employs institutional theory as the basis for explaining the impact of coercive isomorphism on CSR reporting. Ten informants who are responsible for CSR reporting were selected from five listed manufacturing companies in Sri Lanka. The interpretative methodology, multiple case design were selected for the study and data triangulation as the interviewing and CSR reports reviewing was employed as the data collection methods.

Findings of the study concluded that the supplier relationship is the crucial coercive pressure on CSR reporting in the Sri Lankan context. This is due to the continued relationships maintained by businesses with local and foreign suppliers and customers. Furthermore, the study reveals that the CSR reporting is a method of maintaining the company image, and hence this reporting is for the purpose of an image building process rather than satisfying stakeholders information need. Thus, it reveals that institutions have regulative characteristics which exert coercive pressure and influence behavior due to the potential for reward or threat of punishment.

Implementation of the balanced scorecard in a Sri Lankan firm: A case study

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Although the Balanced Scorecard (BSC) is considered as a superior performance measurement tool compared to traditional budgeting; only some BSC implementations succeed while others fail. The objective of this study is to explore ‘how’ and ‘why’ the BSC implementation of Beta¹ became a success. It uses the qualitative methodology and case study approach. Data has been collected through interviews with senior managers of the firm, and review of documentation. It uses Actor-Network Theory (ANT) as the theoretical lens. The evidence suggests that the BSC implementation in the firm grew out of the need for a balanced view of performance, and as a means to win the national quality award (NQA). These dual aims became a reality for the firm, subsequent to the implementation of the BSC. The findings further reveal that while the BSC was initiated by the corporate planning division linking to the strategic plan; with the Chief Executive Officer’s (CEO) blessings and employees’ support a successful network settled in overtime. The BSC became useful for the senior management in organisational planning and controlling. In the eyes of various managers the BSC was a success, they cooperated towards it, and became part of the BSC network. Within the BSC network, actions of human actors such as CEO, members of corporate planning team and employees, as well as non-human actors such as BSC reports and NQA became important. This study shows that BSCs get transformed into successful and useful management tools, due to actions of various actors and the nature of networks formed. It contributes to the body of literature on the implementation of management accounting techniques (such as the BSC), and provides insights to practicing managers on how success with such implementations can be realised.

¹ A Sri Lankan company in the Information and Communications Technology (ICT) industry. Disguised as Beta for confidentiality reasons.

Intrapreneurial behavior: Towards future research in Sri Lankan organizations

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Several researchers have attempted to understand the factors that stimulate the development of intrapreneurship businesses from their initial status of entrepreneurship. Factors such as external environment, organization structure, business strategy, and management activities have been recognized as what mainly affecting the development of intrapreneurship. Major activities related to intrapreneurship include opportunity perception, idea generation, designing a new product or another recombination of resources, persuading management, planning, and organizing. Key behavioral aspects of intrapreneurship hold personal initiative, information search, new thinking, taking charge, and risk taking. The existing understanding of entrepreneurial and intrapreneurial research issues in the Sri Lankan context is not clear whether they directly apply the Western ideologies and/or create innovative organizational culture in intrapreneurship in the Sri Lankan context. This fact motivated to conduct a review of literature in order to suggest future directions to study intrapreneurial behaviors in Sri Lankan organizations. As the methodology, the paper reviews related literature on intrapreneurship in the international context, entrepreneurship and intrapreneurship in the Sri Lankan context, as well as some past studies on culture and managerial practices in Sri Lankan organizations. The paper suggests an integrated model to use the three alternative conceptual approaches which reflect the intrapreneurial behavior in diverse aspects, in the future studies on intrapreneurial behavior in Sri Lankan organizations. As implications, the findings could be helpful for both researchers and managers understand the vital role of intrapreneurial activities in order to achieve the success of business in Sri Lankan organizations. To overcome the main limitation of this paper which only use the method of reviewing literature of the relevant past studies, future studies on the topic need to be carried out empirically as single, comparative, and/or multiple cases or survey research in small, medium, and large scale entrepreneurial business organizations in Sri Lanka.

FACULTY OF MEDICINE



Message from the Dean



The wise selection of the theme “**Higher education through the state sector of Sri Lanka in a competitive knowledge economy**”, is certainly just the catalyst we need to sensitise our community to the dire need for making our University the most sort after Institute of higher learning in Sri Lanka. On behalf of the Academics and the supporting staff of the Faculty of Medicine, University of Colombo, I send the organizing committee and all the participants at this Annual Research Symposium 2013 our sincere good wishes for a very rewarding and productive event.

We at the faculty will also be conducting our respective programme under the patronage of our Chief Guest Prof. Uditha Liyanage, Professor of Management of the Postgraduate Institute of Management, a distinguished professional whom we are honoured and extremely happy to have with us on this occasion. The Faculty Oration will be given by Prof. Senaka Rajapakse, a Professor in Clinical Medicine, of the Faculty of Medicine, who was the recipient of the Award for Excellence in Research: 2010-12 of the University of Colombo.

I am sure, that this Annual research Symposium 2013 will also build lasting and sturdy professional bonds that will further strengthen the foundation that has been laid, for the development of research in this faculty.

Professor Rohan Jayasekara

Dean, Faculty of Medicine

Faculty of Medicine

Address by the Chief Guest: Educational reforms for a knowledge society

Faculty Oration: Predicting outcome in Leptospirosis: Towards a severity score

Plenary 1: Legal aspects of research

Plenary 2: Evidence-based medicine need for a paradigm shift based on local research

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Address by the Chief Guest

Educational Reforms for a Knowledge Society



The top ten jobs in 2012 did not exist in 2014. Intelligent Quotient (IQ) accounts for less than 10 percent of one's career success. These are two of the many telling facts that remind us once again that the game is changing. Indeed, education cannot and should not be treated as 'business as usual'. The dual purpose of education for work *and* life must be recognized. It is not about work *or* life. The knowledge, skills, values and mindset required to function effectively at work and harmoniously in life must first be clearly identified and then delivered to a generation that has received an education for a different purpose, with a different focus.

We have moved along, from an agricultural, to industrial, and then to the information or knowledge era. It has been said that the so-called Knowledge Age that has come upon us, characterizes the way in which we live and work today. Importantly, it has been argued that as a society, we have transcended the Knowledge Age, and are now in a Conceptual Age where our problems no longer have a single verifiable answer. The success in the Industrial and Knowledge Age was mainly determined by a "SAT-accuracy"; a series of tests throughout the education system that required logic and analysis to isolate a single correct answer to a complex problem. Today, the Conceptual Age requires, more than any other, creativity, innovation and design skills. However, our education system and processes are still firmly geared towards the needs of the Industrial and the Information Age, a fast disappearing era.

The emergence of the Conceptual Age, also called the Age of Imagination, reframes the educational and learning processes. In this context, one must learn to recognize the increasing complexity that surrounds one. Complexity that is compounded by globalization and information technology. One must realize that one's notions of simple, stable societal systems no longer has currency and validity. Complexity and in its wake, ambiguity is the defining principle of this day and age. The changing mode and response to the changing landscape are characterized *inter alia* by the following shifts in emphasis: From left-brain oriented, logical, analytical thinking to right-brain oriented, creative and patterned non-verbal thinking; from IQ (intelligence as we knew it) to EQ, and now SQ (emotional and spiritual intelligences); from individual excellence to team collaboration; from managing the status quo to challenging the status quo; from functionality of products to design of products; from focus to synthesis, and from knowledge and skills to values and well-being.

The change in the learning environment calls for a change in learning modes. The educational reforms that must be initiated should recognize the requisite changes, and diligently execute them.

Prof. Uditha Liyanage

*Professor of Management, Postgraduate Institute of Management
University of Sri Jayawardenepura*

Faculty Oration

Predicting outcome in Leptospirosis: Towards a severity score

Leptospirosis is a zoonosis of ubiquitous distribution, caused by infection with pathogenic *Leptospira* species. It is now considered a re-emerging infectious disease, following many recent epidemic outbreaks. Human hosts acquire infection through skin abrasions and mucosal surfaces following contact with water contaminated with the urine of rodents. The illness has a wide spectrum of clinical manifestations, ranging from undifferentiated fever to Weil's disease, a severe icterohaemorrhagic form. The exact pathogenesis of severe disease is poorly understood. Severity of leptospirosis has been linked to both pathogen and host factors. Vasculopathic organ damage, endothelial dysfunction and inflammatory infiltrates result in renal, hepatic and pulmonary injury. Severe leptospirosis runs a variable clinical course. Treatment includes supportive care, antibiotics, vital organ support, and management of complications related to organ dysfunction.

The findings presented here are results of a series of collaborative, original, clinical and laboratory studies involving a team of researchers, focussing on refining diagnostics, and identifying clinical, immunological, biochemical and haematological parameters which would predict severity and outcome in leptospirosis. Diagnosis of leptospirosis in the acute phase remains a challenge, and is often made on clinical features, with the microscopic agglutination test (MAT) used for epidemiological case definition and for case confirmation. Different immunodiagnostic tests were compared with MAT, and found to have varying degrees of diagnostic accuracy. No scoring system or predictive model exists to guide clinicians in identifying which patients will develop potentially fatal forms of leptospirosis. The PIRO (Predisposition, Infection/Insult, host Response, Organ dysfunction) model has been proposed to determine outcome in severe sepsis. A literature survey identified factors in leptospirosis which are associated with disease severity. Based on these, a tentative score is being developed, using the PIRO model as its basis, which could predict outcome. The predictive value of several identified factors was tested on a large cohort of patients with confirmed leptospirosis, and factors with predictive value were identified. It was possible to describe the patterns of several biochemical and haematological parameters through the course of the disease, and identify differences in these parameters among severe and mild cases. In particular, nitric oxide production and antioxidant capacity were evaluated in leptospirosis, and correlations with severe and mild disease were demonstrated. The role of nitric oxide in pathogenesis was further explored, with postulates that blunting of nitric oxide production maybe present in patients with severe disease. Rapid measurement of nitric oxide levels are proposed as a potential tool for early identification of patients likely to develop severe disease.

While yet in progress, these studies form the basis of future research, focussing on identification of biomarkers which are of predictive value, and streamlining clinical and laboratory diagnosis. Future focus will expand to investigate derangements in cellular

immunity in leptospirosis, and to determine sero-prevalence of leptospirosis in different districts in Sri Lanka, with mapping of cases using Geographic Information Systems (GIS) technology. The investigators have established a Tropical Medicine Research Unit, which has collaborations with the Institute of Biochemistry, Molecular Biology and Biotechnology, with many hospitals and clinicians in the country, and with the University of Oxford and the Mahidol-Oxford Research Unit, Thailand.

Professor Senaka Rajapakse MBBS, MD, FRCP, FRCPE, FCCP, FACP

Consultant Physician & Professor in Medicine

Project Lead, Tropical Medicine Research Unit

Department of Clinical Medicine, Faculty of Medicine, University of Colombo

Plenary Talk

Evidence-based medicine need for a paradigm shift based on local research

Until two decades ago most medical personnel used to practice *Experience Based Medicine* as there were little facilities for continuous medical education or professional development. They acquired knowledge mainly from text books which took some time to update the latest research findings. One serious deficiency in this system of patient care was that medical personnel believed experience alone would make an expert. This led to the practice of *Ego-based medicine* where the doctor would say “*I know everything, I can never go wrong, my word is the last, you do what I say, there is no need for questions or critical analysis*”. Those who realised the perils of Ego-based medicine found a new paradigm to improve patient care. This was termed *Evidence-based medicine* (EBM). EBM was an important and necessary step forward. EBM was more scientifically appealing than ego-based medicine and helped to improve the health care tremendously. With the advancement of communication facilities, internet, online journals and easy journal publishing, the concept of EBM became the holy grail of medicine.

However after practicing EBM for several decades we have encountered some deficiencies of EBM. Initially EBM was defined as *conscientious, explicit and judicious use of current best evidence* in making decisions about the care of individual patients. Later another phrase was added to make it more realistic - *integrating individual clinical expertise and the best external evidence*. However those who practice medicine in the real life situation know that the idealistic words in the EBM definition are only a utopian dream. In reality such perfect health care is so expensive and demanding that it can be provided only to a handful of the society especially in resource poor settings prevalent in developing countries. Medical personnel who try to provide *reasonable health care to all members of the society* will be reprimanded for ignoring EBM in their practice. It has also given a ‘*scientific back-up*’ to those in the industry who want to sell their expensive products (with marginal or no benefits to the patient) for personal gains and to make exorbitant profits.

Lack of research in the local settings of the developing world is a major obstacle faced during the search for current best evidence. Cultural differences, social differences and cost effectiveness make the issue more complex. Cost effectiveness which is crucial for the sustenance of any health care system is greatly ignored as there is hardly any research on cost effectiveness of therapeutic interventions in the developing world. This has led to diversion of limited resources available in developing countries to relatively expensive interventions as medical personnel are forced to endorse such processes based on evidence generated in the developed world. Failure to do so may lead to allegations of malpractice and litigation. Guidelines and protocols based on EBM are abused by parties interested in making money out of litigation. Therefore EBM promotes defensive medicine.

Hence time is opportune for the medical community to find a new paradigm in delivery of health care which would rectify the deficiencies of the concept of EBM when practiced in

resource poor countries and settings. The main aim of the new paradigm would be to provide reasonable health care to all. This could be appropriately called **Equity-based medicine**. At present there is no political and administrative will or leadership to appreciate and support those who provide reasonable health care to all segments of the society in resource poor settings. Politicians and administrators are also misguided and frightened by the concept of EBM and have no courage to contest the inappropriateness of EBM in resource poor settings.

We need more research on cost effectiveness done at the point of delivery. Guidelines should take into consideration the situation in the local setting. Researchers in the developing world should be persuaded and rewarded. Commitment of the local researchers would encourage politicians, administrators and decision makers to give leadership to low cost health care and *reasonable care to all* rather than ideal care to a few. Changes should be made in the legal framework to accept Equity-based medicine as the new paradigm. We changed from Ego-based medicine to Evidence-based medicine two decades ago. Now it is time to improve Evidence-based medicine and step into Equity-based medicine.

Anuruddha M Abeygunasekera

Urological Surgeon

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'Biochemical hyperandrogenism' in lean and overweight South Asians with polycystic ovary syndrome

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Hyperandrogenism in polycystic ovary syndrome (PCOS) has diverse clinical manifestations, with obesity linked to its severe forms. The objective was to compare differences in clinical and biochemical hyperandrogenism among lean and overweight patients with PCOS. Retrospective data analysis of a consecutive cohort of South Asian women diagnosed with PCOS in a specialized endocrine clinic in Colombo. Women were subdivided into two groups based on their Body Mass Index (BMI) < 23 kg/m² (lean), > 23 kg/m² (overweight). Serum total Testosterone and SHBG levels were measured and Free Androgen Index (FAI) was calculated.

