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”
CONTENTS

Message from the Vice-Chancellor 7
Address by the Keynote Speaker 8
Invited Speakers’ Abstracts 9

FACULTY SESSIONS

Faculty of Arts
  Message from the Dean, Faculty of Arts 14
  Abstracts 15

Faculty of Education
  Message from the Dean, Faculty of Education 56
  Abstracts 57

Faculty of Graduate Studies
  Message from the Dean, Faculty of Graduate Studies 80
  Abstracts 81

Faculty of Law
  Message from the Dean, Faculty of Law 108
  Abstracts 109

Faculty of Management and Finance
  Message from the Dean, Faculty of Management and Finance 184
  Abstracts 185

Faculty of Medicine
  Message from the Dean, Faculty of Medicine 212
  Abstracts 213

Faculty of Science
  Message from the Dean, Faculty of Science 264
  Abstracts 265

Sri Palee Campus
  Message from the Rector 348
  Abstracts 349

Organising Committee 361

5
In the present era of knowledge with its rapid pace of technological advancement, one cannot escape globalization which now embraces all aspects of our lives. The University of Colombo is no different to other universities worldwide. Through its vision and mission, the University of Colombo has prioritized innovation, technology, and the dissemination of knowledge for national and global development. Modern technological advancements in communication have created a virtual space for information sharing, collaboration, debate, and intellectual discourse. Communication through internet and intranet is of foremost importance to the university in fulfilling its mission and achieving its objectives. The careful use and management of all electronic communication tools can have a tremendous impact on our virtual space, quality of our teaching, mode of delivery, research and our intellectual discourse. Learning has been made easy through this novel technology. Having realized the ample opportunities offered by such advancements, the University of Colombo has adopted and promoted measures to expand higher education further through blended modes of delivery both locally and globally. The University M-based learning virtual campus is one such venture.

The theme for this year’s Symposium is ‘Converging Technologies & Sustainable Communities,’ a topic that is currently being discussed, researched, and implemented globally. Therefore, the University of Colombo, the premier University in the country, selected the theme in order to be on par with global trends. The convergence of technologies is for all disciplines and is equally applicable to simple day-to-day life as to highly sophisticate industrial products and communication technologies – ICT, plays a pivotal role here. The theme was also selected to make staff and students aware of global innovations.

I wish to thank the organizers of the 2012 symposium, chaired by Prof. Neloufer de Mel. I also wish to thank the Rector, Deans, Registrar, Bursar, Heads of Departments and all the academics, academic support and non-academic staff who contributed to make this Symposium a success.

My thanks are also due to the sponsors, Ministry of Higher Education and Mobitel (Pvt) Ltd. for their generosity in making this academic endeavour a success.

I wish the Research Symposium 2012 all success.

Professor Kshanika Hirimburegama  
Vice-Chancellor, University of Colombo  
Senior Professor in Plant Sciences
Address by the Keynote Speaker

Sustainable Development and Codes of Scientific Conduct

One of the major problems besetting the world order today and militating against the concept of sustainable development is the fact that the power and reach of technology have grown to such an extent as to outpace all attempts by legal and judicial systems to keep them in control. Indeed, the power of technology grows so fast that even if the law moves into action to control any area of development, the rate of development of technology far outplaces the rate of development of legal controls. Consequently, the gap is ever widening between the power of technology and the power of the law to keep that technology under control in the interests of society.

Technological advances in relation to human society, the human environment and even the human body itself, which ought strictly to be kept within the confines of law and human rights, are not only out of control, but racing further out of control day by day.

I have sought over the years to draw attention to the need for societal checks on technological power through ethics, religion, morality and law, drawing attention to the fact that when scientific power began extending itself in the worlds of Chinese, Hindu and Islamic civilization, the moral and ethical codes of those civilizations kept the developing technological power under societal control.

However, when the scientific revolution began in the Western world, this was not the case, and many of the problems the world faces today, ranging from nuclear weapons to restructuring the human body, are due to this lack of societal control. This is a problem urgently needing the concerned attention of scientists, lawyers and the general public and is growing to the point of endangering the human future. It needs attention now.

Since the law by itself is unable to achieve a meaningful result, it is through the development of ethical codes among the scientists themselves, that this can be achieved. Each scientific group from nuclear scientists to molecular biologists needs to work out an appropriate ethical code in its area of activity. Such codes need to receive substantial support and understanding from the general body of scientists involved in the relevant areas of research.

Lawyers, ethicists, religious personnel, members of the public and scientists need to coordinate their efforts for this purpose, and this Conference needs to issue a call for action in this regard.

Honourable Judge Professor C.G. Weeramantry
Former Vice-President, International Court of Justice
Emeritus Professor, Monash University
Invited Speaker

Education for All: A Case Study on mLearning

Sri Lanka has a literacy rate above 94%. This is with the basic writing and reading skills. But as a developing country to uplift standards to the next level, the mode of education needs a shift in gear. The focus on Life Long Learning in every sector will further enhance the economy of the country enabling skill development and specialization related to the fields that they are already working on.

A major barrier to achieve this is geographical distances, cultural barriers, quality tutors and busy schedules of people. Most of the good educational institutions are located in main cities and quality education is not equally distributed to every part of the country.

The mLearning platform is developed with the focus to overcome these barriers to education, where people who are in remote locations are able to access the same quality education provided from a central location to different parts of the country in a live environment. mLearning is equipped with Live lecture delivery mode, where students are able to access and participate in lectures live using basic computer equipment and Internet. Furthermore mLearning enables live interactivity between lecturers and students. Students have the capability of following through previous lectures many times as they wish since these lectures have the capability of getting recorded.

Education providers are able to teach students from many locations as well as can connect to virtual classrooms in any parts of the country or the globe at the same time.

mLearning has now evolved to a level where it is used to teach farmer communities, public and government servants, private sector employees, defense employees as well as to conduct workshops for school children and general public. In each situation knowledge has been disseminated from Colombo to every rural corner of the country.

Mr. Janaka Jayalath
Senior General Manager, Corporate Planning and Marketing, Mobitel (Pvt) Ltd.
Man is inherently innovative and creative. However, technologies developed by man have more often than not led to creating a great disparity between the haves and have-nots, and between the privileged and the under-privileged. In spite of great strides made on the technological and economic fronts, technologies have also triggered a great deal of socio-economic and socio-political issues the world over. If proper attention is not paid to social needs and ethical issues and to the implications of unifying sciences, the impending converging technologies (Nanotechnology, Biotechnology, ICT and Cognitive Science), despite their potential revolutionary impact on human performance, communication, agriculture, healthcare etc., could further add to the yawning disparity, disorder and chaos in the world. Therefore "Technology for Inclusive Development" should occupy centre stage of any development initiative of the country.

Professor Ranjith Senaratne

Vice Chairman, University Grants Commission, Sri Lanka
Invited Speaker

Convergence and Divergence in 21st Century Academia: Three Visions of a University

The political, economic, and technological transformations of globalization have made the world smaller and more connected. In the university context, the opportunities to share knowledge and ideas are almost limitless. Faculty and students can engage with their counterparts around the world, either in person or virtually. Moving forward, however, what will this mean for universities - in particular for those in the developing world? Building on the experience of the National University of Singapore, this paper will outline three distinct visions for a university in this new and challenging world.

Professor Simon Chesterman
Dean, Faculty of Law, National University of Singapore
FACULTY OF ARTS
Message from the Dean

The Annual Research Symposium of the University of Colombo is a unique opportunity for academic staff members, senior and junior, to demonstrate their research capacity and to share their academic work and findings with the rest of the academic community. This is an opportunity to disseminate the research findings of seniors and to encourage juniors to follow the long standing research traditions.

This year the theme of the symposium, *Converging Technologies and Sustainable Communities*, has cross cutting issues that professionals in all faculties can share. Abstracts submitted by the members of the Faculty of Arts have addressed the issue from social, community and human perspectives.

I would like to use this opportunity to express my sincere gratitude to Prof. Lasantha Manawadu who worked tirelessly to get 31 abstracts submitted and reviewed in time. This year, the Faculty of Arts has 26 presentations. Editors, Reviewers and those who submitted abstracts are also gratefully acknowledged.

From submission of abstracts, to reviewing and finally presenting these in the academic forum involves much effort, as does organizing and carrying out the research session itself. This is a team effort. Many were involved in the different stages of this process and must be acknowledged with gratitude. Without their dedication and interest, this Annual Research Symposium would not be a reality.

I hope this event will uncover new ideas and new ways of thinking.

Professor Athula Ranasinghe
Dean, Faculty of Arts
Faculty of Arts

Abstracts

1. Reproductive Health Knowledge and Attitudes among Secondary School Children in Sri Lanka 17
2. Cave Temple Paintings Technology in Uva Province 18
3. A Preliminary Study on Surface Water Quality Variations in Negombo, Maturajawela and their Coastal Region 20
4. Impact of ‘Modern Development’ on Socio-cultural Life of Vedda Community: A Socio-anthropological Analysis 22
5. Facing Problems Created by Modern Technology – The Buddhist View 23
6. The Impacts of Changing Patterns in Traditional Chena Cultivation in Sri Lanka: A Study with Reference to the Monaragala District 24
7. Recent Trends of Morbidity and Mortality in Sri Lanka 26
8. Motorised Mobility in Sri Lanka and the Effectiveness of the Conventional Tools in Addressing Sustainability Concerns 28
9. Revealing Language Patterns Through the Use of Technology 30
10. An Application of Equivalent Uniform Depth (EUD) of Precipitation Method to Investigate Spatial Distribution Patterns of Rainfall 31
11. ‘Freeing us from burdens that we should not want to be rid of’: Technology’s Gift to Humanity 32
14. A Study of the Condition of Water Pollution in the Bolgoda River 37
15. The Politics of Urban Space: A Sociological Study of Pavement Hawkers 38
<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Impact of Population, Affluence and Technology on Environment</td>
<td>40</td>
</tr>
<tr>
<td>18</td>
<td>Problems and Issues Related to River Sand Mining in Sri Lanka</td>
<td>42</td>
</tr>
<tr>
<td>19</td>
<td>Investment in Human Capital Portfolio in Sri Lanka: the Case of University Graduates in Sri Lanka</td>
<td>43</td>
</tr>
<tr>
<td>20</td>
<td>An Evaluation of the Threats of a Dusty Environment on the Sustainability of Human Health: A Study of Sammanthurai Division Secretariat Division</td>
<td>44</td>
</tr>
<tr>
<td>21</td>
<td>Effective Factors towards First Language Acquisition in Hearing Impaired, Cochlear Implanted Children</td>
<td>46</td>
</tr>
<tr>
<td>22</td>
<td>Contribution of Citizen Journalism as a Tool for Development Communication in Sri Lanka</td>
<td>47</td>
</tr>
<tr>
<td>23</td>
<td>Globalization, International Migration and Transnational Communication</td>
<td>48</td>
</tr>
<tr>
<td>24</td>
<td>The Traditional Newspaper Industry vs. the Technology Driven News Media - Predatory or Complementary Behaviour</td>
<td>49</td>
</tr>
<tr>
<td>26</td>
<td>Socio-demographic Determinants of Subfertility in Sri Lanka</td>
<td>54</td>
</tr>
</tbody>
</table>
Reproductive Health Knowledge and Attitudes among Secondary School Children in Sri Lanka

Gayathri Abeywickram
Department of Demography

For many decades researchers have paid attention to reproductive health research that explores mainly married women’s reproductive health. However, less attention has been given to explore adolescent students’ reproductive health issues. Therefore, the objective of this study is to examine the reproductive health knowledge and attitude of secondary school children in Sri Lanka. Such an investigation would help to evolve innovative solutions in advancing knowledge by employing new technologies in order to ensure healthy environment for the adolescent population in the country. Data for the study was obtained from 110 students who were in grade 11, representing rural and urban schools in the Colombo district. An interviewer administered questionnaire was used to gather data.

The findings revealed that all the respondents were aware of the secondary sex characteristics irrespective of gender and sector. Urban students were more aware of reproductive health matters than rural students. Female students had better awareness than their male counterparts. Female students who were in urban and international schools were more aware about reproductive health issues than rural female students. The knowledge and perceptions on practices during menstruation among rural female students was poor. Majority of the students had considerable knowledge about reproductive hormones, reproductive system, child sex abuse and sexually transmitted infections. Male students were more likely to be involved in love affairs for fun and to reduce stress, while many of the female students were not in favour of a love affair as it might adversely affect education. The study further revealed the attitudinal gaps that exist between urban and rural students. Furthermore, it revealed that, friends and peers were more influential sources of obtaining reproductive health information than school teachers and parents. Internet has become the main source of obtaining information on reproductive health knowledge for the international school students. Attitudes on pre-marital sex show that urban students especially, international school students tend to favor premarital sexual relationships as a source of gaining experience. Majority of students in all sectors had agreed that reproductive health knowledge is essential and that it needs to be included as a subject in the school curriculum. These findings suggest that policies and programmes should be more focused on educating rural students and also awareness programmes need to be implemented separately for male and female students to address their specific issues.

Keywords: reproductive health, secondary school children, pre-marital sex, menstruation
Cave Temple Paintings Technology in Uva Province

T.A.C.J.S. Bandara
Department of Sinhala

The research area has been identified as a part of Ruhuna, one of the principle politico-religious seats of ancient Sri Lanka. Among the other archaeological remains in the area, it was noticed that the temple paintings in Uva province have long been neglected. This research attempts to study and document them in a methodical way. Three major research questions are to be addressed: (a). How do these paintings reflect the contemporary Socio-Cultural sphere and why are they so? (b) . What are the criteria for defining such characteristics? (c) What is the relationship between cave paintings and technology?

Methodology in such research can have multiple approaches. The traditional methods of collecting secondary and primary data through literature survey will form the initial step of data collection. Documentation followed a number of steps. Compilation of an anthology on the subject, especially collecting published references on Sri Lankan Painting was the activity which was done at the outset of the project. A considerable sample was selected for field visits. These covered 10 individual locations that represent two administrative districts while enveloping one physiographic region in the country. Selected sample is 50% of the total number of sites recorded. The second major step followed was the photographic recording. Two professional cameras were used for this purpose under low light conditions.