Data from N= 108 women were analyzed. Overweight/obese (n=54) and lean PCOS group (n=54) with mean age 24.6 " 4.8 years *versus* 24.5"4.7; mean BMI 28.7"5.7 kg/m² *versus* 21.1 " 1.5 kg/m² (p=0.00) respectively. Mean serum testosterone (T) 2.72 *versus* 2.18 nmo/l (p=0.04). T >3.5 nmol/l occurred in 32 % of overweight PCOS *versus* 21.1% of lean PCOS patients (p = 0.000). High FAI (>5) was found in 46.6% *versus* 12.5% based on BMI (p = 0.043). Logistic regression analysis found BMI to be an independent predictor of elevated T with an odds ratio of 2.984 (95% CI = 2.045, 3.922).

In conclusion, lean and overweight PCOS subjects have significant differences in Testosterone and FAI. BMI is an independent predictor of elevated Testosterone levels. Therefore, it is important to consider the BMI in the management of hyperandrogenism in South Asian subjects with PCOS.

Infection in second trimester pregnancy losses: a pathological evaluation of 86 autopsies and placental tissue

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Infection is a leading cause of second trimester (T₂) pregnancy loss. Assessing the incidence and identifying the factors associated with infections would provide valuable data, useful in therapeutic decision making. The objectives were to determine the incidence of infection in T₂ pregnancy losses by histopathological examination of fetal and placental tissues and to assess the factors associated with incidence of infection in T₂ pregnancy losses. This cross-sectional study included material from 86 pregnancy losses occurring between the period of gestation (POG) of 12-28 weeks, received at the Department of Pathology, University of Colombo and at the private sector over a period of 3 years. The fetuses were examined and samples from both lungs, spleen, liver, heart, both kidneys, adrenals and brain were taken for histological evaluation. The trimmed placental weight was recorded and sections were obtained from focal placental lesions, placental parenchyma including maternal and fetal surfaces, membranes and the cord. Clinical data was obtained from patients' records. The histopathological evaluation was done by the same perinatal pathologist and data analysis was performed using SPSS 16.0.

Of 86 necropsies 38 (44.18%) were considered as early gestation (POG:12-20 weeks) and 48 (55.82%) were late (POG - 21-28 weeks). Fetal growth was appropriate for POG in 55 (69.77%) and retarded in the rest. Overall incidence of infection was 36 (41.9%). Chorioamnionitis: 33.7%, villitis: 7%, deciduitis: 12.8%, funisitis: 5.8%, vasculitis at chorionic plate: 15.1% and fetal pneumonia: 10.5%. Infection incidence between early (42.1%) and late POG (41.6%) did not differ significantly. Similarly, the correlation between growth retardation and incidence of infection was not statistically significant.

Chorioamnionitis is the most common histologically evident pattern of infection in second trimester pregnancy losses. The POG or fetal growth retardation does not appear to be associated with the incidence of infection.

University Research Grant 2010, University of Colombo, Sri Lanka, is acknowledged.

Growth Hormone Therapy for Short Stature in Adolescents; Experience in a University Medical Unit

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Short stature is known to occur in 5.3% of Sri Lankan children. Growth hormone deficiency (GHD), Turner syndrome, Prader Willi syndrome, are well recognized causes of short stature. The aim of this study was to observe the response to growth hormone therapy (GHT) and its side effects in adolescents who are indicated for GHT. This was an observational study done at University Medical Clinic, NHSL of adolescents presenting with short stature over 2.7 years. Adolescents were diagnosed with GHD by IGF-1 levels and insulin tolerance test (ITT). In addition, adolescents who have other indications for growth hormone therapy (Turner syndrome, Prader Willi syndrome, chronic renal insufficiency, etc) were selected and commenced on growth hormone therapy. All were monitored by anthropometric measurements, growth velocity, bone age and IGF-1 levels observed for side effects.

Among the 21 adolescents with short stature, 15 were males (71.4%). Mean age, height, weight at presentation were 15.0 (10.4-19.1) years, 138.6 " 7.6 cm and 38.4 " 12.9 kg respectively. Low IGF-1 was found in 16 (76.1%). IGF-1 was normal in Turner patients. Failed response to ITT was observed in 13(81.3%; n=16). Growth Hormone therapy was discontinued in one patient due to hypoglycaemia. Mean growth velocity and period of follow up of all were 7.1 " 3.7 cm/year and 1.3 " 0.8 years respectively. No significant correlation between growth velocity and age, bone age at commencement of therapy and mid parental height were found. Four of the five girls with Turner syndrome had normal IGF-1 and showed a mean height velocity of 5.86cm/year with therapy with no significant difference compared to the rest. Side effects were detected in 3 (14.9%) patients which were diabetes mellitus and carpal tunnel syndrome.

Growth hormone replacement therapy is useful in achieving satisfactory height gain in adolescents with short stature and is usually a safe treatment.

Markers of hyperandrogenism in South Asians with polycystic ovary syndrome

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Many clinical and biochemical criteria are used to assess hyperandrogenism in subjects with Polycystic Ovary Syndrome (PCOS). The objectives were to evaluate effectiveness of the Modified Ferriman-Gallwey score (FG Score- hirsutism), serum total testosterone, and free androgen index (FAI), in the assessment of hyperandrogenism. A case control study was conducted on 100 women aged 20-45 years (mean age=30 years). Confirmed cases with PCOS were age-matched for controls from healthy volunteers. Recommended cut-offs were used; FG >8, testosterone (T) >3.5 nmol/L, and FAI > 5. Specific cutoffs for South Asians have not been defined. Receiver operating characteristics (ROC) curves were drawn to compare diagnostic power of each parameter.

There were 50 cases and 50 controls. Cases had significantly greater FG score [median FG=10 (cases); 3 (controls), $p=0.00$], testosterone [mean testosterone concentration = 2.76 " 1.7 [(cases); 1.04 " 0.40 nmol/l (controls) , $p=0.00$], and FAI [mean FAI =7.31 " 7.5 (cases); 3.64"4.8 (controls), $p=0.01$] than controls. 76% cases and 4% controls had a FG score > 8. 8.30% cases had elevated T with none among controls, 43.3% cases and 14.7% controls had FAI > 5. The diagnostic power of T was greater than that of FAI in subjects with FG score > 8. In ROC analysis, the area under the curve (AUC) for T and FAI were 0.832 and 0.766 respectively. in Sri Lankan PCOS subjects. T had 27% sensitivity and 97.5% specificity at a cut-off of 3.5 nmol/l and FAI had 50% sensitivity and 87.5% specificity at a cut-off of 5.

The clinical assessment by FG score detects hyperandrogenism in PCOS subjects more frequently compared to biochemical tests; Testosterone and FAI. A higher detection rate was observed in controls when FAI was used as the indicator, suggesting a possible influence from changes in sex hormone binding globulin concentration. Total testosterone had greater diagnostic power than FAI.

Estimation of cardiovascular disease risk in patients with metabolic syndrome; use of the Framingham Risk Score

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Metabolic syndrome (MS) is associated with increased mortality which could be partly attributed to cardiovascular diseases (CVD). The Framingham risk score (FRS) is an age and gender specific tool widely-used to estimate the 10-year CVD risk. The aim of this study was to identify 10-year CVD risk status of patients with MS. Preliminary data of 80 patients (aged 35-55 years) from a randomized controlled trial on lifestyle change in patients with MS was used in this evaluation. Patients were recruited from the medical clinics of the National hospital of Sri Lanka and data on medical history, lifestyle and smoking were obtained. Weight and height were measured and BMI calculated. Waist circumference (WC) was measured. Serum lipids and blood glucose levels were assessed. The 10-year CVD risk was evaluated using the FRS.

The study population consisted of 17 (21 %) males and 63 (79 %) females. Prevalence of type II diabetes mellitus or hypertension were 92.5 % and 55 % respectively. 8.8 % were current smokers. Low HDL were seen in 47 % males (< 40 mg/dl) and 68 % females (HDL < 50 mg/dl). Mean cholesterol concentration was 176.7 ± 36.6 mg/dl, while 5.8 % males and 20.63 % females had elevated TC [intermediate risk (200 - 240 mg/dl)]. Four (6.3 %) females were in the higher risk category (TC > 240 mg/dl). Mean WC among males was 96.3 ± 5.4cm, and was 93.6 ± 8.67cm in females. The mean BMI was 30.3 ± 4.5 kg/m². In the study population, only 2.5% of participants were within the normal BMI range. The overall mean 10- year CVD risk (by BMI) was 11.5.

In conclusion the group under study had an intermediate elevated 10-year CVD risk.

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Patient's knowledge about insulin therapy, factors affecting it and its effect on glycemic control

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Type 2 diabetes mellitus (T2DM) is a chronic disease with a high prevalence in the South Asian region. Successful insulin therapy can effectively control disease and prevent its complications, and is dependent on many factors including patients' knowledge regarding insulin treatment. A study was carried out to describe patients' knowledge about insulin therapy, factors affecting it, and determine its relationship with glycemic control. A cross sectional descriptive study as carried out on 120 patients with T2DM attending the diabetic clinic of the National Hospital of Sri Lanka, selected using systematic sampling.

Majority of patients had moderate knowledge about insulin treatment (60.0%), followed by people who had poor knowledge (29.17%) and good knowledge (10.84%). 62.5% showed poor glycemic control while only 7.5% had good glycemic control. Complication rates were high among participants with 87.5% having at least one complication of T2DM. A significant relationship existed between patients' gender and over-all knowledge on insulin treatment with males having better knowledge ($p=0.011$), and between patients' gender and glycemic control with males having better glycemic control ($p=0.001$). A significant relationship existed between patients' level of income and complication rates; patients with lower income levels had a higher rate of complications ($p=0.030$). Time period since diagnosis of T2DM and time since commencement of insulin therapy was significantly associated with patients' rate of complications, with higher time periods generating more complications ($p=0.001$). Time period since the last education session was significantly associated with glycemic control, with longer time periods associated with better control ($p=0.037$). Patients overall knowledge had no significant association with glycemic control.

In conclusion, male patients had significantly higher overall knowledge and better glycemic control. Lower income levels, longer time periods since diagnosis or commencement of insulin treatment were associated with higher complication rates. Further educated about insulin treatment is essential.

Vitamin D deficiency among patients with non specific bodily pains and osteoporosis

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Vitamin D deficiency is increasingly recognized as a problem in South Asians. Evidence on vitamin D deficiency in Sri Lankans is scarce. We aimed to determine vitamin D status among patients presenting with body pain not specific of any known aetiology such as arthritis or spondylosis. This observational study was conducted among patients attending a private sector out-patient consultation with self reported non-specific bodily pain for 2 months or more with no established diagnosis. Symptom severity was graded in a 10-point Likert scale. Quality of life was assessed using SF-8 questionnaire. Vitamin D status was assessed in all patients and serum ionized calcium, parathormone level and DEXA scan were performed when indicated. Data was analyzed using SPSS-16.

52 participants were included in the study (mean age 55. 7 years \pm 13.2), 92.3% were females, 18 (34.6%) had osteoporosis while 11 (21.2%) had osteopenia. Mean vitamin D level was 24.5 \pm 11.6 ng/ml. 21 (40.4%) and 23 (44.2%) participants had vitamin D deficiency (< 20 ng/ml) and insufficiency (<30.0 ng/ml) respectively. Only 8 participants (15.4%) had sufficient (>30.0 ng/ml) levels of vitamin D. Vitamin D status correlated poorly with symptom severity (Pearson r = -0.104, p = 0.496), quality of life (Pearson r = 0.261, p = 0.094), age (Pearson r = 0.087, p =0.550), and menopausal status in women (p = 0.844).

In conclusion, Vitamin D deficiency is prevalent in this group of patients with non specific bodily pains and maybe prevalent in a wider spectrum of the population. Further studies are needed to determine whether this is a normal phenomenon in all women as well as in men.

Insulin resistance and pancreatic beta cell function in polycystic ovary syndrome; are they BMI dependent?

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Hyperinsulinemia and insulin resistance (IR) are cardinal features of polycystic ovary syndrome (PCOS). A subgroup of PCOS subjects with IR develop pancreatic beta cell insufficiency that leads to impaired glucose tolerance and type 2 diabetes mellitus. It is still debated whether IR of PCOS is entirely BMI dependent, particularly in Asians. The objective was to compare IR and beta cell function in lean and overweight subjects with PCOS. Data of a retrospective cohort study of 140 consecutive South Asians with PCOS attending a single specialized endocrine clinic in Colombo were analyzed. Patient data were subdivided into two groups based on Body Mass Index (BMI) as lean ($\leq 23 \text{ kg/m}^2$) and overweight ($\text{BMI} > 23 \text{ kg/m}^2$). Fasting Blood Sugar (FBS) and serum fasting Insulin (FI) concentrations were analyzed. Homeostatic Model Assessment equations were used to calculate insulin resistance (HOMA-IR) and pancreatic beta cell function. (HOMA-B)

Mean age was 26.2 ± 5.6 years. Ninety six patients (68.6%) had $\text{BMI} \leq 23 \text{ kg/m}^2$. Mean BMI of overweight and lean groups were 28.5 ± 4.6 and $21.1 \pm 1.3 \text{ kg/m}^2$ respectively. Overweight subjects had significantly higher mean FI (17.27 U/ml) compared to lean subjects (7.72 U/ml) ($p=0.020$). HOMA-IR was 3.93 and 1.77 in overweight and lean subjects respectively ($p = 0.057$). HOMA-B in overweight and lean subjects was 1.40 and -1.28 respectively ($p=0.321$).

In conclusion, although overweight subjects with PCOS had higher fasting insulin, there was no association between BMI and insulin levels or insulin resistance. This suggests that insulin resistance and its consequence may be independent of BMI in South Asians with PCOS.

An exploratory study on food poisoning among Sri Lankan University students

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Food poisoning is often observed among university students. It can vary in severity and may affect their study outcomes. The objectives were to identify the demographic characteristics, determine the incidence, severity of illness and loss of work, assess the risk factors, and evaluate the health seeking behaviour of university students. A cross sectional descriptive study was done using a self-administered questionnaire. 858 students of the most junior batch of Universities of Colombo, Sri Jayawardenapura, Ruhuna, Peradeniya and Kelaniya studying in Faculties of Medicine, Arts and Management, were selected by convenience sampling. Data were analysed using SPSS 19.

Forty percent of all students had experienced food poisoning during the previous one month. 12% had the illness lasting for more than 3 days while 39.13% were unable to engage in their studies effectively. Arts faculty students of all universities had the highest incidence with 44.7% being affected which was closely followed by the medical faculties (42.6%). The highest incidence of food poisoning was recorded from the University of Colombo (57.57%). The affected group of students in the University of Colombo had the highest consumption of tap water (87.76%). Majority of the non-affected students from Colombo University used bottled water (50.96%). 132 students took home remedies as treatment, while 32 visited general practitioners, 61 visited the outpatients department of hospitals and 8 students were admitted to hospital.

In conclusion, food poisoning is a highly prevalent but a neglected illness among university students. Students should be educated and actions should be taken to improve the hygiene of faculty food stalls. The research should be broadened to include other institutions such as garment factories and schools.