The line and colour used to produce volume and solidity of figurative forms and natural objects in the classical style, underwent a transformation in the Kandyan period, where it served the purpose of ornamentation in creating a two-dimensional decorative art form. Vigorous, complex and expressive narration of the classical tradition was transformed in the Kandyan style into a method of simple continuous narration. Nevertheless Kandyan painting should neither be construed, as a mere postscript to the classical phase nor should it be elevated to the status of classical achievements, except on very rare occasions where the creative imagination of a genius has transcended the constraints of a style.

The Kandyan painter has used a tempera technique with a limited range of colours - white, red, yellow, black, blue and green. The pigments, made from earth or vegetable substances were mixed with the gum of the wood-apple tree and water. The materials on which paintings were done were plaster (on rocks and walls), wood (ceilings, partitions, boxes), cloth, earthenware, and paper. The rock and wall paintings were executed on a final coat of makul (magnesite). A line drawing of the composition was first done on the surface in red or black and the colours were added subsequently. The under-drawings which get covered in the final stages of the painting are more vigorous and spontaneous than the final outlines of the figures. Uva painters however use another four colours. There are Ash, brown, pink and off-white.

It should be stated that the paintings made in any part on this island during the period under reference fundamentally belong to one school. Nevertheless closer and more critical study reveals that the paintings in the Uva province have some independent
characteristics which make them a group apart from Kandyan paintings. These differences are noticeable in many aspects of these artwork, such as pigments, composition background and details in which Uva artists display a considerable degree of freedom in contrast to the strict conventionality of Kandyan artists.

**Keywords**: archeological, cave paintings, Uva province
A Preliminary Study on Surface Water Quality Variations in Negombo, Muthurajawela and their Coastal Region

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The coastal region of Negombo consists of the Negombo Lagoon, Muthurawajawela wetland and the coastal belt which highlights complex hydrological dynamics. The Negombo lagoon with brackish water opens into the Indian Ocean at a point close to the Negombo town. It receives water mainly from the Hamilton canal, Dutch canal, Dandugam Oya and Ja-Ela. The Hamilton canal which runs in the north-south direction, situated to the left side of the Muthurajawela wetland, connects the southern periphery of the Negombo lagoon and the Kelani estuary. The Dutch canal on the other hand also runs parallel to the Hamilton canal on the right side of the same wetland, connecting the Kelani River and Ja-Ela. The main sources of fresh water to the lagoon are Dandugam Oya and Ja-Ela which discharge at the southern part of the lagoon. This interconnected water system in this area consists of multifaceted hydrological interrelations such as fresh, brackish and saline water. Water in the lagoon is almost still while waters in rivers and canals are flowing. This rare situation is created due to natural as well as man-made causes.

The present research study is conducted to identify the basis of quality variations of surface water in Negombo and Muthurajawela wetland and their parallel coastal region. For this study fifty (50) surface water samples were taken randomly from the periphery of the Negombo lagoon, Hamilton canal, Dutch canal, Dandugam Oya and Ja-Ela during the period of January to April 2012. Preliminary study of the variation of water quality, in the study area was identified with respect to Electrical Conductivity (EC) and Temperature of water using a potable electrical conductivity meter. The locations of water sample sites were recorded using a Global Positioning System (GPS) and the collected data were analysed using Geographic Information System and MS Excel software.

The results of the analysis revealed that the surface water in each source is distinctive. EC in microsiemens per centimeter (µS/cm) values of the Negombo lagoon showed substantial variation along its periphery which fluctuated between 55500µS/cm and 14000µS/cm. The highest EC values were recorded at the outlet area at its Northern tip. However, the southern part of the lagoon showed comparatively low EC values due to dilution and other geographical facts while south east quarter of the lagoon indicated comparatively higher EC levels. EC values of Hamilton canal varied between 25500µS/cm and 989µs/cm while the highest value 25500 µS/cm of EC was recorded close to the Kelani estuary. This is due to the influence of intrusion of sea water through the Kelani River. A gradual decrease in EC with considerable variation could be found up
to the third quarter of the Hamilton canal from the Kelani River and then a significant increase could be seen towards the lagoon. EC of the Dutch canal was around 1903 µS/cm while it recorded 18200µS/cm near the Kelani River. Both Dandugam oya and Ja-Ela recorded comparatively low EC levels. However, close to the lagoon the EC levels were higher than the other readings obtained to the land side of them. EC values fluctuated between 3500µS/cm and 4000µS/cm in Dandugam oya showing a decreasing trend towards the upper area of the catchment. According to the results obtained the temperature of surface water varied between 25.2°C and 26.8°C in the entire study area.

The results reveal that the values of EC variation in waters in the Negombo lagoon are directly influenced by the water flow from the sea, Hamilton canal, Dutch canal, Dandugam oya and Ja-Ela. On a spatial basis, the south east section of the lagoon revealed higher EC levels. This situation could have been due to factors such as nature of the terrain, geochemistry, climate and the anthropogenic activities. Overall it could be stated that each water source is unique, and that within each water source, as well, spatial variation exists. The results of the study did not reveal any significant variations in relation to the temperature of water in the area.
Impact of ‘Modern Development’ on Socio-cultural Life of Vedda Community: A Socio-anthropological Analysis

Premakumara De Silva
Department of Sociology

Veddas of Sri Lanka, an aboriginal group, have survived for several millennia through adapting and coping with external stresses imposed on them. They were inhabiting the island long before the arrival of Aryans and had spread all over the island but later confined themselves only to Vedi rata or Maha Vedi rata consisting of areas from Hunnasgiriya hills and lowlands up to the sea in the East.

Currently they are as a community facing stresses that threaten to modernize them which could easily result in their vanishing as a cultural group. While certain aspects of the Vedda culture, such as using the language, and the bow and arrow in hunting have come to near complete disuse, the assimilation of the Veddas with mainstream Sinhalese and Tamils has resulted in Veddas of Sri Lanka being confined to small scattered communities in the Eastern, Uva and North Central Provinces of the country. Veddas over the years under many stresses have reached their present state where there is a need to preserve their way of life, cultural aspects and their traditional homelands. Like Veddas, there are other cultural groups (e.g., Rodiyas, Gypsies, Burgher, Malay, Chatty, Bharatha and Kaffir), who have been struggling to preserve their ‘traditional lifestyles’ amidst the ‘modern development’ discourses and cultural encroachment of hegemonic Sinhala, Tamil and Muslim communities of the country as well as the process of globalization.

It is against this backdrop that my presentation will focus on the current status of the Vedda community, particularly their socio-cultural life. The study was based on qualitative interactive interviews, collecting life histories and field observation, supplemented by a questionnaire based survey covering 1327 Vedda households. Cultural aspects of the Veddas are analyzed with qualitative and quantitative analysis on the nature of use and disuse of cultural activities such as hunting and food gathering, religion, customs, traditional medicine, language skill and social organization. The findings on the socio-cultural aspects are a mixed bag that includes optimistic and pessimistic views on possible interventions. However, unless speedy holistic action is taken, there is always a chance for the Vedda as a community to become only an episode in history within a generation or two.

**Keywords:** culture, Vedda, development, modernity, cultural groups
Facing Problems Created by Modern Technology – The Buddhist View

Ven. Dr. Medawachchiye Dhammajothi

Pali and Buddhist Studies Unit

Unprecedented technological developments are taking place at an unimaginably accelerated speed. These developments cause the world to change so rapidly that most people, finding it difficult to adjust their lives to these changes, get highly bewildered and confused. In spite of such bewilderment and confusion, they become enslaved by these developments as these make life in many of its spheres more comfortable and easy. Globalization has become the closest ally of these developments. Through globalization, the influence of these developments, have been able to cast the net to catch all, even against their will. This really is the sum effect of technological developments and globalization, both of which are functioning in the modern world as necessary evils.

There is no escape from globalization and none can decry technological developments. Modern society is faced with this crucial challenge of handling both these in a manner that is beneficial to the individual as well as to society. It is in this regard that religion should play a very constructive and instructive role.

Buddhism built on a threefold training of morality mental culture and development of wisdom is well equipped to provide good guidance to come out safe from this critical situation. To draw a parable from the texts the Buddha says that even his teaching should be used with caution, not slavishly carrying it on the head nor dearly clinging to it like a foolish snake-hunter catching a snake by its tail. Even Dhamma should be used as a raft to solve one’s problem.

Sober and mature attitudes should be adopted when utilizing technological developments in this globalized world. Then one would not get enslaved by them. One would be able to master them and use them for good and the wellbeing of oneself and society at large.

This paper will examine selected Buddhist discourses specially from the Pali Sutta Pitaka, and try to point out how they can be used as guidance in utilizing the ever growing facilities provided by technological developments. The thrust of paper will be to demonstrate that the problems lie not with technological developments, but with their users who are either misusing them or getting enslaved by them.
The Impacts of Changing Patterns in Traditional Chena Cultivation in Sri Lanka: A Study with Reference to the Monaragala District

D.M. Karunadasa Dissanayake

Department of Geography

Introduction
The Sri Lankan economy has been constructed around ‘agriculture’ for a long period. Agriculture can be divided into two sections: Subsistence and Plantation (commercial) agriculture. The subsistence agricultural sector can again be divided into two sections as “Chena cultivation” and “Paddy cultivation”.

There is evidence to prove that the livelihood of the ancient people of Sri Lanka was formed by chena cultivation, which is mainly done in the Maha season. Chena cultivation is based on shifting from place to place and using primary methods of cultivation which do not use water supply methods and chemical fertilizer like in wet paddy cultivation.

In the past, chena farmers had cultivated various crops in the chena for food requirements of their families. After that chena farmers have cultivated several crops especially for the market, as well as to meet their family requirements. In the recent three decades chena farmers had tried to change the chena cultivation to become a profitable enterprise given the market oriented economy. To meet these objectives the farmers had given more attention to use of new technical methodology to increase the yield of the chena. As a result, present chena cultivation in Sri Lanka has shown vast differences compared to traditional chena cultivation.

Most of the farmers use machines to cut the forest. Tractors are used for land preparation. Imported seeds and chemical fertilizers are also used. After preparation of the land they cultivate only one or two crops such as Maize and Ground nuts as commercial crops. In addition paddy is also cultivated in the chena.

Objectives of the study
The main objective of this study is to examine recent trends of chena cultivation and the factors responsible for these trends.

The second objective is to examine the economic and social benefits related to these trends of chena cultivation.

The third objective is to analyse the adverse impacts of these trends.

Research methodology
To achieve the set of objectives, primary and secondary data were collected. Primary data was obtained through a questionnaire survey, field observations and focus group interviews in two villages in the Buttala D.S. Division in the Monaragala district. Secondary data were collected from different government agencies such as Buttala D.S. office, Agricultural extension office and the relevant Grama Niladhari offices in the Buttala D.S division.
Findings

The study identified several reasons for recent trends in Chena cultivation in Sri Lanka, their benefits and adverse impacts.

Reasons

i. Increased demand in the local market for chena products, especially for maize, ground nuts, paddy, and gingelly (sesame).

ii. Lack of family labour to carry out chena cultivation as a traditional system.

iii. There are many facilities to use machines for chena cultivation such as Chain saw, bush cutters, Tractors (4 wheel), Chemical spray machines, Combined harvesters etc.

iv. As a government policy a decision was taken to allow the Fertilizer subsidy for all cultivation and to buy the chena products at a high price in the market.

Benefits

i. The farmer gains a higher income from the one or two crops cultivated, rather than merely from paddy because there is a reasonably high price for these products from the government and also the private sector.

ii. Farmers do not shift from their chena plot annually to a new chena plot, because they try to develop the same land. That results in reduced slash new forest area for chena cultivation. Therefore it is an opportunity to protect the bio-diversity of the area.

Adverse effects

i. Reduces the natural soil fertility process because over 95% chena farmers cultivate the same chena plot every year without allowing for a fallow period.

ii. Pollution of water bodies and soil because over 95% chena farmers have used chemical fertilizers, herbicides, and insecticides.

iii. Badly affects the fauna because over 95% chena farmers have used chemicals in chena cultivation.
Recent Trends of Morbidity and Mortality in Sri Lanka

Professor Lakshman Dissanayake

Department of Demography

The major purpose of this paper is to elucidate the recent trends in morbidity and mortality in terms of its continuing time-dimension with the use of existing theory. For this, the paper used Omran’s epidemiologic transition theory (Omran, 1971; 1983) and subsequent additions by Olshansky and others (Olshansky and Ault, 1986; Olshansky et al., 1990) in order to portray the recent trends of morbidity and mortality in Sri Lanka. This is an exploratory analysis and is thus carried out in such a manner that it will attach a predictive power to such trends and consecutively provides a distinctive opportunity to recognize the nature of change occurring in Sri Lanka in relation to morbidity and morality. Therefore, this study offers a strong foundation for health and other development planners to plan ahead and commence appropriate health and development strategies to contain such changes in an effective manner. The analysis utilized diverse data sources accessible locally and internationally to position Sri Lanka’s morbidity and mortality trends in a global perspective.

It is fairly unequivocal that Sri Lanka is currently experiencing the benefits accrued in the course of its mortality transition by cruising through various stages of the epidemiologic transition. Sri Lankan population has improved its life expectations considerably over the years and is expected to prolong that ascent despite impulsive resurgence of infectious and parasitic diseases. Therefore, Sri Lanka will have the prospect of hoisting its life expectancy to a level that is observed in the developed world. Since females tend to live higher than males, the Sri Lankan elderly population will be feminised as a result of enhanced female survival chances.

Declining mortality and morbidity will be able to produce a healthier labour force which can improve its productivity. Since Sri Lanka has a relatively large labour force with a low level of dependency at present, improved health status of its labour force surely will have a significant impact on economic development in the country. It will create a unique opportunity for families to escape poverty and for faster economic growth, provided Sri Lanka adopts appropriate educational skill development strategies and creates more employment opportunities.