Association of tea and coffee consumption with development of colorectal carcinoma

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Colorectal carcinoma accounts for substantial cancer morbidity and mortality worldwide. Tea and coffee consumption may be associated with the development of colorectal carcinomas. Previous studies have demonstrated conflicting results in this regard. Thus identifying this association would enable formulation of primary preventive strategies in the general population. Our aim was to determine the association between tea and coffee consumption, and colorectal carcinoma. A case-control study was conducted for one year in the National Hospital of Sri Lanka from January 2009. Data was collected via an interviewer - administered, structured, pre-tested questionnaire on 200 histologically confirmed cases and 200 age and sex - matched controls. Univariate and multivariate analyses were done.

The median age was 58 years in the cases and 54 years in the controls, while male to female ratio was 1.50 and 1.49 in the case and control groups respectively. In univariate analysis it was found that risk of cancer increases starting from 4 cups of brown tea per day. However, the multivariate analysis revealed consumption of 6 or more cups of brown tea per day [Odds Ratio (OR) = 2.98 (95% CI 1.47-6.05), $p=0.003$] to be independently associated with colorectal carcinoma. Beef too showed a significant association in the multivariate analysis [OR = 1.76 (95% CI 1.12-2.78), $p=0.015$]. Green tea was found to be protective in the univariate analysis ($X^2=7.434$, $p=0.006$), with no significant association in the multivariate. The study did not find associations with body weight, work-sleep pattern, smoking or consumption of alcohol, mutton, pork, fruits or coffee.

In conclusion, the consumption of 6 or more cups of brown tea per day and beef may be associated with colorectal cancer in this population of patients.

Drug resistant cutaneous leishmaniasis: A case series from Sri Lanka

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Leishmaniasis is caused by parasitic protozoa of the genus *Leishmania*. Humans are infected by the bite of phlebotomine sandflies that are seen around forests, burrows of rodents and shrub jungles. There are three main forms of the disease, namely, Cutaneous Leishmaniasis (CL), Muco-cutaneous Leishmaniasis (MCL) and Visceral Leishmaniasis (VL). An alarming increasing trend of CL is observed. In the last decade, over 2500 cases have been reported but the numbers are much higher today. The disease is seen in the southern belt, in Matara, Hambantota, Tangalle and in the North, in Anuradhapura, Polonaruwa and Jaffna. The current treatment options available in Sri Lanka for CL include Intra-lesional sodium stibogluconate (SSG) and cryotherapy. The risk of drug resistance to current standard therapy lingers on and there is no policy designed to control or prevent drug resistance in CL. The objective was to identify resistance to current treatment options available for CL in Sri Lanka. We studied patients who were diagnosed with CL and had been treated with intra-lesional SSG and cryotherapy for several sessions but still had clinically suggestive lesions. The study was carried out in the skin clinic, Teaching Hospital Anuradhapura, from April to June 2013.

A total of nine patients were found to be smear and culture positive for *Leishmania* parasite after having received several sessions of treatment. The aim of therapeutic regimes is clinical healing and parasitic eradication, but the efficacy of the current existing antileishmanial therapy was found to be unsuccessful in some cases.

Evaluation of the accuracy of glucometers currently used in Sri Lanka

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Self monitoring of blood glucose using a glucometer has been shown to be effective in improving glycaemic control in diabetic patients. Studies in other countries have shown variations in accuracy of glucometers but there is a lack of data in Sri Lanka. The aim of this study is to assess the accuracy of commonly used glucometers in Sri Lanka. Commonly used glucometers were identified (n = 8, A-H). Healthy volunteers and patients admitted to the National hospital of Sri Lanka were selected by convenient sampling (n= 50, 34 patients, 16 healthy volunteers) following informed consent. A venous sample (VS) of blood glucose from each subject was analyzed using a standardized method and taken as the reference point. Concurrent finger-prick (FP) values were determined using all glucometers ensuring uniformity. All the glucometers were calibrated prior to the study.

The range of blood glucose measurements was 69- 448 mg/dl. Mean difference (mg/dl) between VS and FP values for glucometers with 95% Confidence Interval and p values according to ascending order were as follows: F 1.78 (-6.48, +10.04), p >0.05; A 6.96 (-11.66, -2.25), p <0.05; C 7.92 (+1.43, +14.40), p <0.05; E 10.20 (-17.19, -3.20), p <0.05; H 13.66 (-20.40, -9.91), p <0.001; D 13.84 (-18.51, -9.16), p <0.001; B 17.42 (-23.78, -11.05), p <0.001; G 18.16 (-25.07, -11.24), p <0.001; Highest concordance with American Diabetes Association (ADA) recommendation of less than 5% bias was seen in 'F' and lowest in 'G'. None of the glucometers managed to achieve ISO recommendation but highest concordance was seen in 'E' and lowest in 'B'.

In conclusion, a statistically significant difference between VS and FP values were noted in a majority of glucometers. The concordance with ADA recommendation appeared unsatisfactory. Patients should be properly advised when buying a glucometer.

High genetic diversity and effective population size despite a demographic bottleneck: Implications for elimination of *P. vivax* from Sri Lanka

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We examined whether the recent dramatic decline in malaria transmission in Sri Lanka led to a major bottleneck in local *P. vivax* population, with a substantial decrease in the effective population size. We used 14 highly polymorphic microsatellite markers to assess levels of genetic diversity and population structure of 190 *P. vivax* patient isolates collected from 15 districts in Sri Lanka over a period of nine years (1999-2008).

We found a high degree of polymorphism, with 189 unique haplotypes (13-47 alleles per locus) and average genetic diversity (expected heterozygosity) of 0.8747. Almost 66% (n=125) isolates had multiple-clone infections. Significant spatial and temporal differentiation (F_{ST} = 0.04 - 0.25; $p \neq 0.001$) between populations was observed. Strong linkage disequilibrium was maintained both geographically and temporally (I^s_A = 0.0265, $p < 0.001$), but no clear geographic structure was found in allelic frequencies. The effective population size was relatively high (estimated as 49,056 or 10,976, depending on the underlying model used). We used three approaches to test for evidence of a recent population bottleneck and found no mode-shift in allele frequency distribution or heterozygote excess, but the low values of *M*-ratio statistics (ranging between 0.150.33, mean 0.26) at all 14 alleles are suggestive of such a bottleneck.

In conclusion, the persistence of high genetic diversity and effective population size despite the collapse in demographic population size of this parasite in Sri Lanka indicates the importance of maintaining stringent control and surveillance measures to prevent resurgence.

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Hypoglycaemia: Do we think enough of the cause?

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Hypoglycaemia is a feared experience for diabetic patients due to the disturbing symptoms. It reduces treatment compliance of diabetes mellitus and also contributes to the morbidity and mortality in diabetes. Identifying the cause of hypoglycaemia is pivotal for optimal glycaemic control. The aim of this study is to describe the common causes and risk factors for hypoglycaemia in Sri Lankan patients. Using consecutive sampling, an audit was conducted using a structured, interviewer-administered questionnaire among 1000 diabetic patients attending a private sector clinic. History and details of hypoglycaemic episodes within the preceding month were obtained and severity was graded on clinical features and /or capillary blood glucose levels if documented.

Mean age of patients was 54.9 "12.4 years, and 58.6% were male. Mean duration of diabetes was 10.6 "8.1 years. Mean FBS and HbA1c were 134.5 " 50.1 mg/dl and 7.82 " 1.7% respectively. Prevalence of hypoglycaemia was 26.1% (mild 20.7%, moderate 3.9%, and severe 1.5%). Sudden changes in quantity, composition or timing of the diet (46.7%), increased dosage of medication (16.9%) and unaccustomed exercise (15.7%) were the commonest causes. A cause was not recognized in 16.3% of the study population. Non-prescribed native food items (Thebu 52.3%, Karawila 54.5%, Kothalahimbutu 11.4%, Madatiya kola 4.5%, Kowakka 6.8%) were mentioned by 16.9% of patients as the perceived cause for hypoglycaemic episodes.

In conclusion, hypoglycaemia is common among diabetic patients. Patients need advice to maintain a regular routine of diet and exercise. Consumption of non-prescribed native food should be specifically evaluated as a possible cause for hypoglycaemic episodes.

Knowledge, attitude and skills on leadership among lectures in medicine

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Leadership skills are recognized as mandatory for all doctors. Enhancing leadership among teachers in medicine will improve their efficiency and would facilitate them to become role models for students. The objective of this study was to identify skills, knowledge and attitude on leadership among teachers in medicine. Self and Rater versions of the Authentic Leadership Questionnaire(ALQ) and a formulated questionnaire based on Medical Leadership Competency Framework(MLCF) were distributed among lecturers of Faculty of Medicine, Colombo. The score calculated for each of the 4 components; Transparency (TR), Ethical skills (ES), Balanced processing (BP), Self-awareness (SA) of ALQ, is the average of the score from 1 to 4(<3 each indicates poor leadership skills). Knowledge was assessed using the formulated questionnaire (\$4 indicates good knowledge). Data were analysed using SPSSv16.

Thirty four teachers responded (response rate; 27.7%). Among teachers who fully completed all four sections of the ALQ (n=24; females=13, males=11) 66.7% had good leadership skills (3.17 " 0.37). Teachers demonstrated good leadership skills in TR (n=34 ; 3.11 " 0.48), ES (n=30 ; 3.53 " 0.47), BP (n=29 ; 3.13 " 0.44), but poor skills in SA (n=28 ; 2.88 " 0.62) when analysed individually. Their leaders'(rater) leadership skills were categorized lower than the self in all sections (TR; n=31 ; 2.39 " 0.85, ES ; n=27 ; 2.67 " 0.99, BP ; n=28 ; 2.41 " 0.91 ,SA ; n=25 ; 2.22 " 1.17) There was a significant difference between all components of leadership skills among self and assessment of their leaders (TR, p=0.001; ES, p=0.001; BP, p=0.005; SA, p=0.004). Among 31 completed MLCF 85.7% (n=30) had good knowledge (4.67 " 0.32). Majority (n=30, 85.71%) rated themselves as good and very good leaders.

Being a self-study the response rate was poor. However teachers who participated in this study have overall good leadership skills assessed through the authentic leadership tool. The leaders of the teachers received a poor rating for all the skills which may need to be assessed through future studies and needs to be addressed during training of the lecturers for administrative posts.

The aggregation behavior of *Phlebotomus argentipes glaucus*

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Sandflies are the known vectors of disease leishmaniasis. *Phlebotomus argentipes glaucus* (*P. glaucus*) is postulated as the probable vector of leishmaniasis in Sri Lanka. Cutaneous leishmaniasis (CL) is already established in most parts of the country. At the same time, visceral disease is also recognized to be increasing at an alarming rate in Sri Lanka. The available drugs are not promising and the treatment cost per patient is very high, especially in the case of visceral leishmaniasis (VL). Therefore, identifying prevention methods of infective sandfly bites is important. In order to understand the biting behavior of the sandflies to promote preventive measures, the aggregation behavior of the sandflies was studied within cattle-baited net traps. Two field sites were selected from Kurunegala district with confirmed cases of CL. A single cow was placed inside a net trap for a period of 12 hours from 18 00hrs to 8 00hrs. The attracted sandflies were collected at the end of each hour and stored separately in containers with a preservative. The procedure was carried out on three consecutive days in each site. The sandflies were identified using standard keys and the number of sandflies that belonged to *P. glaucus* were recorded.

The majority of the sandflies detected within the cattle trap were *P. glaucus* with small number identified as genus *Sergentomyia*. The peak aggregation of *P. glaucus* was observed during 20 00hrs to 23 00hrs with maximum collection at 21 00hrs to 22 00hrs. Male sandflies dominated the collection on all occasions.

In conclusion, the aggregation behavior is closely related to the biting time therefore, the maximum preventive measures should be applied within this period to minimize the infective bites of sandflies that belong to *P. Glaucus*. Further studies are needed from other disease prevalent areas to strengthen this claim.

Epidemiological study of Leishmaniasis in Matara District, Sri Lanka

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Cutaneous leishmaniasis (CL) is an endemic disease in Sri Lanka with a steady increase in numbers of diagnosed cases which is caused by the usually visceralizing species *L.donovani*. The objective was to identify risk factors, behavioral patterns and distribution of leishmaniasis in Matara District. Sample size was calculated according to standard formula and 52 grama niladhari divisions in 4 divisional secretariat divisions were randomly selected and 2340 individuals were screened. Patients were investigated by light microscopy/culture/PCR. Age-sex matched controls were recruited from the same vicinity to study possible risk factors for infection.

Sixty two clinically suggestive cases were detected. Highest number of cases were from Dickwella (n=41). Male: female ratio of patients was 1:3 (male=14; female=48). Most females were housewives (95.8%) engaging in outdoor behavioral patterns during evenings. Male patients were either farmers (n=5) or fishermen (n=9). Most houses occupied by patients had unplastered walls (72.6%) and were surrounded by thick vegetation (77.4%). Majority were unaware of leishmaniasis (82.2%). Only few had animal shelters in their gardens (17.7%). Papules / nodules (n=29), plaque (n=14), ulcerating nodules (n=9), ulcers (n=3) and scars (n=7) were seen. Most lesions were on exposed body areas.

Prevalence of leishmaniasis in Matara can be associated with the living conditions and life style of respondents, whose window of increased outdoor activity during evenings coincides with that of the vector, sand fly. Major risk factor for leishmaniasis was identified as outdoor activities during twilight hours. Outdoor occupational behavior, nature of housing, close proximity to jungle, non-awareness of leishmaniasis and inadequate use of preventive measures were also identified as associated risk factors. In geographical distribution, Dickwella has the highest prevalence. A clustered nature was seen in the distribution of disease. Awareness regarding the disease and appropriate control measures are urgently required to minimize further spread.

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Undergraduate ophthalmic education: Preferred methods for the future

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Learning ophthalmology as an undergraduate is a challenging task. Local data on trends of undergraduate ophthalmic education is limited. This study was conducted to identify different learning methods currently used, preferences and novel methods suggested by respondents to improve undergraduates learning ophthalmology in the special senses module. A descriptive cross sectional study was done recruiting 200 undergraduates of Colombo Medical Faculty who were following the special senses module. A self-administered questionnaire was used to collect data. Data were analyzed using SPSS 120.

92% of the students agreed that learning ophthalmology was important in medical education and 90% agreed it was important for their future career. Lectures were identify the best resource to fulfill the learning objectives of the ophthalmology component of the special senses module (41.5%), and to find answers for questions given in the module exam (47%). Text books were preferred as the second best source of learning (28.5%, 34% respectively). Practicing at clinics (62.5%) and skills lab sessions (36.5%) were chosen as the two best methods to improve ophthalmological clinical skills. Introducing virtual ophthalmology clinics were chosen as the most preferable new teaching method when compared to modified problem based sessions and simulated case sessions ($p < 0.01$).

Students should be motivated to refer reading material together with lecture notes to expand their knowledge. Implementing targeted skills lab sessions to enhance basic ophthalmology skills and including newer methods of ophthalmology teaching in undergraduate learning should be focused on.

FACULTY OF SCIENCE



Message from the Dean



The Faculty of Science of the University of Colombo is dedicated to providing an environment for our academic staff and postgraduate students to conduct high quality research. We place a heavy emphasis on research and, as a result, our faculty is at the forefront in generating invaluable scientific knowledge and information which has been disseminated at important national and international forums. The Annual Research Symposium hosted by the university will provide a strong incentive particularly for young academics who are making a head start as researchers. The scientific papers and the thought-provoking discussions that follow would no doubt promote and enhance the research culture in the Faculty of Science.