On the one hand, it is reasonable to claim that a healthy population is a prerequisite for economic growth. On the other hand, it appears that there is a high correlation between population ageing and medical spending. However, it is rather disability and poor health often associated with old age that is costly. As Sri Lanka has commenced to obtain the benefits of the ‘cardiovascular revolution’ and other medical technology advances, its elderly population will be disability free and in good health for a considerable time in their old ages. Therefore, it is quite reasonable to claim that the good health expected among the elderly population can save money and hence healthy-ageing needs to be regarded as an important component of Sri Lanka’s development agenda.
Life expectancy values for Sri Lanka were 68 and 74 years respectively for the years 1980 and 2008. Sri Lanka’s present situation is very similar to countries like United Kingdom, Italy and France in 1980. This means that Sri Lanka seems to be following the trend of the countries which were exposed to the ‘cardiovascular revolution’ in the 1970s but with a time lag. Like in the West, Sri Lanka can expect its life expectancy to continue to grow with a continuing postponement of deaths from degenerative diseases. Similarly, it can be anticipated that mortality rates at older ages will accelerate as well. Early signs of such phenomena can be seen by examining the life expectancy figures as well as adult mortality rate (or probability of dying between age 15 and 60). Life expectancy at age 60 from the 1980s suggests that there has been a significant increasing trend which reflects the postponement of deaths beyond ages 78 and 80 for males and females, respectively. Adult mortality rate had declined significantly between 1990 and 2007. This means that survival chances of the ages 15 to 60 have increased and the higher death rates have been postponed to higher ages of the life span. This shows that those who have died formerly due to fatal complications as chronic disease outcome tend to survive longer. Such a phenomenon can reflect two processes: morbidity expansion or morbidity compression. In other words, people will survive longer but the duration that they spend in a state of sickness and disability at the end of their life span will increase. This will occur if Sri Lanka does not adopt proper health strategies to prevent or postpone degenerative and man-made diseases. The findings of this study evidently signify that there is a high tendency for Sri Lanka to have a fourth stage of the demographic transition which combines both delayed degenerative diseases and resurgence of infectious and parasitic diseases. However, it is realistic to assert that this phase will partly cover the third stage of the epidemiologic transition because firstly, Sri Lanka has already started to use imported medical technology and other health measures which can prevent or postpone degenerative diseases at the adult ages; and secondly, Sri Lanka has become susceptible to world-wide spread of infectious and parasitic diseases.

**Keywords:** morbidity, epidemiology, mortality, degenerative diseases, communicable diseases, non-communicable diseases, medical technology
Motorised Mobility in Sri Lanka and the Effectiveness of the Conventional Tools in Addressing Sustainability Concerns

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Transportation and sustainability are two profoundly related subjects that are not often studied together. The interesting correlation between transport and environmental, social and economic sustainability remains segregated in the literature, and appears to be addressed in isolated compartments in practical policy making.

Economic sustainability, from a mobility perspective, calls for a transportation system that will live up to its expected role of being an efficient service provider to all sectors of the economy assisting their respective processes of value added growth. The benefits of income increase, as a result of this growth impetus, will ensure social sustainability if such is equitably trickled down to the masses. Moreover, social sustenance requires inclusivity of the masses, for which the availability and affordability of mobility solutions becomes necessary. Ensuring both the development effort and social inclusion therefore is necessary for socio-economic development sustenance, and expanded motorised transportation thus becomes an imperative associate of this process.

In the Sri Lankan context, transport provision by the State guaranteed social and economic sustainability during the post colonial period to the immediate post open economy in the late 1970’s, thereby ensuring the country’s environmental wellbeing. This same public transportation appears to have been incapable of sustaining its market share among transport modes amidst changing demand characteristics, both in terms of quality and quantity, driven by increasing per capita incomes and economic growth. The growing transportation needs of the society, since of late, have been met through increasingly letting the people source their own mobility solutions with the State sponsoring the infrastructure. This has resulted in the growth of private ownership of vehicles from a mere 200,000 in the 1980s to more than 2 million by 2011.

This method of responding to transportation needs to meet economic and social sustenance is giving rise to wide-spread negative externalities, by way of vehicular emissions, accidents and congestion, putting the third dimension of sustainable development, namely environmental sustainability, at risk. The conventional tool of attempting to mitigate this ill-effect has been through technological development, in terms of fuel standards, engineering advancements such as the introduction of catalytic converters, as well as through the imposition and enforcement of vehicular emission standards, aiming at enhanced efficiency of the usage of fossil fuels.

This triangular inter-relationship of the domains of sustainability in relation to transportation is subject to appraisal in this research paper. The methodology involves studying the historical trends of transport service provision and the role public transportation played in achieving socio-economic wellbeing, thus supporting development sustenance in the past. Changing development paradigms and socio-
economic perspectives are comparatively appraised in order to understand the evolving demand patterns and pressures, and also to project the resultant ambivalence between the need for growing transport supply to meet development imperatives and the negative impact such a trend is likely to have on sustainability parameters. The study focuses on identifying the conventional strategies adopted to address these sustainability concerns, and appraising in detail their adequacy and effectiveness, to examine whether a strategic re-orientation in transport policies is necessary to keep Sri Lanka from having to face a possible crisis in economic, social and environmental sustenance.

Keywords: sustainability, mobility, transportation, development, technology
Many students struggle to cope with the demands of English medium instruction as institutes of higher education are moving over to English medium instruction from mother tongue education in secondary education. As the Faculty of Arts, University of Colombo, too has been exploring the possibility of such a transition, the study aimed at bringing to light the recurring patterns in academic texts that students would encounter, in order to provide well targeted input data that would facilitate learning.

The study was carried out using a Corpus linguistics approach, which is gaining popularity with the technological advances in the field of computers. This approach investigates “actual patterns of language” in both spoken and written texts (Reppen and Simpson, 2002, p. 92) through the compilation of a corpus. A corpus is defined as “[a] large collection of authentic texts that have been gathered in electronic form according to a specific set of criteria” (p. 9). Furthermore, the guiding principles of a particular corpus are driven by the research question/s for which the corpus is compiled. Representativeness and balance, content and size are factors that need to be predetermined in the design and compilation of a corpus. Furthermore, the investigation of language through computers has greater advantages today as text data can be effortlessly analyzed through corpus analysis software.

The study aimed to compile a corpus of written data from five different disciplines in the Faculty of Arts, University of Colombo, comprising reference reading material prescribed by the departments in order to investigate the relevance of teaching the two thousand high frequency words posited by Michael West and the “Academic Word List (AWL) of 570 words put forward by Coxhead (2000). These two word lists are expected to cover 80% and 10% of academic texts respectively. However, Hyland and Tse, (2007) question the reality of one “core list” that can be recommended for every field of study.

The objective of this study was to investigate the above criticism and verify the relevance of the AWL for teaching purposes. It also aimed at bringing to light the Keywords and collocations that occur in the fields of Sociology, Economics, History and International Relations, Political Science and Demography.

For analyzing the data the corpus analysis software “The Compleat Lexical Tutor” (CLT) was utilized. Three different types of word lists were obtained from the corpus using the above programme. The features ‘VocabProfiler’, ‘Keyword Extractor v.1’ and ‘N-Gram extractor’ of the CLT were utilized for this purpose.

It was revealed that out of the 570 Academic words, 548 words occurred in the compiled corpus demonstrating the value of exposing the students to the AWL. Around 300 Keywords were identified from each corpus, while many interesting collocations were identified in the five different fields of study. As words in the AWL, Keywords and collocations occurred in the compiled corpus with noteworthy frequency, the researcher recommends that classroom teaching should focus on the above aspects of vocabulary.
An Application of Equivalent Uniform Depth (EUD) of Precipitation Method to Investigate Spatial Distribution Patterns of Rainfall

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An Investigation of spatial variations of rainfall distribution is very important to predict the physical characteristics of watershed (catchment) and some important correlations among them. Therefore, the aim of this study was to apply Equivalent Uniform Depth of Precipitation Method in order to examine the actual patterns of spatial distribution of rainfall among sub-catchments of selected watershed by using the Thiessen Polygon (Voronoi Diagram or Dirichlet Tessellation) technique.

The selected catchment (Kukule) consists of three sub-catchments. It is also one of the major tributaries of the Kalu Ganga in Sri Lanka. According to the literature reviewed, there are three main ways in which EUD can be calculated for a watershed; Arithmetic Mean Method, Isohyetal Method, and the Thiessen Polygon Method. Ten rainfall gauging stations were observed for this study; eight out of these ten stations were located inside the catchment and two were outside (near) the catchment.

According to the non-uniform distribution of observed gauging stations and also, in order to achieve accurate assessment of spatial distribution patterns of rainfall within the catchment, the Thiessen Polygon Tessellation technique was applied to calculate the EUD. In order to adjust the non uniform rainfall gauging stations’ distribution through the Thiessen Polygon Tessellation technique, a weighting factor was used for each gauging station. The weighting factor was based on the size of the area concerned, within the catchment that is closest to the gauging station being considered. Almost all those areas (ten polygons) were irregular polygons. The extents of all the irregular polygons were measured and weighted averages for all stations’ rainfall were used to calculate the EUD. The spatial distribution of average rainfall in all irregular polygons was assumed to be similar with rainfall values of relevant gauging stations. ArcGIS 9.1 software was used to delineate the Thiessen Polygons.

According to the results, weighted rainfall values of catchment were ranged from 253.99mm to 522.12mm. Finally the catchment was classified into five weighted rainfall intensity classes; ‘Least or Insignificant’, ‘Low’, ‘Moderate’, ‘High’, and ‘Very High’. The net EUD for the catchment was 3743.18mm. The analysis of the findings of the study revealed that the most effective EUD values were related to Wewagama and Koswatta sub-catchments and that the net EUD shows that the catchment belongs to the Wet Zone of Sri Lanka.

**Keywords**: Equivalent Uniform Depth (EUD), Thiessen Polygon Tessellation, rainfall, catchment (watershed)
'Freeing us from burdens that we should not want to be rid of':
Technology’s Gift to Humanity

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"Everywhere we remain free and chained to technology..... We must find a way of living in a free relationship with technology.

Martin Heidegger, “The Question Concerning Technology”

The human condition comprehends more than the conditions under which life has been given to man. Men are conditioned beings because everything they come in contact with turns immediately into a condition of their existence. The world in which the vita activa spends itself consists of things produced by human activities; but the things that owe their existence exclusively to men nevertheless constantly condition their human maker.

Hannah Arendt, The Human Condition

[It could be that we, who are earth-bound creatures and have begun to act as though we were dwellers of the universe, will forever be unable to understand, that is, to think and speak about the things which nevertheless we are able to do. In this case, it would be as though our brain, which constitutes the physical, material condition of our thoughts, were unable to follow what we do, so that from now on we would indeed need artificial machines to do our thinking and speaking. If it should turn out to be true that knowledge (in the modern sense of know-how) and thought have parted company for good, then we would indeed become the helpless slaves, not so much of our machines as of our know-how, thoughtless creatures at the mercy of every gadget which is technically possible, no matter how murderous it is.

Hannah Arendt, The Human Condition

As we frame our investigation into technology’s relationship to human society in the 21st century Sri Lanka under the theme ‘Technological Development and Sustainable Communities’ we seem to assume a specific relation between technology and community a relation that has come under close scrutiny in attempts to theorise the place of technology in human society under modernity. Such theorising focus on the ambivalence of relation the humans have come to perceive between themselves and technology, that technology holds both the promise for humanity’s advancement and a grave threat to it. The threat is aptly illustrated by the case of the nuclear bomb; the promise is manifested in the advances in science in general and medicine related areas in particular, benefitting human life both in the material world and the biological realm. One of the most recent contributions of technology to the advance of humanity is information technology whose political benefits to community the world witnessed in the social networking that facilitated the now legendary ‘Arab Spring’.

It is this ambivalence the humans have come to perceive in relation to technology that has drawn attention of theorists since the latter part of the 20th century whose responses invite us to cultivate an attitude towards technology that is one of being reflective of both the danger and promise so that we may not sacrifice the world for the advantages technology brings to individual humans. While the prevailing common sense understanding takes a
means and ends attitude towards technology perceived as tools or instruments that enable humans to achieve desired ends, what it seems to ignore is whether any given item of technology makes our lives necessarily better beyond the ends it helps us achieve.

This paper attempts to develop a conversation between the ideas of two leading theorists within the phenomenological tradition namely Martin Heidegger and Hannah Arendt who opened up the space of ambivalence that lies between the realms of technology and community.

It is Heidegger who in modern times most forcefully drew our attention to the idea that technology means more than simply a tool or a means to an end, that it is an attitude that takes control of our lives (“The Question Concerning Technology”). Heidegger saw technology’s essence “as a way of revealing the totality of being, is enframing which both endangers and saves being.” He posited the idea that in modernity we are living in a technological society where technology defines the epoch. Modern technology not only reorders the world, but also reorganizes our understanding of the reality of the world. While technology is an overpowering intervention in man’s authentic relation to being, it inhibits us from appreciating non-technological ways of apprehending the world and obscures the character of the all-encompassing technological enframing itself.

For Heidegger, technology determines how we view our world and this tears apart man’s authentic relation to being. Humans are not in control of technology (“The Question Concerning Technology”). Technology is the destiny of humans in our age. Technology’s approach to nature is to control it. For people to demand to “get in control” of technology simply reinforces the technological attitude. Within this attitude we are unaware that technological attitude is merely one approach of many we have come up with in understanding the world around us. Under modernity it is taken to be coterminous with sound or correct thinking which is manifested in taking scientific method as determining truth for human society. Heidegger concedes that we cannot retreat to a pre-technological society or culture. But it is possible to grasp the essence of technology. He hints at a new attitude to technology that will allow us to use technology while freeing us from domination by it.

Thus while it is Heidegger who invited us to reflect on how technology takes us into its grip, it is Arendt who takes up Heidegger’s cue and reflect on his ideas to raise political questions about technology and community. For Hannah Arendt questions concerning the nature of technology, are political questions because technology affects our collective life in the community (*The Human Condition*). They are not matters to be resolved either through science or by relating to technicalities involved, but only through political debate, in the exchange of diverse opinions among people who share a common world but yet may differ on their perspectives on the world. Arendt’s analysis of labour, work and action in *The Human Condition* invites us to look at technology from the perspective of worldliness whereas our technological attitude focuses on the services that technology renders to humans ignoring the impact of technology on the world and things. In modern times technology has transformed work in to labour tying work to life away from concerns with the world and also into a form of action through new technologies which produce “things that owe their existence exclusively to men...[which] constantly condition their human maker” and that release boundless and unpredictable forces into the world heightening uncertainly in the world.
With a view to examining the question of the good of the community in facing technological modernity, this conversation will be constructed partly through the voices of several contemporary interlocutors namely Albert Borgman, Langdon Winner and Roger Berkovitz who differently but relatedly represent the approaches of Heidegger and Arendt. In constructing such a conversation this paper aims at examining concepts such as ‘device paradigm’ (Borgman), mythinformation, optimistic technophilia, technological determinism vs. social circumstances (Winner) and ‘exchanging freedom for behaviour’ (Berkovitz).