The selected theme for this year, “Higher Education through the State Sector of Sri Lanka in a Competitive Knowledge Economy”, would indeed be of special relevance to us at the Faculty of Science, as we strive to attain international standards in the competitive field of research and development. I am therefore thankful to all those who submitted abstracts and to those who were involved in reviewing and editing them. I am sure these sessions will be of immense benefit to both contributors and participants and would provide an ideal forum to formulate collaborative research in the field of science.

I wish the Annual Research Symposium 2013 every success.

Professor T.R. Ariyaratne

Dean, Faculty of Science

Faculty of Science

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Modeling a feasible actuarially fair crop insurance premium for the paddy field sector of Sri Lanka

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Agriculture plays a vital role in the Sri Lankan economy, similar to most Asian countries. The existence of a crop insurance for the paddy field sector of the country is of vital importance since the crop heavily fluctuates on climate-sensitivities, making farmers vulnerable. This research focuses on determining a feasible Actuarially Fair Premium (AFP) from the perspective of the farming community in Sri Lanka. In order to identify the loss and the financial capabilities of farmers, a survey was conducted in the Monaragala and Kurunegala districts. The Beta Distribution was used as the parametric approach to model paddy yield. The moment estimators of the Beta Distribution were calculated using the Maximum Likelihood Estimation method. Monte Carlo simulation was carried out to generate the yield. The AFP was computed for different coverage levels from the farmer's perspective. Fuzzy logic was used to compute the coverage level by considering membership functions of cost and loss which are considered to be two influential factors. According to the findings, it is observed that, if the crop insurance instrument is to be implemented for the Sri Lankan farming community, the behavioural variation of risk loading factors due to climatic and demographic variations needs to be analyzed, since there is high variability, although the country is small.

Modeling the transmission of dengue with varying extrinsic incubation period of mosquitoes

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Dengue has become a global threatening disease. In Sri Lanka, it usually occurs as an epidemic following a monsoon period. Since no specific medical treatment or vaccine is available, it is essential to control the transmission of dengue and reduce its spread. To understand its propagation, scientists have studied many mathematical models of dengue transmission and one of them is the SIR-model which is the focus of this paper. The effect of the time delay on the transmission of dengue fever was studied. The time delay is due to the presence of an incubation period (IP) during which the virus replicates enough in the mosquito so that it can be transmitted by the mosquito to a human. We modelled the incubation period using climatic data collected from urban Colombo and used it to modify the SIR-model. In this paper, the SIR-model with fixed and varying incubation periods was analyzed. When the SIR-model with fixed IP was used, the simulation showed that the trajectory of the infectious human population is convergent to the equilibrium point (0.000337). The trajectory of the infectious human population of the SIR-model with varying IP is also convergent not to the equilibrium points, but towards oscillations within an interval. In this study, it was observed that the approach with fixed parameters is not suitable for decision makers to control the disease. This is because parameters vary with climatic factors. Our preliminary simulation using the SIR-model was therefore different from reality since the IP was considered as a fixed parameter.

The influence of climate variability on dengue transmission in urban Colombo: A cross wavelet approach

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Dengue is a major public health problem mainly in tropical and sub-tropical regions around the world. Prevalence of dengue is highest in tropical areas of Asia and the Americas, with 50-100 million estimated cases of dengue fever and 250,000-500,000 cases of dengue hemorrhagic fever reported yearly worldwide as explosive outbreaks mainly in urban and suburban areas. The epidemiology and the dynamics of the dengue disease are complex, and climatic fluctuations as well as social and demographic factors heavily influence its incidence. The virus is mainly transmitted to the human by a mosquito vector *Aedes Aegypti*. Increases in temperature and precipitation as well as urbanization can lead to increase in mosquito abundance by increasing their development rate, decreasing the length of reproductive cycles, stimulating egg-hatching and providing sites for egg deposition. We analyzed three time series, namely average weekly maximum temperature, minimum temperature and precipitation in urban Colombo versus the weekly dengue cases. We aimed to identify the significant influences of climate variations on the transmission of dengue in urban Colombo. Cross wavelet power spectral analysis was used in the study to examine the spectral relationships between the climate parameters and the dengue incidents from year 2006 to 2011. We used the MATLAB package to obtain the graphical results. Through the spectral analysis we identified some significant relationships between dengue incidents and climate parameters such as average rainfall and average maximum temperature. The average rainfall seems to be leading dengue cases by approximately eight weeks as indicated by the in-phase relationship in the power spectrum.

Wavelet analysis of the concentration of air pollutants in Colombo Fort, Sri Lanka

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Air pollution is a major problem in Sri Lanka due to rapid urbanization and the development of industries. In Sri Lanka, the quality of air has a profound impact on the economy. The most obvious of these impacts is related to health problems associated with poor air quality and the corresponding cost of medical care and treatment. Therefore it is important to build air quality models, which are mathematical descriptions of the concentration of ambient pollutants. These mathematical models consist of several parameters which vary with respect to external variables such as meteorology and human behaviour. It is important to recognize air quality patterns with respect to measured direct parameters as well as auxiliary parameters such as wind speed, temperature and rainfall and to include these facts in the mathematical models.

The aim of this study was to identify whether there is a specific period during the year in which the pollutant concentration oscillates and to investigate the relationship between air quality and meteorological phenomena, which include temperature, wind speed and rainfall. This paper deals with the wavelet analysis of the air pollutant concentration in Colombo Fort, Sri Lanka. The daily average values of air pollutants such as Carbon Monoxide (CO), Nitrogen Oxide (NO), Nitrogen Dioxide (NO₂) and Sulphur Dioxide (SO₂) were studied. The continuous wavelet of air pollutants was investigated. Simulation was carried out using the MATLAB package. Data was collected from the Central Environmental Authority, Sri Lanka. According to the study all the pollutants have similar periodic oscillatory behaviour from January to March and from October to December. Rainfall is high during the months September to December and low from January to March. Daily average wind speed from January to March and from September to December is also low. These were the reasons for the periodic oscillation of pollutant concentration during these periods. These results are important to determine the dynamic behaviour of the model parameters.

Two mathematical recreations from Sri Lankan indigenous knowledge

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The objective of this study was to explore the basic characteristics of hereditary mathematical recreations prevalent in Sri Lankan indigenous knowledge. We present two mathematical recreations extracted from Sri Lankan indigenous knowledge, namely the *five corner game* and *killing the Yon*. Following the work by contemporary puzzle makers, we analyzed these games in a modern context of mathematics. The historical details associated with these recreations were also investigated to some extent. The *five corner game* is played on a star with ten vertices drawn on a board, where ten pieces are placed on the corners of the star. The challenge is to eliminate pieces according to rules, until only a single piece is left on the board. A traditional winning strategy is associated with the folk game, and the poser is supposed to know this strategy, where the player is supposed to identify this at least intuitively by thorough analysis of the topological properties of the star. We analyzed this strategy, both analytically and by brute-force backward computations, and found alternative strategies to win the game. Thus, by a few algorithmic methods we derived an alternative strategy from the traditional strategy. There are 5,120 possible winning strategies, which can be calculated using basic counting principles. The second, *Killing the Yon*, is a famous folk game with explicit mathematical content, and is played with a circular arrangement of beads, counting from one, eliminating each 9th. The problem is to find the positions of the preselected beads surviving after a predetermined number of counting steps. An analogous version attributed to Josephus, the famous Roman historian, was also considered in our study. A simplified version of the game was solved by determining the original position of the bead that should remain until the last round of the game.

Space debris mitigation and strategy analysis

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Space exploration is a mechanism whereby with the use of astronomy and space technology man is able to explore outer space and the universe at large. Space exploration not only enables man to advance scientific research, it also unites nations across the globe, ensures the future survival of humanity and also enables the development of military and strategic advantages against other nations that are deemed to be a threat to humanity.

As advantageous as it may be, the remnants of space explorations is a menace and is thus considered as being a hazard to future explorations and the universe in entirety. Remnants termed as space debris, also often denoted as orbital debris and space waste, is the collection of objects in orbits around Earth. Space debris is a creation by man, which serves no useful purpose and is a potent threat ubiquitous in the universe. Space debris consists of everything from spent rocket stages and defunct satellites to explosion and collision fragments. Space debris also includes specks from spacecraft engines, surface degradation material such as paint flakes, coolant released by nuclear powered satellites and objects released due to the impact of micrometeoroids or fairly small debris onto spacecraft. As the orbits of these objects often overlap with the trajectories of spacecrafts, debris is a potential collision risk. Hence, the urgency and importance of perfecting a mechanism whereby space debris can be reduced or destroyed in an efficient and cost effective manner. No nation has yet taken any concrete measures to mitigate debris in the low earth orbits except tracking debris up to a certain extent. In this research we have tested two fundamental debris removal strategies using the debris data catalog and proposed a new hybrid strategy that needed a lower Delta-V. Elementary data filtering methodology is used along with basic calculations to simulate simple mission patterns that deduce the minimum Delta-V. Research is further oriented to develop a mathematical optimization algorithm leading to handling a larger search space to identify the class of debris to be removed and to select the optimal maneuver options.

Wind load analysis for structural design of a parabolic trough concentrator

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Theoretical investigation of the effect of wind on parabolic trough type solar energy concentrator (PTC) with reference to geographical and metrological parameters of Hambantota (semi-desert zone) is reported. It has been found that the maximum daytime wind speed reported (on non-disastrous situation) is around 8.3 m s⁻¹ which is a Fresh breeze situation. Beaufort number 5 has been assumed for calculating the wind load. Terrain factor of 1/7 (open country) has been selected after considering nature of the terrain of semi-desert zones of Sri Lanka. Maximum drag coefficient for the shape of parabola used in the study has been found from tables as 2.0. The mean wind load applied on the PTC of dimensions 4.5 m × 4.8 m and the aperture area of 22.3 m² has been calculated is by assuming quasi-steady conditions and the value was found to be 1.3 kN. Weather gust factor is also included in order to deal with more practical situations, and it is found that the maximum wind load and torque are 3.19 kN and 3.64 kNm respectively for a gust factor of 1.53. It has been found that the maximum load calculated with the gust factor is compatible with the values obtained by assuming light gale conditions (wind speed around 12.7 m s⁻¹) with a laminar flow.

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An optical technique for evaluating the shape of reflective parabolic trough

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Development and testing of an optical technique for evaluating the shape of reflective parabolic trough is reported. This method consists of a single axis rotatable He-Ne laser with a vernier scale and a target plane with a millimeter scale. The parabolic reflector was scanned by the laser beam vertically with known angles and the positions of the reflected beam hit on the target plane were recorded. The deformed angle of the reflective surface was then calculated using these data and the variation of the focal length is finally derived. The surface quality of a prototype Parabolic Trough Concentrator (PTC) was evaluated using this technique at three different positions along the reflector, the testing method developed was found to be acceptable as it produced consistent data over different locations of surface. Deviations up to 90 mm in the focal length were detected using the method and the results revealed that the shape of the parabola of this PTC was significantly deformed in the first quarter of the vertical direction of the shape and the other part is of the acceptable level in view of the large acceptance angle of the Heat Collecting Element (HCE).

Financial assistance provided by the university of Colombo (Grant No: AP/03/2012/CG/13) is greatly acknowledged.

Estimating daily maximum and minimum temperature observations in the northern and eastern parts of Sri Lanka

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A method based on the between-stations technique in estimating missing daily temperature observations was applied to estimate daily maximum and minimum temperature in the northern and eastern parts of the country which experienced disruptions in maintaining continuous weather records due to the hostilities in the region. The method assumed that for a given day, stations having similar geographical conditions will have temperatures that will deviate from their standard normal by similar amounts. Standard departures of serially complete 15 year daily maximum and minimum temperature records at several stations were used to estimate the temperature at a target station. The accuracy of estimating the daily maximum and minimum temperature was $\pm 0.7^{\circ}\text{C}$ and $\pm 1.1^{\circ}\text{C}$, respectively. The accuracy of the estimation is higher for the maximum temperature compared to the minimum temperature. Approximately, 95% of the estimated maximum and minimum temperature values are within $\pm 1^{\circ}\text{C}$ and $\pm 2^{\circ}\text{C}$, respectively from the observed values. The results indicate that simple statistical methods can be applied successfully to a cluster of weather stations to estimate the missing data or to validate recorded temperature observations in the northern and eastern parts of Sri Lanka.

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Distribution and frequency of thunder events in Sri Lanka

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A study was carried out to analyze the thunderstorm activity over Sri Lanka using thunder day data. A thunder day is simply a calendar day in which thunder is heard at least once at a given location. Two sets of data were collected and analyzed; annual totals for 10 stations for a period of 50 years and monthly totals for 20 stations for a period of 20 years. The average annual thunder days over Sri Lanka was found to be 75. Compared to other locations considered, a high number of annual thunder days (>100) were recorded in Ratnapura, Colombo and Bandarawela. Most locations show no significant long-term trends (upwards or downwards) in thunder activities. However, Colombo, the capital of Sri Lanka which has close to 1 million people shows an increasing trend of 0.8 thunder days/year. Although there is a high variability between years of the number of thunder days, the general variation within a year is clear. Thunderstorm activities are high for two periods March - May and September - November, which coincide with the 1st inter-monsoon and 2nd inter-monsoon periods overlapping with the arrival and withdrawal of the South-West monsoon period. Compared to the dry zone, the wet zone, especially the south-western region has high thunderstorm activity. There is a clear spatial difference in thunderstorm activities in the south-west and north-east monsoons seasons.

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Effect of meteoritic dust on the variation of global rainfall

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The tendency for the recurrence of rainfall singularities, on or near the same calendar date has been the subject of controversy for many years. Some researchers propounded the phenomenon that dust from meteors acting as rain forming condensation nuclei is the cause. This concept is well known as meteor-rain hypothesis.

Most of the investigations on meteor-rain hypothesis had been carried out by scientists in 1950's and 1960's. All those investigations have been dealt with limited available local precipitation data from different parts of the world and meteor shower information. This research is an attempt made to understand the level of influence caused by meteoritic dust on the variability of global rainfall. To the best of our knowledge this is the first time that such an attempt has been made in the global context using northern and southern hemispheric precipitation data covering the entire world.

Data files of global precipitation for 30 year period 1981-2010, obtained from NOAA database, were used as precipitation data. Data obtained from Visual Meteor Database (VMDB) of International Meteor Organization-IMO, on meteor rate data and meteor magnitude data for 30 year period 1982-2011 were used as meteor data for the analysis. By shifting one series relative to the other, the relationship between the meteor series and the rainfall series was studied for the greatest positive correlation, using a variety of statistical analysis methods.

Results of a few significant singularity days were found to tally with those of previous researchers obtained from various parts of the world, and that pattern is found to be continued year by year. When searching the time lag 28-30 days of previous researchers obtained for local precipitation using a few meteor showers, a poor correlation ($r = -0.08$) was found in the global context. The best correlation ($r = 0.97$) was found with a lag of 6 to 7 months after a meteoritic activity.

Possibility of using satellite microwave imagery as an alternative technique to obtain rainfall data in Sri Lanka

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Accurate measurement of rainfall is necessary to develop climate models and in disaster management under extreme events endangering the lives, property and resources within a society. The conventional method of measuring rainfall at ground based stations has its own advantages and disadvantages. In Sri Lanka, there are only 24 weather stations. In addition, there are 350 rain gauges located in various parts of the country. With the limited number of stations, the spatial frequency is low and localized variation of rainfall does not reflect in this system.

This communication describes an attempt made to understand the possibility of using satellite imagery techniques as an alternative method to determine the precipitation level in Sri Lanka. In this study, rainfall patterns in Sri Lanka occurring in the monsoon periods within the western coastal region, eastern slopes of central hills, and western slopes of central hills during the period 2009 to 2010 have been considered. Meteorological data were collected from the Meteorology Department, and corresponding satellite data related to rainfall were retrieved using an on-line visualization and analysis system TOVAS. Observations of matching and mismatching of daily rainfall within the two techniques were statistically analyzed focusing attention on separate regions and seasons in Sri Lanka.

It is found that the satellite imagery retrievals considered for 32 occasions on related months, did not exactly coincide with those values of ground based measurements provided by the Department of Meteorology. Results indicate that though rain gauges can give good temporal sampling, their poor spatial sampling can lead to significant errors in estimates of area-averaged precipitation rates. Detailed analysis of these data indicate the necessity of conducting an in-depth study in a selected area in the country with more rainfall measuring gages installed one each in a grid of 4 x 4 km similar to the spatial resolution of satellite images to understand the possibility of using satellite data to supplement ground base rainfall data.

Public complaints on lightning related hazards to the neighborhood of communication towers in Sri Lanka

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The number of telecommunication towers has drastically increased in the recent years due to the rapid expansion of mobile communication. A growing concern has arisen among the public as to the lightning hazards of antenna structures on their neighbourhood. By February, 2013 five mobile operators and three fixed line operators were using 5083 communication towers island wide. This issue has been discussed at the Parliament of Sri Lanka at several occasions and the policy makers have emphasized the necessity of a proper investigation conducted at national level.

Public complaints on lightning hazards to the neighbourhood due to communication towers received by the Telecommunication Regulatory Commission (TRC) of Sri Lanka during the period 2008 to 2012 were analyzed to understand the extent of the problem. Out of the 205 public complaints archived, TRC had visited only 53 clear-case sites and had measured the earth resistance. Those 53 complaints were used for the present study. According to the National Policy on Antenna Structures in Sri Lanka, earth resistance of a tower should be maintained at less than 10 ohms. It is found that 75% of the towers visited were maintaining the stipulated earth resistance of less than 10 ohms, 7% 10-20 ohms and 18% over 20 ohms. Only 18% of the towers visited had extremely good earthing conditions with earth resistance less than 5 ohms. Results indicate that low earth resistance is not a decisive parameter related to public complaints on lightning hazards in the tower neighbourhood. It is found that 7.5% of complaints are on lightning direct hits, the majority of 86.8% are on indirect effects and the balance 5.7% is unclassified. When the types of damages reported on those visited tower neighbourhoods are considered; 18.8% claims electrical and electronic equipment damage, 6.2% are on protective device damage and the rest 75% are on unverified miscellaneous incidents. Currently the TRC measure only the earth resistance. On the outcomes this study recommends a better lightning complaint inquiry system in the form of a check list with additional information.

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Factors associated with the fertility of Sri Lankan women

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Along with other developing countries, Sri Lanka has also experienced declining trend of fertility during the last five decades due to various demographic, socio economic and cultural factors. The average number of live births during the mother's reproductive life span has decreased from 5.4 live births in 1953 to 1.9 live births in 2000 and the total fertility rate has approximately become stable during 2000 to 2006/07. Human reproduction is purely a biological process. It is affected by numerous biological as well as demographic, socio economic and cultural factors. Therefore it is important to study the determinants of fertility and show their behavior in the reproduction process of a woman.

In this study our aim is to examine the relationships between fertility and the indirect determinants of fertility. The data collected through the Sri Lanka Demographic and Health Survey 2006/07 is been used in this study. Different descriptive, univariate and multivariable methods of data analysis are used to satisfy the main objective of this study.

The results indicate that, current age, age at first union, ever use of contraceptives, nationality, level of education, occupation and status of having current unions are the major determinants of fertility of the mothers in the country, in this order of importance. Therefore demographic factors might have played the main roles in this issue of childbearing. The results from the Generalized Estimating Equations (GEE) model suggest how the fertility has changed at individual level, in terms of increasing or decreasing of fertility rate which can be identified at the aggregate level.

Characteristics and determinants of informal employment in Sri Lanka

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Informal employment has become an important source of livelihood for people all over the world. As in other developing countries a major portion of the work force in Sri Lanka are engaged in the informal sector. The concept of informal employment, as defined by the International Labor Organization, has been developed based on the three factors namely; permanency of the job, entitlement for leave and entitlement for fringe benefits such as pension or provident fund. Informal employment is a developing phenomenon in developing and developed countries. Sri Lanka has remarkably high incidence of informal jobs recording around 78% of total employed population in 2009. Due to its heterogeneous and precarious nature, studying the structure of informal employment is imperative.

To understand the structure of informal employment in Sri Lanka, the individual and household characteristics of people engaged in informal employment and characteristics of informal employment were discussed initially at descriptive level. Secondly, a binary logistic regression model on “whether a person engaged in informal job or not” was fitted with determinants that affect person’s decision on choosing informal employment. In fitting the model, Generalized Estimating Equations technique was used as the responses were correlated within districts. The study reveals that level of education, sector that person resided, salary, ethnicity, sex and age were the most significant factors that were associated with person’s decision on moving towards informal employment. The order of significance will be discussed. Informal employment is characterized by comparatively low wage rates or income except for a very small portion of informally employed population.

Predicting the possibility of children falling ill or facing injuries in child labour

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The International Labour Organisation (ILO) definition of the worst forms of child labour includes work that is likely to jeopardise health and safety. Effective management of child labour damaging to health requires both conceptual understanding and empirical evidence of the interferences between child labour and health. In Sri Lanka too, statistics provide evidence of health hazards faced by children engaged in child labour. However, the significance of the association between the type of working condition and the condition of health of children has not been the focus of many studies. The work reported here emphasizes the requirement of an in-depth study of this aspect.

The objective of this study is to predict the possibility of falling ill or facing injuries due to work when children engage in child labour. The data is collected from the Child Activity Survey, 2008 conducted by the Department of Census and Statistics. The sample concerned consists of 334 children.

The T-tests and Chi-square tests for significance indicate that variables including the employment status, the industry of employment, age and gender have significant associations with illness or injury due to work. Moreover, certain working conditions such as exposure to dust/fumes and carrying heavy loads are also found to be associated with the health condition of children engaged in child labour. The logistic model included employment status, carrying heavy loads, exposure to extreme cold or heat, handling dangerous tools and chemicals and the type of industry, and can be used to predict the possibility of a child falling ill or facing injuries. Furthermore, 69% of the actually fallen ill children were correctly classified using a validation test, indicating a good model fit. Findings of this research will help to educate the public about the consequences of employing children in harmful working conditions and also to develop policies to safeguard the children.

Comparison of frequentist confidence and Bayesian credible intervals for the normal mean (μ)

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We considered interval estimation of a scalar parameter of interest when we have uncertain prior information about some of the parameters of the sampling model. Farchione & Kabaila (2008) described a $(1-\alpha)$ frequentist confidence interval for the normal mean (μ) that utilizes the uncertain prior information that this mean is zero ($\mu = 0$). This confidence interval reverts to the standard $(1-\alpha)$ confidence interval for μ when the data happen to strongly contradict the prior information that $\mu = 0$. It is natural to ask how this confidence interval compares with a Bayesian credible interval in the same scenario. An improvement to the research of Farchione (2011) was carried out in this research, where we made the more realistic assumption that the variance (σ^2) is unknown.

We considered two prior distributions for (μ, σ^2) in the forms of $\pi(\mu, \sigma^2) = (\xi\delta(\mu) + 1-\xi)\sigma^{-2}$ and $\pi(\mu, \sigma^2) = \xi\delta(\mu\sigma^{-1} + 1-\xi)\sigma^{-2}$, where $0 \leq \xi \leq 1$ and δ denotes the Dirac delta function. We found that the resulting Bayesian credible interval for μ reverts to the standard Bayesian credible interval for μ only for the marginal posterior distribution of μ for the latter prior distribution. This marginal posterior distribution of μ was then used to compare the frequentist 0.95 confidence interval for μ of Farchione & Kabaila (2008) with the corresponding Bayesian equi-tailed 0.95 credible interval for μ . The appropriate functions of the upper and lower endpoints of the Bayesian credible and the frequentist confidence intervals were used for comparisons. We found sufficient evidences to reasonably conclude that these functions depend on the data differently. Therefore, the findings suggest that this is yet another evidence where the Bayesian and frequentist inferences happen to disagree.

Determinants of crime: A case study for Kalutara prison

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Increasing crime rate is a big challenge and a major barrier for the development of a country. It causes an increase in various kinds of social, economic and cultural problems. In Sri Lanka, a considerable number was convicted and sent to prison in the last decade. However, the crime rate does not seem to be decreasing. In such a situation it is necessary and important to find out possible influential factors that may have contributed to committing a grave crime. The main objective of the study is to identify the possible influential demographic and socioeconomic factors of grave crime relative to minor crime.

Primary data used for this study was collected through a questionnaire. Two hundred and forty six prisoners from Kalutara prison were selected using a stratified random sample method based on their gender. A binary logistic regression model was used to identify the determinants while using dependent variable as “grave crimes” and “minor offenses”.

Study found that prisoners’ mothers’ education, usage of drugs and mode of the relationship with the parents are the most significant factors. Also, most of the criminals in Kalutara prison (80%) were engaged in serious. House breaking & theft is the most frequent grave criminal activity in Sri Lanka, and Colombo ranked one in reporting the gravest personal crimes.

Small area estimation: Some potential applications

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The necessity of more precise and accurate estimates of unknown population parameters is increasing in both public and private sectors. Precise and accurate estimates can be obtained through a 100% error free census. Due to obvious reasons it is not possible to conduct a census every year. Censuses usually give estimates for national level or larger areas which are not suitable for small domains of population. Although surveys are good alternatives to predict parameters for small domain, due to coverage errors these may give inaccurate results with low precision. Coverage error means that none or very few units of a small area/domain are covered by the sample. Due to this factor the corresponding variance of estimates are either very large or they do not exist. Small area estimation (SAE) which usually combines both census (auxiliary information) and survey data, provides a good alternative to obtain precise estimates of parameters at small domain level.

In Sri Lankan context, less attention has been given to predict the parameters by using SAE techniques. The error components model and a multivariate extension of it can be used to estimate parameters in small areas. Using this approach it is shown how to obtain precise estimates for 'number of households with toilet facilities within the unit' at district secretariat (DS) level. Prediction of election results for a given party at polling division level is also discussed. How to improve these estimates by careful selection of suitable auxiliary variables and using a multivariate approach possibly in the presence of missing values, is also discussed. Limitations and underlying theoretical assumptions are also discussed.

An inventory control model for an optimal batch quantity of a beverage company

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Inventory is an essential concept in the operation of a system or an organization. An inventory can be classified into three categories such as; raw materials inventory, work-in-process inventory and finished-goods inventory. This research is mainly based on the finished-goods inventory. The main objective of the research is to find out an inventory model to optimize the batch quantity of the production of finished-goods for a well-known beverage company in Sri Lanka. The quantities of sales collected from all the distributors of this beverage company were considered as the demands for the inventory model. These demands were used to determine the optimal batch quantity of the production of the company.

Three methods were considered in this research to estimate the production volumes were; the current estimation method used by the company, time series forecasting method and the finished-goods inventory method. The best method that gives the optimal batch quantity was chosen to estimate the volume of the products. In the time series method seasonal autoregressive integrated moving average (SARIMA) models were fitted to forecast the productions. In the third method, the solutions were obtained by minimizing the differentiated total cost function by considering all the associated costs of each product such as; ordering cost per production run and carrying cost per unit per period. The finished-goods inventory model was chosen as the best method to estimate the total volume of production by comparing with the actual demand. This study was carried out to estimate the production volume of two products which are highly demanded, and the findings can be extended to other products.

Investigation of some properties of compounds extracted from *Pouteriacampechiana* (Lavulu) fruit and seed

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Pouteriacampechiana (Lavulu) is an economically important fruit of the family Sapotaceae. The pulp of sapotaceae fruits are edible and fresh or frozen pulp is used as an ingredient in milkshakes, ice cream and to prepare a number of local delicacies. The color is an important characteristic of foods. Based on the color of the food, first impressions are made. There is a growing interest in the use of natural pigments for food colors as artificial colors have lots of drawbacks. Seed kernel oils of family Sapotaceae are used to treat indigestion, ulcers, toothache, eye and ear diseases and also used as a remedy for sinusitis, asthma, coronary trouble, epilepsy. Lavulu has a golden yellow color pulp. It was extracted with acetone as a solvent. The seed kernel oil was extracted using hydro distillation method. Antibacterial activity of seed kernel oil was examined using the standard disk diffusion method against *Bacillus spp.*, *Escherichia coli*, *Staphylococcus aureus* and *Streptococcus spp.* test organisms. The water with the Tween 20 was used as the negative control and Gentamicin was used as the positive control. The yield of the dried yellow colored compound was 1.6 ± 2 mg/g and it was soluble in oil and also in water in the presence of tween 20 (999 ml water: 1ml tween 20). The yield of kernel oil was 8.4 ± 0.3 mg/g and the density was 0.74 ± 0.07 g/ml. The results of antibacterial assay showed that all bacterial strains were inhibited by lavulu seed kernel oil at different levels and the highest inhibition was observed with *E.coli*. The all strains showed MIC at different levels and the MIC of lavulu seed kernel oil for *Bacillus spp.*, 15 mg/ml, *Escherichia coli*, 40 mg/ml, *Staphylococcus aureus*, 50 mg/ml and *Streptococcus spp.* 60 mg/ml. These results revealed the lavulu seed kernel oil would be a potential source for broad spectrum antimicrobial compound. The yellow colour extracted from lavulu pulp can be used in both oil based and water based foods as a natural pigment.

Antibacterial activities of endophytic fungi isolated from mangrove plants in the Negombo lagoon, Sri Lanka

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Mangrove endophytic fungi are suspected to be a rich source of structurally unique and biologically active metabolites with great potential for anti-microbial and cytotoxic activities. However, Sri Lankan mangrove ecosystem is a largely unexplored source for endophytic fungi. Therefore the objective of the current study was to isolate endophytic fungi from several mangrove plants from Negombo lagoon and investigate their antibacterial activities.

Leaves and bark parts from nine mangrove plants were collected, surface sterilized and placed on five types of nutrient media for isolation of endophytes. The endophytic fungi which emerged from the tissues were transferred onto PDA dishes and sequential sub culturing were done until pure cultures were obtained. The ethyl acetate crude extract of the pure cultures were tested against two Gram positive bacteria *Staphylococcus aureus*, *Bacillus subtilis* and two Gram negative bacteria *Escherichia coli*, *Pseudomonas aeruginosa* at 200 µg/disc by agar disc diffusion method. Antibacterial activity was categorized into low, moderate or high depending on the diameter of the inhibition zone.