References


Factoring Gender into the Discourse on Post Conflict Economic Development: A Conceptual Framework

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The post second world war era saw a vast output of neoclassical economic theories for developing conflict hit Europe and Japan. For instance, the linear stages growth theories were central in the Marshall Plan policy initiatives for revitalizing Europe’s economy after World War II. The neoclassical resurgence in the 1980’s heavily influenced the post cold war debates of “shock therapy” and “gradualism” as policy courses for economies in transition from Communist central planning to decentralized market mechanisms. The most recent literature on post conflict development comes from the works of Collier (2003) and Collier, Hoeffler and Soderbom (2008). The post conflict recovery recommendations of the above mentioned authors are predominantly neoclassical in nature. Known as Expeditionary Economics, is another body of literature which is largely catering to the United States led post conflict development attempts in Iraq and Afghanistan. The justification for Expeditionary Economics is also found in Japan’s economic success during the seven years of American occupation and from the experience of the Marshall Plan.

In this backdrop of ‘neoclassicalized’ post conflict development theory, major weaknesses of neoclassical theory apply to post conflict development outcomes. Feminist Economics discourse brings to light one such missing dimension in neoclassical theory: the neoclassical economic discourse is gender blind.

Hence, this work is centered on the major question of how to shape post conflict development mechanisms to address the needs of women and female headed households. It is significant for the following reasons. Firstly, female headship is a large-scale phenomenon in post-conflict settings, and such households are particularly vulnerable to poverty. Secondly, the conflict driven vulnerabilities of women demand particular protection and assistance that exceeds or is different from the needs of men, thus when both poverty and headship continues to be feminized assistance for livelihoods, child care, shelter and access to credit continues to be vital. Therefore, a gendered analysis is needed to asses post conflict economic development.

This paper is a presentation of a conceptual framework in assessing vulnerabilities, risks and current household outcomes of female headed households in the post conflict regions of Sri Lanka. The degree of vulnerability depends on the characteristics of the risks and the households’ ability to respond to risks. Hence, central to the framework is the notion of risk regarding income, assets and consumption.

As data the paper predominantly uses secondary data in terms of available literature mainly based on the feminist discourse and gender analytical methods. It also uses my own field experiences in the Eastern province of Sri Lanka working with vulnerable female headed households. In conclusion, this framework is an integrated risk, livelihood and gender analysis that will be tested by the author’s future field work and can be viewed as the theoretical underpinning towards a gender mainstreamed post conflict development approach.

Keywords: feminist economics, neoclassical economics, post conflict development, female headed households
Fertility Preference among Married Women in Sri Lanka: The Role of Modern Contraceptive Technology

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This study attempts to explore the role of modern contraceptive technology in determining the fertility preference of married women in Sri Lanka. For the past few decades the use of modern contraceptive technology has played a vital role in fertility transition in Sri Lanka. However, the effect of modern contraceptive technology on current fertility preference among married women is not adequately addressed in the fertility literature on Sri Lanka. As fertility behavior is shaped by current fertility preference, this would determine the size and growth of the future population. Therefore, addressing this research issue is very important in maintaining a sustainable fertility level among communities in Sri Lanka. In addition, the paper examines other factors, such as socioeconomic and demographic factors affecting the fertility decision.

The data for this study was obtained from the secondary data derived from the 2006/2007 Sri Lanka Demographic and Health Survey (DHS), conducted by the Department of Census and Statistics. The sample of 19,872 households, 14,692 ever-married women, aged 15-49 years, who slept in the household the previous night were chosen for the survey. A multi-stage stratified sampling method was used. In this survey, the women were interviewed about their nuptiality, fertility, fertility regulation and preferences, infant and child mortality, and health. The present analysis focuses mainly on the fertility preferences and use of contraceptives. Bi-variate and multi-variate (binary logistic regression) analyses were used. The dependent variable is whether they prefer a large family or a number of children above the replacement level considered the ‘Ideal number of children of married women’.

The findings revealed that modern contraceptive technology has played a significant role in deciding family size. It also found a significant difference between the fertility desires and fertility decisions that exist especially among estate sector women. Though, the higher fertility preference exists among communities, the availability of modern contraceptive technology has lowered the fertility decision among married women. Furthermore, other factors, such as education, economic status and community level characteristics have a significant impact on fertility preference among married women in Sri Lanka. Moreover, still, the Muslim community has a high fertility preference as well as higher fertility. These findings suggest that modern contraceptive technology can be used to reduce fertility differences among communities.

Keywords: fertility preference, contraceptive technology, ideal number of children
A Study of the Condition of Water Pollution in the Bolgoda River

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Water pollution in urban areas of Sri Lanka is increasing due to contaminants, especially human waste. The major water pollutants are organic matter, inorganic matter, infectious agents, toxic organics, sediments and heat. Developing nations have poorly developed sewage treatment facilities, which result in environmental pollution. This situation is relevant to Sri Lanka. Untreated or improperly treated sewage, animal waste and trade effluent dumping in the Bolgoda River causes serious environmental issues today. With this brief account, the present study aims to assess the water pollution condition of the Bolgoda River. The Bolgoda Lake is a brackish water body located in the western province of Sri Lanka. The lake has two major basins called North Bolgoda lake and South Bolgoda Lake. These two lakes are connected by a narrow stream called the Bolgoda River.

The objectives of the present study are twofold: The first objective is to test the water quality of the Bolgoda river; the second objective is to identify the impact of human activities on the pollution of river water. Primary data has been used to pursue both objectives. Five locations which are near the waste dumping sites were selected for water testing. Three parameters were taken into account in the water testing of the river: temperature, PH values and electrical conductivity values. A community based questionnaire survey was used to investigate the second objective. The G.S. division of Kadaveediya North has been selected for the questionnaire survey and 15% of the population formed the group of respondents. The preference ranking method was used for the analysis of sample data.

The results of the present study are as follows. It is clear that the temperature of the river water is higher than the normal atmospheric temperature. The PH values of the five locations range from 6.45 to 7.64. According to the World Health Organization, PH values less than 6.8 are considered polluted water. According to this, the two locations selected can be considered to have highly polluted water. Electric conductivity values for the selected locations range from 1221 to 1831 micro Siemens. This makes it evident that that, all the five locations have higher MS values when compared with the standard value of pure water (1000 MS). Domestic sewage could be considered the most significant pollutant matter which is dumped into the river, which is followed by waste water and trade effluent respectively.

Keywords: water pollution, sewage, human influence, electrical conductivity, pure water

References
The Politics of Urban Space: A Sociological Study of Pavement Hawkers

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This paper focuses on the politics of urban space in the context of pavement hawkers of Colombo City and its suburbs. The traditional role of vending in the subsistence economy of rural areas or towns and cities has undergone structural change. Rapid urbanization, as an off-shoot of industrial, technological and commercial activity, has changed the urban scene drastically where the conflict for urban space has become a long drawn struggle of urban poor who may constitute even a half of the population of the city. As observed, in high growth profile cities, like Mumbai, Delhi, Calcutta and Colombo, vending (e.g. the sale of lottery tickets, newspapers, cloths, toys, tools, sweets, fruits and vegetables, etc.), no more remain an unnoticed activity but a major source of survival and also conflict between the city managers and city planners on the one hand, and the large number of vendors and hawkers, on the other. This conflict for urban space has to be understood through its relationship with the political economy of city. Thus, contemporary pavement hawking in high growth profile cities, is no more confined to a survival struggle of the ‘poor people’ but involves multi-actors, including local politicians, musclemen, and bureaucrats. Therefore, their struggle for a share in the urban space has to be understood in its proper perspective. The paper presents an overview of related theories in the spatial context of evolution of the city. The ecological theory is reconsidered for its over-emphasis on the role of spatial forms in the city on human relationships. However, the original Marxian perspective that the city has no other role to play than being instrumental in capital formation is also scrutinized. As observed by a few key thinkers on the urban question (like Neo-Weberians and Neo-Marxists), the political power under localized political compulsions may extend its role to tje social distribution of public goods and services which may not necessarily be within the production relationships as conceived in the class struggle paradigm. The struggle of pavement hawkers of Colombo City and its suburbs for the urban space and the role of state and bureaucracy in manipulating the needs of various interests groups, for their local political or monetary gains, amply prove this.
Reasons for Rejecting of Contraceptive Technologies: Case Study of Educated Women in Sri Lanka

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In many countries, contraceptive use is one of the most important proximate determinants which affect fertility through socio-economic factors. Increasing mean age at marriage and declining marital fertility were two main causes that contributed to fertility transition in Sri Lanka. From the beginning of the 1970s’, modern contraceptive technologies have made a significant contribution to the fertility decline in Sri Lanka. During 1995-2000, Sri Lanka has reported a Total Fertility Rate (TFR) of 1.9, indicating that Sri Lanka has reached below replacement level fertility. However, the latest Sri Lanka Demographic and Health Survey (SLDHS) shows that there is an upturn in TFR in Sri Lanka reporting a TFR of 2.3. The effectiveness of a contraceptive method mainly depends on quality of practice. Modern contraceptive technologies are more effective than traditional methods in preventing pregnancy. Although ever-married and currently married educated women in Sri Lanka have a good knowledge of modern contraceptive methods, the data suggests they are less likely to use them when compared to less educated women. Instead, they use traditional contraceptive methods. Therefore, it is important to explore the factors influencing the rejection of modern contraceptive methods among educated women in Sri Lanka.

The main objective of this study is to examine the reasons for educated women in Sri Lanka rejecting or showing less interest in modern contraceptive technologies.

The study mainly uses qualitative data gathered through in-depth interviews. In addition, quantitative data from the recent Sri Lanka Demographic and Health Survey (2006/7) was also used to explore the patterns and differences of contraceptive use among women in Sri Lanka.

The qualitative research findings revealed that the key factors which contribute to the rejection of contraceptive technologies are fear of side effects, lack of time for using modern contraceptive methods, lesser frequency of sexual intercourse and misbeliefs regarding modern contraceptive methods. Since educated working women openly discuss their experiences and beliefs with other working colleagues, it is more likely that educated women spread misbeliefs on modern contraceptive methods, which will further decrease the level of use of modern methods. Therefore, the study has pointed out several policy implications such as introducing institutionalized awareness programmes on contraceptive technologies (in private and government sector) and strengthening the family planning counseling programmes which target educated women.

Keywords: fertility, contraceptive technologies, educated women, Total Fertility Rate
Impact of Population, Affluence and Technology on Environment

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Human impact on environment depends on a set of factors that are related with human activities. Millions of years ago human impact on environment and natural resources was very limited within the socio economic conditions of that time. Rapid population growth, expansion of economic activities and advancement of human know-how have increased the complexity of the human environment relationship. \( I = PAT \) is the lettering of a simple conceptual expression that is put forward to describe the impact of human activities on the environment, where Human Impact on the environment (I) equals the product of Population (P), Affluence (A) and Technology(T). This formula was invented by Ehrlich and Holdren (1971) and developed by Commoner (1972). Ehrlich and Holdren identified population size and growth as the most critical \( I=PAT \) factor, whereas Commoner argued that post-World War II production technologies were the dominant reason for environmental degradation in the world. Increase of population and affluence intensifies consumption of resources but sometimes are difficult to measure. The impact of technology is complex since it can work both ways.

This study seeks to explore the current relationship between population, affluence, technology on the one side and environment on the other side, in a global perspective. In order to ensure the reliability and compatibility, all the data has been extracted from the development indicators published by the World Bank, 2011. World Bank has divided 214 countries (including territories) in the world into five groups according to Gross National Income (GNI) per capita: high income OECD (Organisation for Economic Co-operation and Development) countries, high income non-OECD countries, upper middle, lower middle and low income countries. The population component was measured by population growth rate. Affluence was mainly measured by GNI per capita. Technology was measured using several variables. Environmental impact was measured by indicators representing utilization of resources and pollution.

The top 20 countries with highest GNI per capita are responsible for the highest share in utilization of resources such as energy and vehicles. OECD countries spend more on research and development and produce more patent applications compared to other countries. However, several upper middle income countries export 25% or more high technology products as a percentage of manufacturing exports, exceeding the share of OECD countries (15 -25% on average). Mainly upper middle and lower middle income countries are responsible for using the highest amount of chemical fertilizers (10Kg/hectare or more) in agriculture. The recent trends (1998 -2008) in the growth of GNI per capita and the increase of carbon dioxide (Co2) emissions per capita show that higher growth of income results in more Co2 emissions in high income non-OECD countries, upper middle income countries and lower middle income countries \((r = 0.9 \text{ for each group of countries})\). In contrast, there is a minus (-0.7) correlation between income and Co2 emissions for OECD countries during the past 10 years. In low income countries where per capita income grows slowly, Co2 emission remains almost stable at a low level.
Some of the non-OECD countries and low income countries are mainly responsible for the highest (2.5% or more) population growth of the world. Population growth of OECD countries remains below 1% while some of the OECD countries maintain minus growth of population.

Thus, growing economies are more responsible for the current global environmental degradation. With the efficient use of resources with advanced technology, impact of affluent economies on environment is relatively low despite exploiting more global natural resources for the past two centuries. Impact of stagnant economies on the environment still remains low.
In the recent past rapid development has led to an increased demand for river sand as a construction material. In-stream sand mining is a common practice because the mining locations are usually near the “markets” or along the transportation route, hence reducing the transportation costs. This has resulted in a mushrooming of river sand mining activities which have given rise to various problems that require urgent action by the authorities. These include river bank erosion, river bed degradation, river buffer zone encroachment and deterioration of river water quality and groundwater availability. Over-mining of rivers in Sri Lanka causes many problems like salination of public drinking water supply schemes due to the intrusion of sea water into the river, collapse of river bank, erosion of riverbank land areas and many more. It is difficult to totally ban sand mining practices in rivers, because many people living near the river are totally dependent on this job, and also there should be an alternative for the construction sector.