In total 32 endophytic fungi were isolated and tested for antibacterial activities. Ten out of 32 isolates exhibited low or moderate antibacterial activities against at least one tested bacteria. Endophytic fungal isolates GPL 1.1 and GPL 1.2 from the leaves of *Nypha fruticans* and RAB 2.2 from the bark tissues of *Rhizophora apiculata* showed moderate antibacterial activities. GPL 1.2 was identified as an *Ascomycete* sp. while RAB 2.2 was identified as a *Gibberella* sp. Accordingly we can conclude that metabolites of endophytic fungi isolated from mangroves in the Negombo lagoon are a potential source of bioactive compounds.

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Isolation of an anti-hepatomacarcinogenic active compound from *Indigofera aspalathoides* extracts

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Therapeutic agents derived from nature plays a prominent role in the treatment of cancer in humans. *Indigofera aspalathoides* (family: Fabaceae), a shrub found in Northern Sri Lanka and South India, is used in the traditional medical systems of India and Sri Lanka to treat many ailments including cancer. A flavonoid with potential anticancer properties has been reported from stem of plant growing in India. Although hepatocellular carcinoma (HCC) is the 3rd leading cause of cancer deaths worldwide, ability of the flavonoid compound to inhibit proliferation of HCC cells wasn't investigated. The plant growing in Sri Lanka hasn't been evaluated for anticancer activity and active compounds may vary in the Indian and Sri Lankan plants due to variations of climate and soil conditions. Therefore, the present study was conducted with aims of (a) evaluating *in vitro* anticancer activity of the organic extracts of *I. aspalathoides* against the human hepatoma (HepG2) cells and (b) isolating and characterizing active anticancer compound(s). Powdered, freeze-dried aerial plant material of *I. aspalathoides* was subjected to sequential extraction using hexane, chloroform, ethyl acetate and methanol. These extracts were then screened for cytotoxicity by Sulforhodamine B (SRB) assay. Chloroform extract demonstrated cytotoxic activity (IC₅₀ 58 µg/m L) to HepG2 cells. Subsequently solvent-solvent partitioning was done on the active fraction using a series of solvents. The partitioned fractions were then subjected to SRB assay. The chloroform fraction resulting from solvent-solvent partition showed cytotoxic activity (IC₅₀ 28.8 µg/m L). The active fraction was subjected to size exclusion chromatography followed by silica gel column chromatography. The active compound was isolated in pure form and showed cytotoxicity at IC₅₀ = 14.4 µg/m L. The purity of the compound was confirmed by TLC (single prominent spot of R_f = 0.85, silica gel, hexane; EtOAc, 3:2). Characterization of the active compound via spectroscopic methods is in progress.

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Initiation of β -ladder formation of the Osaka mutant of β -Amyloid: A computational study

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Alzheimer's disease (AD) is a progressive neurodegenerative disease. AD of the brains is characterized by the deposition of proteinaceous aggregates and these have two forms in Neurofibrillary tangles (NFT) and Amyloid plaque (senile plaque). It is believed that the major component of amyloid plaques is formed by misfolding that results in the aggregation of β -amyloid peptides with a length from 1- 39 to 1 – 42 amino acids. The mechanism of β -amyloid protein misfolding is not completely understood. The Osaka mutation, which was found in a Japanese AD patient, is a deletion of the Glu22 residue of β -amyloid protein and this was attributed to the enhancement of aggregation. Thus it is important to understand whether Osaka mutation brings about conformational changes to β -amyloid that result in protein aggregation.

β -amyloid and its Osaka mutant were subjected to 20 ns long MD simulation using GROMACS software package. Both proteins were in aqueous medium with 12470 SPC/E water molecules and under neutral electrostatic conditions. Temperature and pressure of the simulation systems were maintained at 300 K and 1 bar and the time step for the simulation was 2 fs.

Root mean square deviation (RMSD) of the wild type protein has indicated an equilibrium conformation while RMSD of the mutant exhibited large fluctuations with an increasing trend, indicating a conformational change. It was found that the conformational change amounted with mutant favours the formation of β -ladder which initiates the aggregation of the mutant in Alzheimer's disease. Further it appears that the alteration of salt bridge formation between Glu22 (and Asp23) and Lys28 may have an effect on the β -ladder formation and prompting the aggregation. Finally results reported in this study are in good agreement with the experimental findings.

Identification of treacle type by analysis of volatile components using head space-solid phase micro extraction - gas chromatography-mass spectrometry (HS-SPME-GC-MS)

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Treacle is prepared by concentrating the respective sap or juice obtained from inflorescence or stoke, using heat. As a result of this treatment, the non-enzymatic heat-induced browning reactions, namely maillard and caramelisation reactions, take place leading to the formation of volatile aldehydes, ketones and heterocyclic compounds. These volatiles contribute to the characteristic caramel-like, slightly burnt-sugar aroma and flavour of treacle. However, the complete identification of these volatile aroma compounds of the kithul treacle has not yet been reported.

The present Sri Lanka Standard for treacle (SLS 772:1987) is a common standard that covers treacle made from kithul, coconut, palmyrah, and sugar cane. The parameter available for identification of the type of treacle in this standard is organoleptic assessment (specific taste and the aroma) of the different treacle, which is subjective. This is one of the major drawbacks in promoting these unique products in the international market requiring to develop an instrumental technique for identification and development of quality standards.

The headspace volatiles for the four types of treacle aroma was subjected to solid phase micro extraction with a 50/30 μ m divinylbenzene / Carboxen / polydimethylsiloxane coated 2 cm stable-flex fibre, and subjected to gas chromatography mass spectrometry for the identification of the aroma constituents with a Carbowax column.

Aroma volatile components were different for the four types of treacles and can be used as a fingerprint of the respective treacle type. Volatile component of kithul treacle was rich in ethanol (70.66%), ammonia (10.60%), isoamyl alcohol (4.95%), bis- (2-ethylhexyl) hexane dioic acid ester (4.10%), 2-methyl -1-propanol (3.94%), benzeneethanol (1.78%), ethyl acetate (1.06%), 3-methyl-1-butanol (0.55%), phenol (0.35%), 3,5-dimethyl pyrazine (0.34%), 2,6-dimethyl pyrazine (0.28%), methyl pyrazine (0.24%), pyrazine (0.06%), as the major constituents. Several furanone derivatives, furan derivatives and phenolic esters were also present as minor constituents. This is the first report of the volatile aroma profile of the kithul treacle.

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A preliminary investigation on organic applications to promote paddy growth and suppress weeds

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This study is a preliminary investigation on the production of an organic application in a liquid form to promote growth of rice while suppressing weeds. Air dried *Lantana camara* L., *Croton lacciferus* L., *Gliricidia sepium* L. and cattle dung were mixed with water in 8 different combinations, fermented for three weeks and filtrates were used as treatments with distilled water as the control. To identify the growth promoting effect, treatments were applied to two week old rice seedlings of cultivars BG 300 and BG 358 grown in pots under green house conditions. Plant height and number of tillers were monitored weekly and dry weight, number of filled grains and total weight of grains were measured at harvest. Data were analysed by ANOVA using Minitab 14 and the mean differences were compared by Duncan's Multiple Range Test. In order to identify the weed suppressive ability of treatments, 50 seeds of *Echinochloa crusgali*, *Ischaemum rugosum* and *Cyperus iriya* were separately exposed to treatments under laboratory conditions and the inhibition % of weed seed germination was determined. The highest nitrate content (48mg/l) was reported in T2, phosphate in T8 (170.8mg/l) and potassium in T1 (20.1mg/l). Treatments significantly increased growth and reproductive parameters in both rice cultivars compared to the control. Grain weight per unit biomass was higher in BG 300 than in BG 358. In BG 300, highest grain weight per unit biomass was observed in T5 and T8 while in BG 358 it was in T1 and T8. *Echinochloa crusgali* (Bajiri) was highly sensitive to treatments showing 86% - 100% inhibition in germination with full strength treatments. The T5 full strength filtrate also inhibited (72%) seed germination in *Ischaemum rugosum* (Batadella). As the organic application exhibited manuring and herbicidal properties, further investigations are recommended.

Character variation along the climatic gradients in birds endemic to Sri Lanka

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We studied phenotypic characters representing the general shape and size, and the plumage in two pairs of phylogenetic sister taxa, each consisting of a Sri Lankan endemic and its closest phylogenetic relative found in both Sri Lanka and India. The objective was to study the role of barriers to gene flow such as climate, geographic elevation and geology (being an island), on endemism in Sri Lanka. We sampled birds in two transects spanning across the island using mist nets from March to July 2013. From each captured bird a series of morphometric (8 characters) and plumage (10 characters) measurements were taken. Separate principal components analyses (PCA) were performed and clines were fitted for phenotypic characters against elevation and distance gradient. Even though the evidence for selection is difficult to measure, we found several clues for the role of local adaptations in shaping the phenotype in these two species pairs – *Dinopium* (Flameback woodpeckers) and *Zosterops* (White-eyes). The plumage variation is mostly clinal across the gradation of distance from mainland and elevation. However the morphometric measurements showed a linear trend. Phenotypic variation and resulted endemism seen in these range-restricted avian taxa are likely to be driven by adaptations to local environment and limited gene flow due to geographic and climatic barriers. The genetic drift and the associated isolation-by-distance could have also played a role in divergence. The role of climate (e.g. rainfall) as an agent of divergence needs further study. The higher the humidity the darker and bigger the individual is. The more humid and relatively dark forests of the wetzone of Sri Lanka would have selected this pattern. The opposite was true near the mainland.

Increased oxidative stress in severe leptospirosis

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Release of reactive oxygen and reactive nitrogen species (ROS and RNS) contribute to increased oxidative stress and to tissue damage which is thought leading to multi-organ failure in leptospirosis. Serum nitrite level is a direct reflection of RNS produced in an acute infection while serum antioxidant capacity (AOC) is an indirect measure of ROS production which indicates the potential for overall protection against oxidative damage. The objective of this study is to assess the level of oxidative stress caused by RNS and ROS in severe leptospirosis patients. Patients fulfilling clinical and epidemiological criteria for a diagnosis of leptospirosis were recruited (n=120). Confirmation of leptospirosis was based on microscopic agglutination test titre. Laboratory confirmed severe (SL) and mild leptospirosis (ML) patients (SL, n=60 and ML, n=60) were selected. RNS levels were determined by measuring serum NO₂⁻ and ROS levels were indirectly determined using AOC levels. Serum NO₂⁻ and AOC levels of confirmed leptospirosis patients were compared with age, sex matched healthy controls (n=30) and non-leptospirosis fever (NLF) controls (n=60). Serum NO₂⁻ levels of severe leptospirosis patients were significantly higher compared to ML patients, NLF controls and healthy controls (p<0.05). Serum AOC levels of severe patients were significantly lower compared to ML patients, NLF controls and healthy controls (p<0.01). Only SL patients showed a significant negative correlation between serum nitrite and AOC levels (R=0.255, p<0.05) among all patient groups whereas healthy controls had a significant positive correlation (R=0.417, p=0.02). Significantly high serum RNS, low serum AOC levels and negative correlation between RNS and AOC predict significantly increased oxidative stress in severe leptospirosis.

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Laboratory confirmation of Leptospirosis: Comparison between microscopic agglutination test IgM ELISA and IgM rapid test-Leptocheck WB

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Leptospirosis is most often diagnosed on clinical grounds, and confirmed by laboratory testing by the microscopic agglutination test (MAT). There are also rapid immunodiagnostic tests which detect IgM antibodies against *Leptospira*. Objective of this study was to compare the laboratory diagnoses by MAT measurement of IgM by ELISA and IgM based rapid immunochromatographic test [Leptocheck-WB test (LCT)] and to evaluate its clinical applicability. Clinically suspected leptospirosis patients (n=150) were recruited from National Hospital Sri Lanka, Colombo and Colombo North Teaching Hospital, Ragama) during the period June to September 2012. All patients were screened with MAT IgM ELISA (Virion-Serion) and LCT. A MAT titer of ≥ 400 , a 4-fold rise in MAT titer or seroconversion to >200 and isolation of *Leptospira* organisms from blood stream were considered criteria for laboratory confirmed cases of leptospirosis as per WHO guidelines and compared with IgM Leptocheck test positivity. Positivity of IgM ELISA, LCT, MAT (acute serum) and MAT (paired sera) was 34.7%, 44.7%, 28% and 39.6% respectively. The sensitivity and specificity of IgM ELISA and LCT with reference to MAT confirmation were 76.4%, 89.5%, 85.5% and 78.9% respectively. There was a good agreement between IgM Vs MAT and LCT Vs MAT ($\kappa=0.666$ and 0.616). The observed high sensitivity, specificity, ease of use in obtaining results rapidly and no specific skills required for performance, make LCT and IgM ELISA suitable test for early diagnosis of leptospirosis.

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Study of physiochemical and microbial water quality parameters of domestic wells in Panadura

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Ground water is a valuable resource and is a vital source of drinking water. Due to population and developmental pressures ground water is vulnerable to contamination in different ways. Since ground water is still consumed by the people in many cities and suburbs, it is of vital importance to ensure the water is of good quality. The objective of this study was to investigate the physiochemical and microbial quality of well water in selected domestic wells in Panadura area, a populated city in the Colombo district.

Thirty wells were selected randomly to determine the physicochemical parameters (i.e. temperature, pH, electrical conductivity, nitrates, phosphates, chemical oxygen demand, chlorides and iron) and microbial water quality parameters (i.e. Coliforms and *E. coli*) during wet and dry season in 2009 and 2010. In addition, investigations were carried out to study whether there is a correlation between ground water quality and structure and locations of the wells. The parameters were then compared with Sri Lanka standards for drinking water.

This study revealed that water from most of the wells were unsuitable for drinking mainly due to poor microbial quality. The results revealed that the levels of Coliform bacteria were of a wide range (2912.93 in the wet season and 1481.63 in the dry season). Similarly, COD values too showed a variation of 42.21 mg/l and 16.79 mg/l in wet and dry seasons respectively. In all wells, pH was less than 5.5, which is below the standard value. Only 13% of wells were within the microbiological limits specified in SLS 614 part II standard. Nitrate, Phosphate, Chloride and Iron levels were within the recommended levels given in SLS standard. It was evident that there is a linear positive correlation between conductivity vs. pH, conductivity vs. COD, conductivity vs. nitrates, conductivity vs. phosphates, conductivity vs. chlorides, phosphate vs. COD and *E. coli* vs. pH. Negative correlations were found between: pH vs. distance to the toilet pit, Coliform vs. distance to the toilet pit, Coliform vs. whether the well is covered or not and depth vs. temperature. According to the paired sample t -test there is a statistically significant difference between the mean values of temperature, pH, nitrates, COD, iron, Coliform and *E.coli* during wet and dry seasons.

Variation in water quality and zooplankton communities in selected microhabitats within the Bellanwilla-Attidiya marsh

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Wetlands comprise a mosaic of microhabitats of varying quality and species assemblages. The objective of this investigation was to document variations in water quality and zooplankton assemblages in selected aquatic microhabitats within the highly threatened Bellanwila-Attidiya urban wetland. Water samples were collected from five selected microhabitats i.e. covered with *Azolla* (ii) covered with *Eichornia* (iii) open and with *Hydrilla* (iv) shady and murky pools without aquatic plants (v) pools near garbage dumps, once a month over four months (from April to July 2013) giving a total of 100 samples, to ascertain eleven water quality parameters. Additionally, 1 L of water was collected (n=100) for enumeration of plankton communities.

Water quality in the five microhabitats were varied, and ranged from pH =3.4 -7.6, conductivity = 91-1042 μScm^{-1} , turbidity =7.7 - 298.4 NTU, salinity = 0 -0.5 ppt, dissolved oxygen (DO) = 0 - 8.4 mg l^{-1} , biological oxygen demand ($\text{BOD}_3 \text{ day}$) = 0.1- 5 mg l^{-1} , NO_3^- and NO_2^- = 0.014 – 13 mg l^{-1} , PO_4^- = 0.64 – 21.07 mg l^{-1} , chlorophyll a = 0.15 – 34.86 and chlorophyll b = 0.01 – 8.06 mg l^{-1} . Significant differences ($p < 0.05$) between microhabitats were noted for pH, conductivity, turbidity, salinity, DO, BOD, nitrates, phosphates and chlorophyll a and b. Although monthly variations were not marked significant differences ($p < 0.05$) were evident for pH, conductivity, salinity, nitrates, BOD and chlorophyll b. Considering zooplankton, pools near garbage dumps recorded the highest abundance (14970 l^{-1}) whilst the species richness was the lowest. The dominant species recorded were from *Macrothricidae* and *Diaphanosoma*. Microhabitats with aquatic vegetation had high species richness. The lowest abundance (3995 l^{-1}) was in the murky pools. All microhabitats except for those with *Hydrilla*, were dominated by cladocerans, while *Hydrilla* pools had greater numbers of copepods. In all microhabitats the least abundant were the rotifers. Despite the high degree of connectivity, the present investigation has shown that microhabitats within wetlands are unique in terms of water quality and zooplankton communities and may therefore show greater sensitivity to anthropogenic disturbances.

Effects of tea cultivation on the quality of water in selected perennial water bodies from different tea growing elevations in Sri Lanka

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This study investigated the effects of tea garden activities on the quality of water in selected perennial water bodies from different tea grown elevations in Sri Lanka. Forty three sampling sites from eight tea estates under one plantation company in three elevational zones were selected and included springs (originating from tea gardens and secondary forests located within or at higher elevations) and streamlets (before and after flowing through the selected land use patterns ie. tea gardens, home gardens, Eucalyptus patches, marshy lands and secondary forest patches). The parameters measured were: the extent of the drainage basin and depth and width of the water body, light intensity and the flow rate, , temperature, pH, turbidity, conductivity, salinity, DO, BOD₃, nitrate, ammonium, sulfate, phosphate, calcium, zinc of the water.

The DO (6.3 ± 0.2 mg/l), BOD₃ (2.6 ± 0.1), Nitrate (1.82 ± 0.12 mg/l), Ammonium (0.69 ± 0.01 mg/l), Sulfate (28.78 ± 2.11 mg/l), Phosphate (0.47 ± 0.01 mg/l), Calcium (1.33 ± 0.13 mg/l) & Zinc (0.11 ± 0.01 mg/l) in all the tea estates were within WHO potable water standards. No significant differences were evident among sampling sites with respect to some factors. In all the estates the tested parameters did not show a significant difference ($p < 0.05$) in the quality of spring water originating from secondary forests at higher elevations. Except home gardens and some marshy lands, the other land use patterns did not significantly ($p < 0.05$) contribute to changes in water quality at tested sites. Comparing chemical water quality parameters at entry and exit points to tea estates, significant differences ($p < 0.05$) were evident only for low elevation tea estates.

The low pH even in the spring waters within forests indicates that the low level of pH found in other sampling sites could not be due to any anthropogenic activity but could be due to natural dissolution. Also this study revealed that the water bodies related to the low-country tea estates are in a vulnerable situation of pollution compared to the estates in higher elevations (mid & high) and this could be due to lack of natural habitats (secondary forest patches) through which the water flows among tea grown areas in the low country estates which contributes to natural purification process. As such, it is recommended to enhance natural forest habitats associated with water ways of low-country tea grown areas to minimize pollution.

Tracing the phylogeography of the recent dengue strain (DENV1) found in Sri Lanka

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In 2009, a severe dengue epidemic occurred in Sri Lanka that caused a high level of mortality and morbidity than any other dengue epidemic in the country. In each subsequent year, dengue has continued to reach epidemic proportions, posing a major clinical burden to the population. The 2009 epidemic correlated with a shift in the predominant disease-causing dengue virus serotypes in Sri Lanka: prior to the epidemic, two serotypes, DENV2 and 3, were isolated from the majority of patients presenting with serious dengue disease, however, in 2009, a previously undetected DENV1 strain dominated as the major causative agent of dengue disease, and DENV1 has since then persisted as the dominant serotype in Sri Lanka. We amplified dengue virus from sera of patients who presented with severe disease to Colombo North Teaching Hospital in Sri Lanka during the early months of 2012, and sequenced the full genomes of four DENV1 isolates. In this work the phylogenetic analysis reveals that the 2009 epidemic DENV1 strain has continued to circulate within the population and was present in Colombo, Sri Lanka during the 2012 epidemic. We applied bayesian phylogeographic methods to infer the historic spatial dispersion of this virus, using the sequences of our Sri Lankan virus isolates and other reported sequences in the literature. These analyses suggest that the 2009 Sri Lankan epidemic DENV1 strain may have traveled directly or indirectly from Thailand, through China, to Sri Lanka, and, caused this epidemic. Our findings delineate the dissemination route of a virulent DENV1 strain in Asia and will be helpful in global monitoring efforts.

Sri Lankan low grown Orange Pekoe grade black tea (*Camellia sinensis* L.) promotes male sexual competence in rats

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The prevalence of male sexual dysfunction is rapidly increasing and thus there is a need for novel therapeutics to combat this condition. Interestingly, according to some Sri Lankan traditional practitioners, black tea (*Camellia sinensis* L.) improves male sexual functions. However, studies on scientific validation on this claim are extremely limited. In this regard, we have recently showed that, Sri Lankan high grown orthodox Dust No.1 black tea, which is a broken grade type, possess promising male sexual promoting activity. However, it is well recognized that bioactivity of black tea varies with several factors including its agroclimatic elevation and grade. Therefore, this study was undertaken to investigate the effects on male sexual function of Sri Lankan low grown Orange Pekoe (O.P.) grade black tea which is a whole leaf grade type. This was assessed in sexually experienced male rats using receptive females. Different doses (223, 446 and 1339 mg/kg) of black tea brew (BTB) was prepared according to ISO standards (ISO 3103) and orally administered to separate groups of rats (N = 6/group). Selected standard parameters of male sexual behaviour were monitored 2h following administration of BTB or water (vehicle). The results revealed that, the BTB significantly ($P < 0.05$) increased the number of mounts (by 81-158%), intromissions (28-74%), penile licking (by 33-81%), the ejaculatory latency (88-98%) and intercopulatory interval (by 18-57%), and reduced the intromission ratio (by 6-16%), copulatory efficiency (by 27-47%) and post ejaculatory interval (by 26-40%). On the other hand, number of rats mounting and intromitting, mounting latency, intromission latency and copulatory rate remained unchanged. Collectively, this result indicates that, BTB of O.P. grade tea (whole leaf type) has marked and quick acting aphrodisiac and sexual stimulant activity. This is a novel finding which has value addition to Sri Lankan black tea. It is concluded that, Sri Lankan low grown O.P. grade black tea brew (whole leaf type) possess marked, orally active, quick acting and significant male sexual promoting activity in the rat model used.

National Science Foundation of Sri Lanka (Grant No. NSF/Fellow/2011/01) for financial support and Department of Zoology, University of Colombo for laboratory facilities.

Cytotoxic effects of some Sri Lankan traditional red rice (*Oryza sativa* L.) brans against human cervical cancer cell line

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Cervical cancer is the third most commonly diagnosed cancer in women worldwide in 2008 and it is one of the most commonly diagnosed cancers in Sri Lanka. Rice is the dietary staple for Sri Lankans and country harbors many traditional rice varieties (RV). Rice bran is the by-product of rice milling process and reported to have bioactive compounds with anti-cancer properties. However, as yet, no anti-cancer evaluation studies reported in the country on these traditional RV. Present study evaluates the cytotoxicity of brans of some Sri Lankan traditional red RV against human cervical cancer cell line. Seventy % rice bran ethanolic extracts (RBEE) and rice bran protein hydrolysates (RBPH) of Masuran, Dik Wee, Goda Heeneti and Sudu Heeneti were used in this study. Initially RBEE and RBPH were screened at 250 µg/ml (n=3) against human cervical cancer cell line HeLa using sulforhodamine-B cytotoxicity assay. Then, RBEE were further studied using different concentrations (15.6, 31.2, 62.5, 125, 250 µg/ml) to study the dose response relationship (n=6). Screening results revealed that RBEE with significant ($P < 0.05$) cytotoxicity compared to RBPH. The % net growth varied from -48.02 ± 1.69 to 14.04 ± 1.87 and 57.31 ± 2.73 to 74.83 ± 4.71 respectively for RBEE and RBPH. The results of dose response studies revealed a significant ($P < 0.05$) and dose dependent relationship among brans of different varieties. The RBEE of Sudu Heenti had the highest cytotoxicity while bran extract of Goda heenti had the lowest cytotoxicity. The GI₅₀ (50 % growth inhibition) values for Sudu Heeneti, Masuran, Dik Wee and Goda Heeneti were 19.24 ± 3.47 , 47.60 ± 1.47 , 69.02 ± 5.36 and 112.58 ± 0.05 µg/ml respectively. However, brans of all the varieties tested in this study had low cytotoxicity compared to the positive control (Doxorubicin: 0.35 ± 0.02 µg/ml). In conclusion rice RBEE are more potent compared to RBPH and brans of Sudu Heeneti had the highest activity against cervical cancer.

Glutathione S –Transferase enzyme inhibitory activity of Ceylon cinnamon (*Cinnamomum zeylanicum* Blume)

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Glutathione S-transferases (GSTs) are multifunctional detoxification enzymes that protect the cell from electrophilic compounds. Over expression of GSTs in cancer results in resistance to chemotherapeutic agents and inhibition of the over expressed GST has been suggested as an approach to combat GST-induced resistance. It is now well established that natural products including spices can affect or modulate drug-metabolizing enzymes including GSTs. Ceylon cinnamon (CC) (*Cinnamomum zeylanicum* Blume) known as ‘true cinnamon’ in the world is used as a spice in Sri Lanka for centuries. Although many biological activities have been reported worldwide, no studies have been reported on the glutathione S –transferase enzyme inhibitory activity of CC to date. Therefore, present study evaluates the GST inhibitory activity of bark and leaf extracts of authenticated CC *in vitro*.

Freeze dried ethanolic and dichloromethane: methanol (DCM:M) bark and leaf extracts of CC were used in this study. GST enzyme inhibitory activity was carried out according to the method described by Habig *et al.*, (1974) with some modifications (ethanolic and DCM:M bark and leaf extracts, n = 6). Both bark and leaf of Ceylon cinnamon showed dose dependent and significant GST inhibitory activity ($p < 0.05$). However, bark extracts had significantly high GST inhibitory activity compared to leaf extracts: The IC₅₀ values for the ethanol bark, DCM:M bark and ethanol leaf were 102.21 ± 4.28 , 195.69 ± 12.51 and 403.78 ± 6.04 $\mu\text{g/ml}$ respectively ($p < 0.05$). However, at 500 $\mu\text{g/ml}$ assay concentration DCM:M leaf showed only 27.31 ± 2.61 % inhibition.

In conclusion, both bark and leaf extracts of Ceylon cinnamon (*Cinnamomum zeylanicum* Blume) possess Glutathione S –Transferase enzyme inhibitory activity.

Effects of chromium exposure in the earthworm *Eudrillus eugeniae*

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Heavy metal pollution of natural ecosystems has recently become a matter of national concern due to their adverse impacts on humans as well as the biota inhabiting them. In the present study we examine the impact of different levels of Cr^{6+} on mortality, body weight, behavior and histology of the outer epithelium, of *Eudrillus eugeniae*, a commonly occurring earthworm. Adult earthworms with a well-developed clitellum and weighing 0.29 ± 0.009 g, collected from a culture facility were acclimatized for two weeks and then used for chronic exposure trials. Earthworms (30 per treatment/control) were placed in clay pots (n=10 per clay pot) containing banana piths soaked in one of five concentrations (between 0.002 and 20 mg l^{-1}) of Cr^{6+} . Mortality and weight changes were monitored weekly, whilst histological changes in the body wall and burrowing behaviour were noted at the end of 28 days.

Results revealed that earthworms suffered significantly higher mortality (up to 43 %; $p < 0.05$) at Cr^{6+} levels of 2 mg l^{-1} and above. In comparison, mortality in the controls and in those exposed to levels lower than 2 mg l^{-1} , was in the range of 5 – 10 %. Although only marginally significant ($p = 0.06$), differences were noted with the burrowing times of the earthworms with those exposed to the higher test levels suffering delays in burrowing. The highest mean burrowing time of 3 mins was observed in worms exposed to 20 mg l^{-1} , whilst that of the worms in the controls was only 1.5 mins. Earthworms exposed to higher concentrations exhibited side tracking behavior to avoid contact with Cr^{6+} soaked piths. Exposure to Cr^{6+} on the other hand, did not cause marked changes in growth rates in terms of weight gain or loss ($p > 0.05$). On exposure to all the different concentrations of Cr^{6+} histological changes of varying magnitudes were evident in the outer epithelium. The histological changes included structural changes such as disintegration of cell margins, nuclear defects, vacuolation and reduction in mucous cells. These effects, that were evident at environmentally relevant levels of Cr^{6+} , are noteworthy as earthworms form an integral component of soil biota and are increasingly used for inoculation of degraded soils and for the production of vermicompost.

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Application of miniaturized human STRs (Mini-STRs) in DNA based identification of a formalin fixed foetus: A case report

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Accurate identification of an individual is fundamental in DNA based forensic investigations. In order to establish identity of a biological sample, Short Tandem Repeat (STR) DNA markers in the human genome are being used extensively considering their high discrimination power over classical methods of human identification. However, biological samples containing environmentally challenged, degraded or damaged and fragmented DNA in low concentration may reduce the chance of obtaining informative results. When unbuffered formaldehyde is added to a biological sample as a preservative, it makes DNA molecules irreversibly fragmented and degraded resulting conventional DNA testing unsuccessful. Further it was reported that the amount of DNA required for a successful PCR amplification from a formalin fixed tissue is dependent on the time of fixation. This limit increase from 10 ng after three hours to 100ng after one week of fixation in unbuffered 10 % formalin. Even though DNA in the sample is fragmented, miniaturized STR DNA markers (Mini- STRs) can still produce successful DNA profiling results due to its ability to generate reduced sized DNA amplicons during Polymerase Chain Reaction (PCR). We have demonstrated a successful genetic identification of a formalin fixed foetus which has been preserved in 10 % formalin for nearly two months, using a newly designed human Mini-STR DNA marker system. This further highlights how a miniaturized PCR amplicon is more suitable over conventional STR amplification using PCR, highlighting the value of Mini-STR approach for analyzing degraded biological samples in DNA based forensics.