The present research study covered three rivers i.e. Walawe Ganga, Nilwala Ganga and Deduruoya in the western and southern parts of Sri Lanka that have different levels of river sand mining activities and problems. The objective of the present study was to identify the impact of river sand mining through a hydrological assessment. Nilwala river in the southern part of Sri Lanka has a long history of sand mining activity along the upper reach. Walawe river recently has been a major source of sand for construction with the development of the southern region of Sri Lanka. Presently due to a legal order fewer activities of sand mining are on-going in Deduru oya in the western part of Sri Lanka.

Field research studies were conducted at selected sites of the three rivers to assess the capacity for river sand removal and its impact on the environment. Data collection on bed material was made to characterize the physical characteristics of sediment responsible for sediment transport that determines the river’s response in terms of erosion and deposition.

The study revealed that in recent decades the Deduru Oya River has been deeply damaged and degraded by unsustainable mechanized river sand mining. Water resources of the area are highly affected by over extraction of river sand that has lead to declining ground water levels. Due to uncontrolled and illogical extraction of sand the depth to groundwater has deepened to 12-15 meters and goes down to 30 meters in certain places. Over-mining in the Nilwala river causes many problems like salinization of public drinking water supply due to the intrusion of sea water into the river, collapse of river bank and loss of river land. River sand mining and inland sand mining along the Walawe river during the past two decades has deepened the riverbed by an average three to four meters, while there are some points where it has dropped by more than six meters.

Sand is required for development of the country, but at the same time the threats posed due to sand mining cannot be ignored. Uncontrolled illicit river sand mining creates a level of damage to rivers that are ecologically irreversible even in the long run; an urgent and sustainable solution is now needed for the affected rivers and communities in Sri Lanka. Hence decisive steps have to be taken and alternate solutions found for sand mining, without disturbing the environment.
Investment in Human Capital Portfolio in Sri Lanka: the Case of University Graduates in Sri Lanka

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One of the objectives of a rational individual is to minimize the risk and uncertainty faced in the labour market. High unemployment rates, long duration of the unemployment and high variation of wages among the graduates in Sri Lanka indicate high risks in the labour market. Responding to this current situation state universities in Sri Lanka are in the process of upgrading the quality and labour market relevance of their degree programs, shifting to the English medium and introducing internship as popular examples to minimize the risk faced by undergraduates. In this context, it is observed that undergraduates are also using strategies to minimize the labour market risk they have to face. For example, skill diversification in terms of investing in more than one form of human capital has now become a popular strategy among the majority of undergraduates (especially in faculties of Arts, Management and Science). When undergraduates engage in other activities such as following vocational training courses they cannot allocate their time fully to university education. Therefore, it negatively affects university education. The main objective of this research is to identify and analyse the impact of skill diversification on university graduates and university education. Specific objectives are as follows:

- Identify whether skill diversification is an effective strategy in terms of Employability, Job satisfaction and Earning of graduates.
- Identify the impact of skill diversification by undergraduates on university education and suggest relevant policies.

The rational individual takes a decision on human capital investment based on cost and present value of lifetime income. (Backer, 1964). As conventional models of human capital assume perfect information and certainty, the above phenomenon cannot be explained using conventional models. According to the signaling model of Spence (1973) education is a good signal of ability; therefore individuals acquire different certificates to increase their employability. On the other hand as there is a credential inflation defined as the devaluation of educational or academic credentials over time and a corresponding decrease in the expected advantage given to a degree holder in the job market (Collins, 1981), as undergraduates move to other courses to increase their employability. Due to educational inflation Milner (1972) shows that required educational qualifications for a particular job increase. Educational inflation means that there is less probability of employment, only with a degree certificate. Freeman (1976) suggested that students invest too much in education creating an over education problem which is a waste of skills and harms people with lower education levels.
An Evaluation of the Threats of a Dusty Environment on the
Sustainability of Human Health: A Study of Sammanthurai Divisional
Secretariat Division

Fareena Ruzaik

Department of Geography

Sammanthurai Divisional Secretariat Division (DSD) belongs to the Ampara district and the dry zone low country agro ecological region. It covers a land area of approximately 123.01 km$^2$ and is located between 7.36215$^\circ$N 81.8034$^\circ$E, including 53 Grama Niladhri Divisions (GND). Its annual rainfall is 1,100 mm, received during the months of October to January due to the inter-monsoon and North-East monsoon. The annual average temperature is 25°C-27.5°C. The population of Sammanthurai consists of 83,524 people.

Air pollution is an obvious environmental health threat which contributes to a number of illnesses, and has an adverse impact on peoples’ respiratory systems. Accordingly, the spectrum of human health has a close relationship with dust exposure. It has been identified that a majority of those who are sick have different types of respiratory diseases which are mainly caused by their dusty environment. The dusty air with bad odour has become a major threat to the daily lives of inhabitants of the area. The post-tsunami and post war development activities and subsequent resettlement programs have contributed to air pollution. In addition, solid waste generation, contamination of water and mosquito breeding, have also caused much damage to peoples’ health.

Considering the above, this study was designed with the prime objective of identifying the human health issues caused by the dusty environment and to provide recommendations to mitigate such issues. The data was collected through household questionnaires survey method, using a random sampling technique. In addition, observations, formal interviews and discussions were held with individuals and officials of the area. Secondary data was also used for the study.

The results revealed that 65% of people who are sick have been affected by respiratory diseases due to dusty air and the remaining of 35% are affected by vectors and other forms of environmental contamination. Accordingly, the dusty environment creates illness such as wheezing (10.5%), asthma (9.5%), breathing difficulties (8.5%), cough (8.4%), dizziness (8.4%), nausea (5.2%), headache (7.4%), hypertension (6.3%), skin diseases (6.3%) and sleeping disorders (5.2%).

It is identified that the main causes for a dusty environment are vehicle congestion, frequent transportation using heavy vehicles, population density, animal farming, dispersion of cow dung, quarry and bricks industries, open disposal of solid waste, saw mills, rice mills and utilization of machinery for agricultural activities. These human activities are not at an acceptable standard from an environmental point of view. Physical features, such as sandy and silt land surfaces and dry climatic conditions further contribute to the formation of a dusty atmosphere. Such a scenario has created numerous non-communicable diseases as well.
Considering the above, it is recommended that all economic and infrastructure development activities be implemented in an environmentally sound manner. The general public, industrialists and policy makers should be made aware of and educated on following cleaner production concepts/and nature friendly practices. In addition, responsible authorities should implement strict compliance of rules, regulations, and existing environment related laws in this regard. This will result in mitigating emissions of the most harmful pollutants, such as particle pollution (acids, organic chemicals, metals, and soil or dust particles) which affect the respiratory system of a human being.

**Keywords:** health issues, diseases, dusty, contamination, industrialist, sustainability
Effective Factors towards First Language Acquisition in Hearing Impaired, Cochlear Implanted Children

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Introduction
The main focus of this study is to determine the efficacy of first language acquisition among hearing impaired (HI) children with cochlear implants (CI) and the basic contributory factors which have been premised as mandatory. With the advancement of new technology in the field of audiology, Cochlear Implants have become very popular in the world, although it is yet to be popular in Sri Lanka. Nevertheless, there are about 250-300 candidates who have undergone this CI surgery from 2005 onwards in Sri Lanka. This is a device which is very helpful to hearing impaired individuals with severe to profound hearing loss while conventional hearing aids, invented by Alessandro Volta in 1800, were supportive only up to some extent.

Objectives
The main objective of this study is to enable these hearing impaired, CI children in Sri Lanka to attend mainstream education with other normal hearing children and thereby facilitate them to live as independent individuals in society. Accordingly, it is expected to determine the importance of age at implantation, parental support and rehabilitation therapy as the most effective factors which would enhance the efficacy of CI, with regard to first language acquisition.

Significance
When we consider parental support, preoperative involvement of them emphasizes identifying the impairment as soon as possible which will lead to early intervention. Post operatively, these parents should once again incorporate with the language development process of their CI children, by creating a suitable environment for them to acquire language and by directing them for speech therapy on a regular basis.

Methodology
A qualitative, observational study was carried out in Sri Lanka, among hearing impaired children who underwent cochlear implants. Data was collected basically through direct observation and focus group discussions with E.N.T. surgeons, audiologists, speech therapists and parents.

Key Findings
As per findings it was quite evident that all the hearing impaired, CI candidates whose parents were very much alert about an early cochlear implant, demonstrated a rapid development in their speech in comparison to the other CI children who received a CI later in their life.

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Contribution of Citizen Journalism as a Tool for Development Communication in Sri Lanka

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The Media and Communication industry has undergone significant changes in the last few decades due to rapid developments in communication technology. The media landscape has been divided into two main categories as traditional media and new media in the current context. New Media is the interactive forms of communication that use internet, blogs, social media, text messages and virtual worlds. Citizen Journalism is one of the most significant characteristics of New Media which brought a paradigm shift by empowering the ordinary citizen to be an active contributor in the journalism process. Shayne Bowman and Chris Willis (2010) describe Citizen Journalism as the act of a citizen, or group of citizens, playing an active role in the process of collecting, reporting, analyzing and disseminating news and information. Citizen Journalism promotes and gives prominence to the information and news which are left out by the mainstream media due to political and ideological agendas. The role of Citizen Journalism is to build more interconnected communities through citizens empowering each other with accurate news and information. Citizen Journalism provides an independent voice and a space for expression to people on political, economic and social issues of their society. Media consumers had a very limited opportunity to convey feedback, share their views and comments in traditional media due to the inherited characteristics of newspaper, television and Radio. Websites, blogs and social media have not only given the opportunity to its users to comment and share their thoughts, but also users are given the opportunity to generate their content as journalists. New Media tools have become familiar to Sri Lankan users and there is an increasing use of Citizen Journalism platforms in the country. This paper discusses the contribution of Citizen Journalism as a tool for development communication in Sri Lanka. In the contemporary context media is considered as the fourth state which is not merely an information provider, but a crucial phenomenon which can be used for the development of the human being. Development Communication is identified as one of the main functions of media in the current context. As post war Sri Lanka is looking forward to development in social, economic and cultural aspects, the study focuses on how Citizen Journalism has contributed in addressing development issues. As blogging is a leading Citizen Journalism platform in the current media age, five leading blog sites are selected for analysis. Selection of blogs is based on the internet ranking. A content analysis of selected blog sites is conducted in this study. The representation of development issues in the selected blog sites will be analyzed in the research. A questionnaire is distributed among the readers of the selected blog sites to identify the impact of the development issues reported in the blogs.

Keywords: development communication, new media, citizen journalism, communication technology, blogging
Globalization, International Migration and Transnational Communication

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There is growing attention to transnational migration with the increasing involvement of both men and women in overseas migration. It is not a new phenomenon; in the past, migrants have maintained contacts with their homelands. What is new about transnational migration is the ease of transportation and communication, remittance flows, increasing dependence on remittances by sending countries, and the interference of governments in managing migration, the results of globalization. Globalization is a powerful driving force that moves capital, goods, technologies, and people across borders. With its tremendously increased speed of the circulation of people, goods, and technologies globalization has not only greatly facilitated international migration but has also enabled migrants to maintain close contacts with their places of origin. Consequently, the traditional notion of geographic and the social space is changing. The new transnational social spaces illustrate the contemporary relationship between the social and the spatial, which has emerged with new communication and transportation technologies, alongside the massive transnational movement of people.

Transnational families in which one or more members are out of the country for several years are increasingly common in the world today. These are the families whose core members are located in at least two nation-states and members in these families belong to two households, two cultures and two economies simultaneously. These take many forms and are marked by changing heads of household including grandmothers and youth who take charge of children while the parent(s) are away. Transnational communication which is known as the flow of ideas, information, goods, money, and emotions between family members in different countries is the most powerful technology use by the transnational migrants to maintain intimacy across borders.

Sri Lanka is seen as a country with increasing numbers of women who are employed as domestic workers overseas over the last three decades. Consequently, a greater number of transnational families have emerged with female members being away from their families for several years. These migrant women bring economic benefits not only to their families but also to the Sri Lankan economy. However, they have to leave their children in the care of their spouses or other family members to work for other families overseas and care for more than one family simultaneously. However, migrant mothers attempt to maintain the responsibility of nurturing their children while abroad, and maintain intimacy across borders indicating that many migrant mothers remain responsible for ensuring both the economic and emotional security of their children. Sending remittances and gifts, making telephone calls and writing letters are some of the alternative ways available to these migrant women. This paper attempts to address Sri Lankan female migration from a transnational perspective and to examine how migrant women make use of transnational communication to maintain contacts with their families from a distance. The paper is based on a study done in 2008 which collected both quantitative and qualitative data on migrant households in the districts of Colombo and Kurunegala. Although Sri Lankan migrant women use transnational communication to maintain intimacy across borders, the study concludes that it is not the only mechanism they can use to repress their feelings of separation and to lessen the social costs of migration.
Background

There is an emerging research interest worldwide about the nexus between the print media and the technological advancement in modern communications. The relevant corollary in this context is the fate of the print news media itself. A very pertinent question is how hard technology, namely the advancement in hardware, copes with the exponential mutations in web-based communications. Research carried out globally project to the possibility that the newspaper industry, famously connoted as “that sells letters to readers and sells readers to advertise”, is faced with “inevitable extinction” in the “near future”.

Studies carried out across the globe lead to suggest an eventual demise of the print media due to the fact that people as a percentage of total population are hooked on to the worldwide web for almost every bit of information they seek, be it current or historical, basic or in-depth. Research estimates predict that the last newspaper prints in the USA would occur by 2040, whereas, internet users have been growing exponentially, and currently stand at 65% of the USA population. The picture in North America is even more decisive notching a whopping 78.6% of the population using internet access while Europe is having about 61.3% population hooked on to it. In the meantime, the late starters are also doing a fast catching up job. For instance, in South America it reads at 43.3%, Central America 32.6%, the Caribbean 28.7%, and Asia at 26.2%.