A simple, cost effective and sensitive Immuno– dot blot assay for detection of Weligama Coconut Leaf Wilt Disease associated phytoplasma

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Phytoplasma borne Weligama Coconut Leaf Wilt Disease (WCLWD), the current major threat to the coconut cultivation of Sri Lanka was first reported in 2006 from Weligama, in Southern Sri Lanka. There would be dire consequences if it spreads to the coconut triangle which consists of more than 70% of the total land under local coconut cultivation. As a sensitive, specific and rapid diagnostic test for WCLWD is an imperative need, we undertook to raise diagnostic monoclonal antibodies to be used in immunologic assays for WCLWD. This study reports the establishment of a specific immuno dot blot assay based on polyclonal serum raised in experimental animals to purified phytoplasma to be used for subsequent screening of hybridomas.

Immuno – dot blot was established by optimizing reagent concentrations; antigen(1/5 - 1/50 w/v), phytoplasma specific antibody(1:100 – 1:2000), enzyme conjugated secondary antibody (1:250 – 1:2000) and antigen volume per spot (1 μ L – 6 μ L) using checker board titration to achieve maximum specificity and sensitivity. Optimized conditions for sensitive detection of WCLWD was achieved using 1:20 (w/v)antigen, 1:250 antibody and 1:500 conjugate dilutions. Briefly, Polyvinylidenedifluoride (PVDF) membrane was spotted with 4 μ L of test antigen, blocked, incubated with phytoplasma specific polyclonal antibody, then with enzyme conjugate and finally with substrate, 3-amino-9-ethylcarbazole. In between each step, the membrane was washed with washing buffer. The optimized assay enabled visual differentiation of infected coconut palms from apparently healthy samples. The cross reactivity of the assay was determined using sugarcane leaf extract infected with white leaf disease caused by another phytoplasma. This assay, that did not cross react with crude leaf extract of Sugarcane white leaf disease, will be validated using a significant number of disease positive and negative coconut samples. Cross reactivity of the assay will be further analysed using arecanut and bermuda grass leaf samples infected with closely related phytoplasma strains.

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Effect of BOPF grade Sri Lankan black tea (*Camellia sinensis* L.) produced in different agro-climatic elevations on gastroprotective activity in rats

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The aim of this study was to investigate the effect of Sri Lankan BOPF grade black tea [*Camellia sinensis* (L) O. Kuntze] produced in different agro-climatic elevations on gastroprotective activity using rats. Black tea infusion (BTI) for oral administration in rats was prepared using representative black tea samples obtained from major three agroclimatic elevations: high- (>1200m, average mean sea level); mid- (1200 – 600m, amsl) and low grown (< 600m, amsl). Three doses of BTI (300, 600 and 2400 mg/kg bw of rat/day ((n = 9/Group) which is equivalent to 1½, 3 and 12 cups/day respectively for human). Cimetidine (20 mg/kg, positive control) and water (negative control) were used in the assessment of gastroprotection activity. The gastroprotection action was evaluated using three well established rat gastric lesion models: ethanol-induced (oral), indomethacine-induced (oral) and serotonin-induced (subcutaneous). The results revealed that, the Sri Lankan orthodox BOPF grade black tea possesses marked dose dependent and significant ($p < 0.05$) oral acute gastroprotective activity (in terms of reduced number of mucosal haemorrhagic lesions, shortening of the length of gastric lesion and impaired perforation area of gastric lesions). This is a novel finding to BOPF grade Sri Lankan black tea. The order of potency of gastroprotective activity was: low grown > mid grown > high grown, which could be attributed to the differences in caffeine, catechins and theaflavins contents in black tea amongst the agroclimatic elevations. The gastroprotection activity of BOPF grade black tea was mediated via multiple mechanisms: impairment of gastric volume, gastric juice acidity, gastric acid production, anti-purgative or gut transit time, pepsin content and improvement of endogenous mucosal protection barrier, gastric mucosal blood flow in experimental rats, and increments of conductivity and antioxidant activity of BTI. It is concluded that, BTI of BOPF grade of Sri Lankan black tea has *potent gastroprotection and gastric ulcer healing capability* and seem to function as a natural beverage food for gastroprotection in the rat model used. This potency of the gastroprotective activity of BOPF grade black tea differs in different agro-climatic elevations.

Financial assistance by the Sri Lanka Tea Board is acknowledged.

Heavy metal induced toxicity of the Indian green frog, *Euphlyctis hexadactylus* (Ranidae), in the Bellanwila-Attidiya sanctuary

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Amphibians are reported to serve as decisive indicators of ecosystem health. A previous investigation of a polluted urban wetland, Bellanwila-Attidiya sanctuary in the Western province revealed contamination of water and frog tissue with heavy metals Cd, Cu, Zn and Pb. These findings in conjunction with the global amphibian crisis provided the impetus for a study to evaluate toxic effects of selected heavy metals on *Euphlyctis hexadactylus* in the Bellanwila-Attidiya sanctuary. Naturally exposed frogs, from this site were compared with their healthy counterparts from the reference site at the catchment of Labugama reservoir. Standard methodology assessed toxicity based on frog erythrocyte morphometry, histopathology of major organs and serum biomarkers of hepatic and of nephro toxicity.

Erythrocyte morphometry measured mean cell volume (MCV), mean nuclear volume (MNV), aspect ratio and nucleo-cytoplasmic ratio. The exposed versus healthy *E. hexadactylus* reported discrepancies in all these tested parameters; particularly, MCV of exposed animals ($179.0 \pm 32.58 \mu\text{m}^3$) was significantly lower ($P = 0.0001$) than that of reference animals ($200.79 \pm 35.96 \mu\text{m}^3$). Histopathological assessment showed pronounced disturbances in tissue development; severe bile secretion, hemorrhages and sinusoidal dilations of liver, distortion of alveolar sacs in the lungs, damaged Bowman's capsules in the kidney and damaged glandular cells of the skin epidermis. Liver injuries observed were clearly explained by increased activity of serum hepatic marker enzymes, aspartate transaminase, alanine transaminase and gamma glutamyl transferase, indicating cellular leakage and loss of functional integrity of frog hepatocyte membrane in the polluted site. Reduced total protein and albumin levels suggested hepatic dysfunction. Significantly elevated levels of urea ($P = 0.033$) and higher creatinine in blood indicated renal dysfunction.

Thus, as evidenced in this study erythrocyte morphometry, developmental alterations in major organs and serum biomarkers of *E. hexadactylus*, may be used as indicators of heavy metal pollution of aquatic amphibians.

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Free radical scavenging effect of a few selected Sri Lankan marine sponges (Demospongiae)

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Sponges are one of the most interesting taxa due to the presence of a large number of bioactive secondary metabolites. Despite the high diversity of Sri Lankan marine sponges, the potential of using these as a source of bioactive compounds has been scarcely investigated. The role of free radicals and reactive oxygen species in the pathogenesis of many diseases such as diabetes, arthritis, cancer etc is well established. This study assessed the *in vitro* free radical scavenging effect of 4 different Sri Lankan marine sponge species.

Sponges were collected from Kaththankudi, Batticaloa (N=3) and from Unawatuna, Galle (N=1) Sri Lanka. The class of the sponges was confirmed as Demospongiae, by spicule analysis. Collected samples were repeatedly extracted in absolute methanol and dichloromethane, followed by rota evaporation. The crude extracts were tested for their 2,2-diphenyl-1-picrylhydrazil(DPPH), nitric oxide(NO) and Superoxide(SO) radical scavenging activities using standard methodology. Dose dependant radical scavenging effect was observed only in the sample collected from Unawatuna. While the IC 50% value for free radical scavenging effect of this sponge against DPPH was 402.63 µg/ml, no activity was observed in this sample for NO and SO. The three samples collected from Batticaloa did not show free radical activity against the three free radicals tested.

Thin Layer Chromatography (TLC) of the crude extract which showed free radical scavenging activity against DPPH indicated the presence of high polar compounds. These were identified both in short and long UV wave length and with anisaldehyde spray indicating the presence of saturated and unsaturated polar secondary metabolic compounds, respectively.

In conclusion, this study demonstrated that a yet to be identified Sri Lankan marine sponge species of class Demospongiae, contains saturated and unsaturated polar secondary metabolite(s) that possess *in vitro* free radical scavenging effect against DPPH.

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Development of country-specific emission factors for methane emissions from livestock sector in Sri Lanka

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Agriculture has been identified as one of the key source/sink categories under the United Nations Framework Convention on Climate Change (UNFCCC) to be considered for the national greenhouse gas inventories by the member countries. Methane (CH₄) emissions from enteric fermentation is a sub category under Agriculture, and most member countries have so far used the default IPCC 1996 revised guidelines in estimating such emissions. The latest IPCC 2006 guidelines for national greenhouse gas emissions are more elaborate and provide better guidelines for developing country specific emission factors. In this study, we developed country-specific methane emission factors for estimating methane emission from the main livestock categories in Sri Lanka, following the IPCC 2006 guidelines. In Sri Lanka, cattle and buffaloes are the major livestock categories, while goats, swine, and sheep remain as the minor categories. The amount of CH₄ emitted depends on the body size, metabolism and activity level of these animals, and their feed quality. For estimating the CH₄ emission factor from enteric fermentation, a Tier2 approach was used with energy calculations (IPCC, 2006) based on country specific activity data. Components of Gross Energy and CH₄ emission factors were estimated for different ruminant livestock categories. Each animal category was further subdivided for the analyses. The cattle population was subdivided as mature dairy cows, mature bulls, and growing cattle (i.e. calves, heifers). Separate emission factors were calculated for local (indigenous) and improved (Indian and European) breeds. The CH₄ emission factors calculated for other cattle categories ranged between 13 to 58 kg head⁻¹ yr⁻¹ and the population weighted methane emission factor for dairy cows (i.e. 51 kg head⁻¹ yr⁻¹) matched the IPCC default value.

SRI PALEE CAMPUS



Message from the Rector



I am very pleased to give this message to the Annual Research Symposium 2013 of the University of Colombo in Sri Lanka.

The aim of the Annual Research Symposium of the University of Colombo in Sri Lanka is to give an exposure to young researchers and an opportunity for them to publish their findings at an academic forum.

Today, knowledge is a very important factor not only for intellectual development, but also for the social and economic development of the country. We are now living in the post war era where we need to produce new knowledge, experiences, and, intellectual and ideological forms to build Sri Lanka in a global context. The prime responsibility of university academics is to contribute knowledge for human development.

I would like to conclude by wishing all the paper presenters a bright and prosperous academic future.

Dr. Tudor Weerasinghe

Rector, Sri Palee Campus

Sri Palee Campus

Abstracts

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Study on effectiveness of Facebook as a medium of marketing and advertising

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The Facebook is high potential effective medium in advertising & marketing. It has been a tool to assists for efficient communication in the modern age. It can be used as a medium of advertising, marketing and as a medium of socialization. The primary reason behind success in the context of aforementioned aspects is the interactivity—to be more exact the continuous two-way communication and effective feedback. The population which uses the Face book in Sri Lanka is 902,460 and it shows a transparency of 4.9%. In Pakistan, it is 2'19 %. In India, it is 1'88 %. In Bangladesh; it is 0'92 %. It is an interesting fact that Sri Lanka shows a considerably higher value than the other large South Asian countries.

The organizations which advertise & market their products & services through Face book can be seen in Sri Lanka as well as in the world. It was obvious that Face book possessed a direct response and feedback mechanism than any other medium. 60% of the sample said they get details from the Facebook, while 25% relied on radio and television. 15% use newspapers. Facebook has become the most effective marketing and advertising tool especially among the younger generation.

As a productive advertising medium, it has the ability to carry out promotion campaigns through the Facebook. It could be seen that they have carried out sales promotion campaigns on their Face book fan pages. Therefore, Face book is recognized as an effective medium of advertising & marketing especially for small-scale organizations through which they can communicate about their products & services to their small target groups in Sri Lanka.

According to the information collected through the qualitative and survey methods it reveals that the cost of advertising on Facebook is lower by comparison with other media. This research study reveals the effectiveness of Facebook as a medium of marketing and advertising.

The persuasion of the Sri Lankan audience towards satellite television

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The medium of communication was created to fulfill the needs of human beings and later developed it into a complicated nature of technology. Television is a positive apparatus to spend their time to enjoy something simple and to obtain entertainment and education.

Satellite television is a television system in which the signal is transmitted to an orbiting satellite and transmits the amplified signal back to the earth. It was started on the 27th of May, 2003 by CBN Sat Company and Sri Lankan audience got a great opportunity to get exposed to digital experience. But, this satellite television system was legally shut down on the 06th of June 2006 on vague allegations of improper license, the broadcasting of fashion TV and LTTE related programs. The Dialog television which was commenced in 2007 could fill this void. At the very outset, there were over 25,000 subscribers and it has increased up to 1, 45,000 immediately.

The research problem of this study is what made the audience persuade towards satellite television network when there is an already available terrestrial transmission system. The Interviews, Question areas, Content Analyzing and Observation were used for collecting data.

Earlier the Analogue system was used for the terrestrial transmission and this leads to form unclear pictures and sounds. Since the digital transmission system was used for the satellite television system the masses could undergo a digital experience. Moreover, the advent of the satellite television system leads to increase the number of viewers, to overcome the geographical boundaries, to overcome the limitations of the range of frequency and the viewers got an excellent opportunity to view more foreign channels.

A study on the meanings depicted by the dresses worn by the youth of the contemporary society

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This study attempted to examine how meanings are originated or constructed through a fashion system. Fashion system is a sign system. Sign is a relation between a signifier and a signified, a sound or mark and a concept. Consequently, sign is the equivalence between a signifier and a signified. Sign can have denotative; the direct, meanings as well as connotative, indirect, meanings. The secondary meaning associated with the sign was named as myth.

It passes real garments through a series of structures until it finally meets the public with a meaning, a sign, thoroughly dependent upon language. This meaning can be first layered meaning or a second layered meaning. The main objective of this study was to examine how first and second layered meanings are associated with dresses worn by youths. One hundred participants were distributed questionnaire to investigate the meanings created by the costumes they wear.

It was found that there is a strong relationship between their social status and the dress. The dress seemed to vary depend on their profession, age, sex, income and marital status. It was found that dress did not mean only to covering or protecting body. Many other functions; image building, power indicating, identity maintaining, professional standard maintaining, were associated with the dress worn by the youths of the contemporary society.

Dresses remain each year, obviously, but their variant allows the fashion system to perpetually recreate and regenerate its messages from a simple stock of elements. Fashion system could be used to represent the contemporary social ideological and cultural values and believes.

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