The rise in the internet penetration in many countries is accompanied by a corresponding decline in the print media share. Not only in developed countries has this trend been in evidence, but also in developing countries. With the rapid enhancements in mobile telecommunication technology and drastic gains in costs of telecommunication infrastructure development, the worldwide web is becoming accessible to rural and far reaching places; more and more people opt for web-based news through mobile, notebooks and tablets. While this is the most visible trend, newspapers too have moved into new technology – based communication spheres for greater advantages, production economies and most notably for a global reach with a virtual information feed.

Over the past few years, the number of Sri Lanka’s internet subscribers or those who have access to the web has increased significantly, though the local internet penetration has not been in line with that of the world. The statistics published by the Telecommunications Regulatory Commission of Sri Lanka (TRC) estimates local internet user share at a lowly 4%. While it is true that Sri Lankan newspaper houses run their internet on line versions, they are of a limited use. Often, the internet edition is a below par effort, which often
engages junior journalist staff. Thus, the web editions of Sri Lanka’s newspapers remain sketchy and also in contrast to the common global trend are not updated regularly.

**Research Question**

Is the Sri Lankan print media industry faced with an inevitable fate of being replaced by the internet based news media? What evidence is available to determine the time line of such a shift? What evidence is possible to be gathered to determine the threshold point of internet penetration that will decide the fate of the local print media industry?

**Research Hypothesis**

With the expansion of broadband penetration, development in Information and Communication Technology (ICT) and resulting increase in internet access, the public will reduce their reading of newspapers. As a result, the reliance on newspapers will be reduced and at one point in the future the newspaper industry in Sri Lanka may collapse.

**Rationale**

There has not been adequate research on the technological impact on the local print media industry. Given that the local print media plays a very decisive role in the Sri Lankan political economy and hence the development path and the impact of local news bulletins on social life remains a very crucial one, a sound understanding of the emerging trends in this aspect is of immense use for policy makers and development strategists.

**Methodology**

An opinion survey of internet users was carried out to see whether they have reduced their dependence on printed newspapers after they gain access to the internet. The survey methodology includes accessing a sizeable cross-section of internet users to respond to a web-based survey by responding to an opinion-based questionnaire covering three strata of respondents such as government employees, private sector employees and university students as the main focal groups. Current survey data were analyzed to extract the emerging trends and comparative assessments of selected countries with development characteristics similar to Sri Lanka. The data was analyzed using the SPSS data package as the main analytical tool.

**Findings of the Opinion Survey**

Television is the most attractive mass media for news for 60% of the people who were surveyed where less than 20% said they get news from the radio while 30% use newspapers. However, internet has become the most attractive mass media for news especially among the younger generation, below thirty years of age. The potential threat of the internet on newspaper is quite visible and over 40% said that they have reduced newspaper reading after they get internet access. Most of the internet users (over 60%) use office or university internet connections and a few use private internet connections and less than 10% use internet cafes.

The survey reveals that there is no decline in newspaper circulation and there is no real threat from the internet to newspapers, the newspaper circulation has increased over the past ten years. Also there is no decline in newspaper advertising, where as it has increased in most cases while there is no significant increase in online advertising.
References:


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Sri Lanka, being a tropical country, is characterized by rainfall which has many faces; heavy, torrential intensity during a short time, striking seasonality and great inter-annual variability. Before 1960s Sri Lanka had been divided into two main climatic zones based on the annual rainfall as Wet Zone (WZ) and Dry Zone (DZ). By mid 1960s it was understood that this demarcation itself does not provide a precise classification and another zone was introduced as an Intermediate Zone (IZ) which reflects a combination of characteristics of both the Dry zone and the Wet zone (Punyawardhana, 2000). The annual average rainfall of these regions, WZ, IZ and DZ varies as >2500mm, 1750-2500mm, <1750mm respectively.

This work attempts to capture the temporal and seasonal variability of rainfall in the IZ where cultivation of a variety of economic crops, such as paddy, tea, coconut and spices are taking place. An inter-comparison between the two periods of interest is also carried out alongside studying the seasonal variations. Further this work aims to identify rainfall anomaly events focusing on inter-annual variability.

The fundamental rainfall seasons, Northeast Monsoon (NEM; May to September), Southwest Monsoon (SWM; December to February), First Inter-monsoon (FIM; March to April) and Second Inter-monsoon (SIM; October to November) were considered to identify the seasonal variability of rainfall in the IZ based on monthly mean rainfall. The seasonal variability of main monsoons (NEM and SWM) and inter-monsoons was compared separately for the two periods of interest, 1941-1970 and 1971-2000. Further the inter-annual variability of rainfall was also considered by focusing on rainfall anomalies in the two periods. In all cases monthly average rainfall figures for the periods considered were used and these were taken by averaging values across nine stations in the IZ.

When considering the seasonal variability of FIM and SIM, it clearly shows that the rainfall is less in both seasons for the period of 1971 to 2000 as compared to the period of 1941-1970. But the amount of rainfall in both periods is higher during the SIM. The SWM and the NEM seasons also show the same characteristic with regard to variability with an exception in the SWM, where in May the average rainfall for the period of 1971-2000 exceeds that of 1941-1970. Further the SWM shows a decreasing trend followed by an increasing trend within the season while NEM is only associated with a decreasing trend. The anomalies obtained for the period of 1941-2000 further confirm the overall deficit of rainfall within the period 1971-2000. From 1971-2000 it was found that only 9 events (years) were associated with positive anomalies out of 30 events (years) but 21 out of 30 events were so for the period 1941-1970.
It can be concluded that the seasonal and temporal variability of the IZ are playing a significant role in the rainfall climatology of Sri Lanka and also the deficit of rainfall found in the second half (1971-2000) further provides a clue that the island would also to be vulnerable to climate variability and/or to so called climate change which can be further confirmed using a tool like climate modeling.

**Keywords**: variability, seasonality, NEM, SWM, inter-monsoon
Socio-demographic determinants of subfertility in Sri Lanka

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Though many couples expect children after marriage, a significant proportion of them (approximately 8% -10%) are worried over their inability to have children even after several years of married life. The incidence of subfertility in a population has important demographic and health implications as it directly affects the country’s overall fertility, and the psychological wellbeing of these couples. Previous research has focused on the medical aspects of infertility but has rarely examined the socio-demographic determinants. Therefore, this study examines the socio-demographic determinants of subfertility in Sri Lanka.

The data for this study was obtained from a primary survey which was conducted in three subfertility clinics namely, Family Health Bureau, De Zoysa Maternity Hospital and Vindana Reproductive Health Center. The sample consisted of 150 subfertile couples who approach clinics for treatment and a systematic sampling method was used to select respondents. An interviewer administered questionnaire was used to collect data.

The findings revealed that the prevalence of primary subfertility among couples is higher than the prevalence of secondary subfertility. Both male and female factors are associated with the subfertility. It was found that demographic factors such as the age of the woman, age at marriage, sexual intercourse within the fertile period and irregular menstruation have a significant influence on subfertility. In addition, health related factors such as reproductive system related problems, usage of long term drugs, body mass index, genetic factors and mental illnesses have affected fertility. Furthermore, socio economic factors such as education, occupation, daily working hours, location of work place, income and expenditure status have shown up as significant determinants of subfertility in Sri Lanka. These findings suggest the importance of technological advances to provide better solutions to the subfertility issues in order to minimize the prevalence of subfertility in Sri Lanka.

Keywords: subfertility, socio-demographic determinants, infertility
FACULTY OF EDUCATION
Message from the Dean

It gives me great pleasure to issue this message to the proceedings of the annual academic sessions 2012 of the University of Colombo.

This year’s theme of the academic sessions - “Converging Technologies and Sustainable Communities” is very significant to all those involved in teaching. Technology enriches teaching and learning by delivering new challenges to which we must aspire. Sharing experiences, exchanging knowledge and passing on new ways of teaching through technology are key elements in any form of education in the modern world.

In this context, I am very happy to have Professor Ji-Hi Bae of the Department of Early Childhood Education of the Sungshin Women’s University, Republic of Korea as the Keynote speaker at the Academic Sessions of the Faculty of Education. Her presentation on “Trends, Practices, and Technology Issues in Early Childhood Education in Korea” is very relevant to our main theme.

While expressing my gratitude to Professor Bae for accepting our invitation to deliver the key note address, I congratulate the other presenters and thank them for sharing their new knowledge with us.

I thank the Vice-Chancellor and the organizers of the University of Colombo Annual Research Symposium as well as the Faculty level Organizers for the efforts taken to make this event a success.

I wish the Academic Sessions 2012 all the best!

Professor Marie Perera
Dean, Faculty of Education
Faculty of Education

Keynote Address: Trends, Practices, and Technology Issues in Early Childhood Education in Korea

Abstracts

1. Students’ Patterns of Library Use: Cognitive Differences in Information Searching
2. Educational and Occupational Mobility of Plantation Youths in Sri Lanka
3. An Analysis of the Perceptions of Teachers on Science Teaching
4. How to make Decisions with Programme of School Improvement System in Sri Lanka: Case Studies from Colombo District schools
5. Problems Encountered by Teachers in Implementation of the Basic Features of Competency Based Education (CBE) in the Classroom
6. Academic Service Learning for Sensitizing BEd Undergraduates on the Future Professional Role: A Design Based Research Initiative
7. A Psychological Study on Burnout among Tamil Medium Secondary School Teachers
Keynote Address

Trends, Practices, and Technology Issues in Early Childhood Education in Korea

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Education for young children has always been valued in Korea. Korean people believe that children should be educated and cherished from the time of conception. Prenatal education thus is greatly valued. During early childhood, character education and the formation of basic, everyday life habits are emphasized. This is well-reflected in a famous Korean saying: “Habits formed at three last until eighty.”

Korean early childhood education aims to promote the development of the whole child. In practice, an integrated curriculum with a focus on diverse activities that reflect children’s developmental stages, interests, and everyday life is implemented. Respect for children, child-centered educational philosophy, play-oriented activities, interactions with their environments, peers, and teachers are all highly valued. Children are encouraged to actively participate in the learning process with teacher guidance, and diverse educational programs and approaches for young children are adopted and applied.

Types of Early Childhood Education and Care Facilities

There are two major types of early childhood education and care institutions in Korea: kindergartens and childcare facilities. Kindergartens are educational institutions serving children from age 3 to 5 and are under the administration of the Ministry of Education, Science and Technology. With the legislation of the Early Childhood Education Act in January 2004, kindergartens function under this law. Childcare facilities serve children from birth to age 5 (until entrance into elementary school), and are under the administration of the Ministry of Health and Welfare. The Infant and Child Care Act regulates childcare facilities.

Rate of Attendance

The kindergarten attendance rate was less than 1 percent before 1960 and less than 3 percent during the 1970s (Lee, 1993). The number of children enrolled in kindergartens started to grow rapidly since the 1980s, while childcare facilities experienced a rapid increase in enrollment between the years of 1990 and 2000. As of 2010, about 40 percent of children between the ages of 0 and 2 eligible for childcare service were enrolled in childcare centers, and 83 percent of children between the ages of 3 and 5 attended either kindergartens or childcare centers. The rate of attendance increased with children’s ages: 76 percent of 3-year-olds, 86 percent of 4-year-olds, and 87 percent of 5-year-olds. Breaking down these numbers by children’s ages and institutions, more 3- and 4-year olds used childcare facilities, while more 5-year-olds attended kindergartens. The trends in the
attendance rates reflect Korean parents’ preference for kindergartens when their child reaches the age of 5, which is a year before children enter elementary school.

**Technology in Early Childhood Education**

The 21st Century is characterized as the Age of Information. In the Age of Information, it is important to enhance children’s creativity, problem-solving skills, and ability to work effectively with computers. A computer center is provided in almost all kindergartens in Korea. The computer center is one of the favorite areas of children during their chosen activity time.

Early childhood educational institutions have started to incorporate computers in their curriculum since mid 1990s in Korea. At the beginning, there were hot debates surrounding the introduction of computers to early childhood education. Many teachers and parents were concerned that children might lose opportunities for physical and social development due to the overuse of computers. Research findings, however, have pointed out that children prefer to use computers together with peers rather than alone. Studies report that children teach and help each other in the computer center. When children used computers, they spent a great deal of time talking to others. With proper teacher guidance, computers were found to facilitate children's peer interactions.

Recently, smart phones and tablet PCs have been incorporated into some Kindergarten curricula. With teacher guidance, children use various applications to find information they need. Children easily move between on-line and off-line environments and learn to apply information found on-line to real-life situations.

An intelligence-based robot named Genibo was developed and used in Korean kindergartens. Korean researchers and educators are working together to develop a robot that looks similar to a human being. They are in the process of using the robot in some kindergartens to test the possibility of adapting it in the classroom. The robot is meant to work as an assistant teacher in the classroom as well. Some educators are concerned, however, about the overuse of technology in early childhood education. In Korea, educators have faced the challenge of introducing technology to young children without overemphasizing the power of technology.

**Family Involvement and Parent Education**

A growing body of research indicates positive influences of family involvement on children, families, and schools (Connors & Epstein, 1995; Epstein, 2001; Swick, 1991). Family involvement takes place in many forms, including volunteering in classroom activities, attending parent education meetings and workshops, and participating in various family gatherings at school.

As children’s first and foremost teachers, parents have a great influence on their child’s development and learning. In order to maximize the positive effects of early childhood education, teachers need to share with parents their knowledge on child development in general and information about individual children specifically. Parent education activities at kindergartens take place in the form of lectures, workshops, discussion meetings, individual conferences, note and printed material, email and telephone communications, or observations made by parents. Kindergartens also invite parents and other family
members to visit classrooms on various occasions. Some activities are provided during the weekends or during evening hours to accommodate working parents.

**Concluding Remarks**

With the growing awareness of the importance of the early years of life, the field of early childhood education and care in Korea will continue to face new opportunities and challenges for development. Educators, researchers, policy makers, and parents will continue to work together to provide high-quality education and care for young children, as young children are our future.

**References**


Students’ Patterns of Library Use: Cognitive Differences in Information Searching

K.G.D.A. Karunanayake
Main Library

Background of the Study
It is difficult to comprehend how students could gain experience in the proper use of a library without analyzing their cognitive context (knowledge and skill). This study aims to identify students’ use of the library for information searching and to understand their efforts towards various patterns from the cognitive point of view.

There are three objectives that elaborate the relationship between the cognitive context and patterns of library use:

1. How the cognitive context is related to the use of library
2. Whether there is an existence of a cluster of students who have different cognitive contexts
3. To discuss the cognitive context that may affect the different patterns of library use in the two countries selected for the study.

Methodology
For this purpose, two data collecting tools which are classified into five observable search stages such as starting a search, resources/tools selections, locating the information and materials, use of library service and system and self evaluation were designed. Two surveys were conducted in two universities: first in Sri Lanka and the second in Japan. The collected data was analyzed through factor analysis to reveal the affective factors. Based on the factor scores, a cluster analysis was conducted for identifying the different patterns of library use.

Outcomes of the Study
According to the results, it was found that the students use libraries in different ways for their own information needs and requirements due to different cognitive contexts. In fact, students’ basic knowledge and skill traits in library use are not identical. Applying the factor analysis to information incidents in the first survey, most students appeared to be affected by four factors in using library services. They are “Method of Locating & Searching”, “Use of Materials & Services”, “Searching Needs”, and “Own Competence”. The knowledge and skill of students can be plotted on cognitive space with the four factors which explain the cognitive context. The cluster analysis also revealed that the four different groups of students: “Users with Technical Concern,” “Positive-Active Users,” “Users in the Beginning Stage,” and “Users Demanding Results” in library use show different concerns on the factors.
The research exploring the students’ patterns in library use in Sri Lanka was implemented again in Japan to find out more evidence of user patterns from a different student community. However, the questionnaire was modified for the second survey within the five basic observable search stages. The extent of knowledge and skill relation to library use was illuminated by core six factors in Japan such as Proficient Search Capability, Reliability on Library Services, Acknowledgement of Digital Resources, Usage of Assistance, Way of Finding the Materials, and Prior Knowledge. Simultaneously, four segments of user groups such as Unsettled Users, Positive Active Users, Users Seeking Assistance, and Self-Dependent Users were identified through cluster analysis.

The obvious patterns of library use and group of students were indicated by the two surveys. Among them, a group of users who can be referred to as Positive-Active Users was commonly seen between the two communities. But they were represented only one fourth and one fifth of student communities in Sri Lanka and Japan respectively. Rather characteristic patterns of library use were indicated by other groups which show the combination of affecting factors on students’ behavior. There are several implications for universities and library specialists to learn from the derived results. This paper identifies the users’ context which implies the constructive concept or factors affecting the library use while the group of students generated by these concepts reflects the patterns of library use. These findings could be used as criteria for understanding students’ cognitive contexts as well as the organizing information search process in libraries. The constructive concept materialized the ways of approaching and accessing of information through libraries. It also disclosed that the highlighted factors were consistent in library use among the students.

**Conclusion**

Analyzing the cognitive context of university students is vital to understanding how academic libraries are being used and what kinds of patterns the students constitute. This paper generates library use patterns with regard to students’ cognitive context. Since different cognitive contexts are the basic causes for the different patterns of library use, upgrading of cognitive context by university level, library level and individual level is required and appropriated. Teachers being the major partners of students’ learning process have a vital role to play in educating the students about the importance of a library and its use. Library personnel as practical partners should have better rapport with their students in library use. In fact, as library users, students should be self-reliant and need to cope with teachers and library personnel when encountering any problems in accessing information. In designing library educational programs, every effort must be taken to upgrade the users’ information skill in relation to the constructive concepts found by these surveys. Some of the differences between the two communities shown here could be caused by those cultural contexts. Identification of such patterns is a prerequisite for the development of libraries and is of practical importance in designing library services.

**References**


Educational and Occupational Mobility of Plantation Youths in Sri Lanka

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Introduction

National and international studies reveal that education is one of the key instruments for occupational mobility. Educated workers are more likely to move to a high level of occupation, and schooling has a strong effect on the likelihood of moving to a high level of occupation (Nachum Sicherman, 1990). The impact of further education on occupational attainment is greater than the impact of basic education (Konig, Bachman and Sacchi, 2000). Occupational mobility via education is a cherished dream of many people who are in the lower strata of society. Divergence in educational and occupational mobility is aggravating the problems of social inequality (Ray, Jhilan, Majunder and Rajashi, 2010).

Even though the education of plantation children has become part of the national education system, the educational attainment level of plantation youths is still far behind the national education attainment level, and the occupational attainment too remains without much change (Karunanithy, 2001). This study examines the extent of intergenerational mobility in both educational and occupational mobility of youths in the plantation.

Objectives of the study

• To identify the differences in educational attainment levels between two generations.
• To analyse the differences in occupational mobility between two generations.
• To identify the relationship between educational and occupational mobility among youths in plantation.

Methodology

In this intergenerational study, the objective of the researcher was to record, analyse and interpret the existing situation in educational and occupational mobility. Therefore, the method of descriptive survey research was employed. One hundred youths including male and female and their fathers from the Pedro Plantation, Nuwara Eliya were selected randomly. In intergenerational mobility studies the comparison is usually between children and fathers. Data and information were gathered using a questionnaire and focus group interviews. Frequencies, cross tabulation and chi – square test were used for data analysis. The occupational prestige scale for Sri Lanka constructed by Chandra Gunawardene (1987) was used to categorise the occupational class.

Findings

Results indicate that there is a vast difference in the educational attainment between the two generations. In the fathers’ generation the percentage attained for Grade nine and
below is 52% and Grade nine and above is 15%. Thirty percent of fathers had no schooling. In the respondents’ generation the percentage attained for Grade nine and below is 19%, Grade 10 and above is 61% and Grade 13 and above is 19%. It is evident that there is an upward educational mobility in the respondents’ generation than that of the fathers’ generation.

Further the results reveal that there is stickiness in occupational mobility. In the fathers’ generation the percentage falling into the categories of Class VI and Class V are 35% and 25% respectively. Forty percent of fathers responded as unemployed. However, the occupational attainment level of respondents in different classes are as; Class VI = 34%, Class V = 46%, Class IV = 07 %, Class III = 05 % and Class II = 04 %. Out of one hundred youths only two are graduates and they are in the teaching profession. Those who fall in to the category Class V are mainly involved in self employment, apparel industries, driving, or working as sales assistants in shops. These results indicate the disadvantaged position of plantation youths and inequality in socio economic status.

**Conclusion and Suggestions**

Findings reveal that the educational attainment level of youths in the plantation is not adequate to face the challenges in the job market. It hinders upward movement in the occupational ladder. Since a substantial percentage of youths have obtained G.C.E O/L and A/L qualifications, opportunities for developing diversified skills in the fields of technical and vocational education to suit the needs of present job market should be introduced.

**References**


An Analysis of the Perceptions of Teachers on Science Teaching

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Background

Science has been made a compulsory subject at junior secondary level and senior secondary level ending at G.C.E Ordinary Level, considering the educational value of science for all citizens. Science is taught to provide scientific literacy to all students who do not have an opportunity to study science after Ordinary Level due to the selection of other subject streams or due to the termination of their formal education after Ordinary Level. The curriculum should also lay the foundation for higher education in the science streams at more advanced levels. Due to these reasons, the curriculum has to cover the life needs and higher educational needs during the compulsory education period. To address these needs, teachers should have a thorough understanding of the nature of science. Science is a subject which contains accumulated knowledge as well as the process of acquiring knowledge. The influence of science is essential to everyone for their life and vocational needs.

Considering the aspects related to these perceptions, science educationists have identified process based science teaching instead of product based science teaching. There are various ends of science teaching:

- integration of science vs. specialization of sciences,
- product based science teaching vs. process based science teaching,
- cognitive and affective.

Parkinson (1994) states that breadth and balance have to be maintained in a curriculum. Therefore, teacher perception is very important in achieving the purpose of science teaching.

It has been observed that the purpose of science teaching is not achieved at the expected level. There are many reasons for this, among which are some teacher related reasons. One is the teaching process which is determined by the perception of the teacher. Wellington (1996) states that the teacher’s view of what science is and what science education is have implications on the way that they present and teach in the classroom both on content and process. This paper aims to analyze teacher perceptions on science teaching. The research inquired whether teachers are in favour of teaching the process of science or the content of science and also about teaching separated sciences such as Physics, Chemistry, and Biology or integrated science.

Objectives

- To identify the attitude of teachers on teaching the processes of science and the content (product) of science
- To identify the attitude of teachers on teaching integrated science and separated sciences
- To identify where the teachers stand within the extremes of science teaching
- To identify the diversity in the teachers’ perceptions and awareness of science teaching
Methodology
As the research need was to inquire about attitudes of teachers, a descriptive survey method was employed in this study. The study was limited to the Gampaha zone. The population consisted of teachers, from type 1AB, and 1C schools. The teachers consisted of trained graduates, non-trained graduates and trained teachers. Teachers (51 in number) were selected using stratified random Sampling method. Four 1AB schools and five 1C schools were used as the sample. Questionnaires and focus group discussions were used in this study.

A questionnaire consisting of 20 statements in the Likert scale was given to teachers. Four aspects of attitude were examined by the statements. The attitude of teachers towards teaching the process of science (P), teaching the Factual content of science (C), Teaching separated sciences (S), Teaching science as integrated science (I) were examined.

The scale ranged from +2 to -2, and therefore the total marks were within the range +12 to -12 for P & S, +10 to 10 for I & C. In the analysis means and standard deviations (P-C) and (I-S) were calculated. (P-C) is positive when processed based science teaching is preferred than content based science teaching. (I-S) is positive when Integrated Science teaching is preferred than separated sciences

Outcomes
The means and standard deviations (SD) of scores obtained from the teachers for process teaching (mean5.62, SD 2.67) show that they feel process teaching is more important. The mean scores show that the opinion, “content teaching is more important” is negative (mean-0.21, SD2.36). The opinion does not change with school type or teacher qualifications. Similarly integrated teaching at compulsory education period is preferred rather than teaching specific subjects. The mean score for integrated science is 2.70 and S.D. is 3.01while those for separated science are -0.21and 2.36 respectively. Means and standard deviations of scores according to school type or qualifications do not show differences. The scatter graph shows preference spread in the quadrant process based and integrated approach and not in the quadrants content integrated and content separated sciences. Discussions with teachers also verified the same opinion.

Conclusion and Suggestions
The preference of teachers on science teaching at compulsory education is towards process based science teaching. They are of the opinion that teaching the process is more important than the content or the product of science. Similarly they prefer integrated science teaching than separated sciences teaching at the compulsory education period. The study suggests that inquiries have to be done about teachers’ competencies and that teacher awareness about science education has to be further strengthened.

References
How to Make Decisions with the Programme of School Improvement System in Sri Lanka: Case Studies from Colombo District Schools

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Background of the Study
This study focuses on School Based Management (SBM) which is termed Programme of School Improvement (PSI) in Sri Lanka. This study expects to investigate the decision making process of the PSI implemented schools. Caldwell (2005) defines SBM as a “systematic and consistent decentralization to the school level of authority and responsibility to make decisions on significant matters related to school operations within a centrally determined framework of goals, policies, curriculum, standards and accountabilities” (p. 3). According to the Ministry of Education (2005, 2008), key characteristics of the PSI are the delegation of power, authority, and responsibility at the school level by the education authority seeking accountability for school decisions. Government schools in Sri Lanka have been implementing the PSI system for more than six years. The Ministry of Education (2008) points out that the decision making process in the schools in Sri Lanka has considerably changed since the PSI implementation. Conversely, many research studies have not been carried out by educational researchers in Sri Lanka on this theme. This paper expects to explore the nature of the decision making process with the new change in the PSI implemented schools in Sri Lanka. Therefore, the main research question focused in this study is “what is the existing nature of the decision making in the PSI implemented schools in Sri Lanka?”

Objectives
1. Examine the formulation and implementation of decision making boards in the PSI implemented schools.
2. Study the involvement of the community members in the decision making process in the PSI implemented schools.
3. Identify constraints and challenges faced by the decision makers in the PSI implemented schools.

Methodology
Three multiple case studies were used among PSI implemented schools in the Colombo district to address the main research question in this study. Yin (2009) states that case study approach can be used to investigate actual contemporary life settings and life cycles of people, and it allows researchers to retain the holistic and meaningful characteristics of real life events of people.

Primarily, document analysis and semi-structured interviews were used to collect data from research participants in this study. Further, data were gathered through informal discussions and informal observations. Purposive sampling method was used to select the participants in this study. The sample consisted of three principals, three deputy principals, six teachers, six past pupils and six parents from the School Development Committees (SDC). Data was analyzed using thematic analysis.
Outcomes

According to the Ministry of Education in Sri Lanka (2008), each and every government school is anticipated to form a SDC to make school decisions. The school decision making process should be converted into a participatory mode and SDC members must be selected in a democratic way (Ministry of Education, 2005, 2008). However, it seems that the selection process of SDC members is unofficially controlled by the principal, and sometimes by the other top level managers of the schools, with the intention of selecting knowledgeable and suitable members for the SDC. The majority of the respondents’ argument is that the selection process of SDC members is influenced by the principals. Teacher and parent participants claim that “most of the outside members of the SDC are nominated by the principal, and our duty in the SDC is to approve his/her agendas”. One principal authenticates the above statement: “the principal is responsible for all the things happening in the school. Therefore the principal must have power to select members for the SDC”. According to the above statements it is evident that the principals informally use his/her power in selecting members for the SDC. One deputy principal explicates the reasons for the interference of principal or other school managers in selecting members for SDC: “every outside community members does not have adequate knowledge on the concept of PSI, and even school management. Hence, we must select suitable members for the SDC, otherwise selection would be ineffective”. The above statement validates furthermore the real situation in the current selection process of SDC members. According to the majority of parents and past pupils, only a half or less of the outside SDC members are invited to attend the SDC regular meetings. In addition, only a limited number of outside SDC members actually participate in the SDC meetings, and most of the time, only the same members participate in the SDC meetings. The majority of principals indicate the lack of experiences of the SDC members in school management and lack of awareness and training on the PSI as main barriers in current school decision making. Other research participants point out the poor leadership skills of the principals as a big challenge in decision making.

Conclusions and Recommendations

Findings show that the selection process of SDC members is informally controlled by the principal and other top level school managers. It is clear that a participatory decision making process is not currently being practiced in the PSI schools. Most school decisions are made by the principal, and they directly influence the school decisions. Majority of the members in the SDCs have not been empowered for the participation in school decisions. Most of the community members do not have adequate knowledge on the concept of PSI and school management procedures. Therefore, it appears that each of the three schools do not have genuine community participation in school decisions. It is evident that the outside community members of the PSI implemented schools are still underprivileged in school decisions. These research findings focus on the need to maintain at least a minimum standard of PSI implementation. For that, it is vital to make the SDC and SMT members aware of the PSI concept. Besides, it is required to establish a better monitoring mechanism or governing body to supervise PSI implemented schools and to guide SDC members.

Keywords: decision making, programme of school improvement, school based management, community participation
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Problems Encountered by Teachers in the Implementation of the Basic Features of Competency Based Education (CBE) in the Classroom

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Background of the study
Under the competency based, activity oriented, student centered curriculum introduced to state schools in Sri Lanka since 2007, a new role for teachers has been proposed to guide students to construct knowledge and derive meaning through their day-to-day experiences. In order to adopt this role, teachers first need to know the philosophy of the intended CBE and its basic features. Misinterpretations in this regard lead to a wide gap between the expected curriculum and the implemented curriculum.

Researchers have pinpointed that previous curriculum reforms have failed to achieve most of the objectives for which they were introduced, mainly due to inefficiencies in teacher preparation for the expected curricular changes. (Karunasena, 1994, Leelaratne, 1994). Seneviratne( 2009) carried out a research on the organization of science lessons under CBE and concluded that teachers have faced problems in its implementation because the basic features of CBE have not been disseminated to teachers considering their actual practices and the realities of many schools. Thus, the responsibility of the teacher preparation institutes is to find out the feasibility of a curriculum reform by teachers at regular intervals and take necessary measures to fill the existing gaps. Therefore, this study attempts to explore the issues associated with the implementation of basic features of CBE among the in-service teachers of different subjects in order to support them to adopt this new role in the classroom.

Methodology
Questionnaires were administered to teachers of different subjects who are following the Postgraduate Diploma in Education (PGDE-2011/2012) and interviews were held with the PGDE teachers as the main data collecting instruments. The data was analyzed quantitatively in terms of tabulating, graphs and calculating the percentages.

Outcomes of the study
As revealed, majority of the teachers (71.7%) in the sample have been made aware of the CBE by the provincial Teacher Centers for Continuing Teacher Education. However, 40% of them had no idea of the basic features of CBE at all and no one in the sample was fully aware of all the basic features in its real sense. 30% of the PGDE teachers have problems in interpreting the competency based education due to less awareness. However, 20.7% of the teachers who were aware of the basic features of CBE had stated that they faced problems in applying these basic features with the classroom specifications. Further, 29% of them had issues in matching the expected outcomes of the CBE with student factors.

The findings of the specific nature of problems encountered by the PGDE teachers clearly showed that 71.7% of the sample has problems in identifying the specific learning outcomes under CBE, while organizing the student centered learning activities/experiences under the CBE was a problem for 64.1% of them. Moreover, 61.7% of the teachers in the sample have problems in providing learning opportunities in their
disciplinary contexts which focused on discovery/exploration mode though it is the multifaceted instructional system introduced under the CBE. The proposed CBE recommends process oriented assessments in place of traditional assessment tools in order to assess the achievement of competencies/competency levels. However, it was evident that 73% of the teachers have problems in planning such assessment tools. Extending the learning teaching process has been considered as an important component of CBE. However, the findings of the study revealed that 64.1% of the teachers encountered problems associated with extending lessons towards the respective competencies.

This study concludes that more than 50% of the in-service PGDE teachers do not possess the ability to analytically review these problems encountered in their classroom practices related to CBE. It was further evident that this ability is comparatively high among the teachers of Sciences than those of Arts and Commerce.

Conclusions and Recommendations

This study highlights that more than 60% of the in-service teachers following PGDE have problems associated with four key features of CBE namely, specific learning outcomes under CBE(71.7%), adopting student centered learning activities with discovery mode(61.7%), adopting newer approaches to assessments(73%)and extending learning teaching process towards competency development(64.1%). Further, this study concludes that the ability of analytical thinking is comparatively high among the teachers of Sciences than the teachers of Arts and Commerce in the attempt at solving these problems at the classroom level.

Hence, this paper suggests that the present teacher education institutes should revisit their existing modes of curriculum dissemination which must focus on teachers’ actual practices and the realities of many schools and students. Furthermore, it is essential to revise their curriculum and instructional system in accordance with the emerging needs specially to empower the present teachers with 21st Century workforce skills such as professionalism/work ethics, teamwork/collaboration, critical thinking and problem solving.

References


Academic Service Learning for Sensitizing BEd Undergraduates on the Future Professional Role: A Design Based Research Initiative

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Background and Rationale
Improving teacher quality is a recurring problem. Although a number of teacher development programs prevail in Sri Lanka, new initiatives are sought to improve the quality of teachers (World Bank, 2011).

Academic service is a teaching method which promotes student learning through active participation in meaningful planned service to the community related to course content. It is founded on theories of experiential learning, transformation theory, critical reflection and education as preparation for civic responsibility (The Design-Based Research Collective, 2003).

This study was an outcome of the exposure to service learning in California State University (CSU), Chico, USA during the United States Institutes for Scholars program in 2011. The service learning program in CSU is not confined to teacher education but open to all undergraduates.

Service learning is absent in teacher education programs in Sri Lanka. This study focuses on the exploratory design process of an intervention to be implemented in the BEd program conducted by the Faculty of Education, University of Colombo. Research questions are:

1. How does academic service learning in teacher education pose as an effective strategy for linking theory and practice?
2. What are the service learning interventions in teacher education reported in literature?
3. How could service learning interventions be introduced in the BEd program?

Methodology
The utilized design based research (DBR) methodology has three phases: assessing the needs and defining objectives, designing material/artifacts, and evaluating material. This paper addresses the design phase of the study. DBR uses mixed methods. The design of the intervention was based on two steps:

1. Case study of the CSU, Chico Service Learning Program
   This study collected data from Focus group interview with ten students, two lecturers, artifacts and documents such as video clips and publicity documents.
2. Identification of possible interventions from relevant literature.
   The literature review is a critical phase in DBR because it facilitates the creation of draft design guidelines to inform the design and development of the intervention.
Outcomes

Case study outcomes on CSU Chico service learning program
- Service learning opportunities are linked to the students through a student-led non-profit volunteer organisation.
- Undergraduates need to apply from the list of opportunities, selecting the relevant service learning opportunities that are linking with the theories discussed in class.
- All students and staff interviewed are highly satisfied with the experience gained by the service learning opportunities.
- The main challenge faced by the program is the lack of teachers who can motivate the students towards engaging in service learning and make effective assessments.

Outcomes of the literature survey on teacher education service learning interventions
- Teacher candidates when enrolled in the methods courses conduct a service learning project as a course assignment (Bates, 2009).
- Encouragement to continue service learning across the entire final year of the teacher preparation program, rather than confining it to the methods course, is an option to help teachers build a strong foundation and comfort level with service learning pedagogy to carry with them into their early career years (Bates, 2009).
- Service learning as a first year transition tool for teacher education programs in higher education (Donninson and Iter, 2010).

Initial design solutions drafted based on the analysis of case study data and literature outcomes
Following can be regarded a draft design solution that may be tested in the next phase of this design based research:

The BEd assignments on the core subjects in the first two years can be based on service learning. In designing the assignment, the following three basic questions can be raised by the lecturer:
- What skills or knowledge do I want my students to learn or use?
- Who in our community could benefit from my students’ use of these skills and knowledge?
- How can students use their skills or knowledge to help others?

Conclusions and Recommendations
Service learning could be an effective solution to developing skills and attitudes of student teachers as they would begin to conceptualise themselves as future teaching professionals with the service learning experiences. These skills would be both soft and hard skills. At the onset, service learning should be initiated by the faculty rather than through a student led organization. The design solution derived from the study should be implemented in order to evaluate the outcome. However, motivation and commitment of university faculty...
members need to go beyond the traditional classroom roles to learn how to incorporate service learning into their university courses.

References
A Psychological Study on Burnout among Tamil Medium Secondary School Teachers

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Background and Rationale

In spite of the fact that teaching has already been a high-stress profession (Haberman, 2009), in Sri Lanka, the implementation of secondary level reforms (1999) in the general education system has created a relatively higher stressful working environment, particularly for teachers in the secondary classes. The curricular changes including School Based Assessment, student centered approach, etc., have significantly increased the stress level of the teachers because of the challenges and demands placed on them in fulfilling their duties and responsibilities. Hence teachers are overloaded in their work. Dorman (2003) identified role overload as a potent variable which influences work pressure and subsequently teacher burnout. Therefore, it is imperative to study about the prevalence of burnout among secondary school teachers. In Sri Lanka a few studies have been conducted to examine this particular phenomenon. However, these studies concentrate more on Sinhala medium teachers (De Silva, 2007). Therefore, this study is focusing on Tamil medium teachers with regard to the prevalence of burnout and possible outcomes.

If teachers are working under high levels of stress for significant periods of time they develop burnout characteristics (Blasé, 1986) including depleting energy that leads to emotionally overextended and exhausted (emotional exhaustion), negative, cynical attitude and feelings about students and colleagues (depersonalization), and negative self-evaluation in relation to his or her job performance (diminished personal accomplishment).

The issue of teacher burnout seriously affects the well-being and the performance of teachers and consequently, it becomes a serious issue to school administration as well as the effectiveness of a school. Paradoxically the burned out teachers who stay in the school cause more damages to students than those who leave the school (Haberman, 2009). Hence this study is timely and useful in addressing the issue of teacher burnout.

Objectives

The study was carried out to achieve the following objectives: (a) to assess the level of burnout experienced by the teachers; (b) to determine whether teacher demographics were significant predictors of burnout; and (c) to investigate if the group differences of teacher demographics were significantly related to three burnout dimensions.

Methodology

This study was approached quantitatively using a survey design. One hundred Tamil medium secondary school teachers were selected using a stratified random sampling
A translated version (Tamil) of the Maslach Burnout Inventory-Educators Survey was used to measure the level of teacher burnout. The English version is a 22 item self-report instrument describing the three types of feelings or attitude of burnout namely (dependent variables); Emotional Exhaustion (EE), Depersonalization (DP) and reduced feelings of Personal Accomplishment (PA). The questionnaire consisted of two components. Part one was designed to collect such basic teacher demographics (independent variables) like age, gender, educational qualifications, marital status, teaching experience, client load (student teacher ratio/class size), and the total number of working hours per week. The second part comprised information pertaining to teacher burnout.

Descriptive statistics were used in terms of means and standard deviations to analyze burnout level of the teachers in three burnout sub-scales. Demographic variables were tested using inferential statistics t-test and multiple regression analysis).

Outcomes
The teachers experienced a moderate level of emotional exhaustion with a mean score of 21.10 (SD=10.20), a low level of depersonalization with a mean score of 8.68 (SD=7.94) and a high degree of personal accomplishment with a mean score of 13.77 (SD=9.30). The results also showed that about 39% and 35% of the teachers were reported to assign as ‘high’ for EE and DP respectively, about 19% and 17% of them were assigned as ‘moderate’ for EE and DP subscales respectively and the majority of them (97%) were assigned as ‘high’ for PA subscale.

The results of multiple regression analysis showed that teacher demographics were able to explain about 15.2% of the variance of EE subscale scores and teaching experience and client load contributed significantly to the prediction of EE. However teaching experience seemed to be the most meaningful indicator of the EE dimension at the 0.05 level.

Teacher demographics accounted for about 24% of the variance of DP subscale scores. Client load, total number of working hours, teaching experience and educational qualifications were significant predictors of DP. However, given the small magnitude of the contribution of the latter three, client load seemed to be the most meaningful indicator of DP at the 0.05 level.

Teacher demographics accounted for 30.6% of the variance of PA scores. Teaching experience, total number of working hours and client load contributed significantly to the prediction of PA. However, due to the small extent of the contribution of the latter two, teaching experience appeared to be the most meaningful predictor of PA at the 0.05 level.

The study further showed that the differences were statistically significant with regard to age, teaching experience, total number of working hours per week, client load and civil status to all three dimensions of burnout. However, regarding educational level, the difference was statistically significant for depersonalization and insignificant for other two sub-scales. Likewise, with regard to gender the difference was insignificant for all three dimensions of burnout.
Conclusions and Suggestions

Teachers experienced a moderate level of emotional exhaustion, high level of personal accomplishment and low level of depersonalization. The teaching experience appeared to be the best predictor of emotional exhaustion and personal accomplishment. Client load was found to be the best predictor of depersonalization. Taking into account the two variables, the differences were significant and negatively correlated with EE and PA dimensions, it can be concluded that more experienced teachers and the teachers who had large class sizes tend to experience less emotional exhaustion and personal accomplishment or vice versa. As the negative correlation between client load and depersonalization indicated teachers who were having crowded classes appear to experience less depersonalization or vice versa. Therefore, it is suggested that a qualitative study be carried out to understand the factors that influence the emotional exhaustion of less experienced teachers and the diminished personal accomplishment of more experienced teachers.

References


FACULTY OF GRADUATE STUDIES
Message from the Dean

It is indeed with great pleasure that I write this message for the Annual Research Sessions 2012 of the University of Colombo. The FGS, winner of Asia’s Best B-School award for two consecutive years (2011 and 2012), is a key contributor to human capital development in Sri Lanka. Its mission is to foster excellence, creativity and value innovation in postgraduate education and research at the University of Colombo.

The Annual Research Symposium is an important academic event. The FGS sessions will provide an opportunity for the academics, 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 multi disciplinary nature of the faculty. This year’s sessions at FGS will have 18 presentations representing themes from Social Sciences, Humanities and Para-Medical Sciences.

I am thankful to all the reviewers for their kind corporation in reviewing the abstracts and to the contributors who submitted research abstracts. I extend my sincere thanks to Mr. S. Vidanagama, Dr. S. P. Premarathne, Dr. D. A. I. Dayaratne, and the administrative staff who helped to organize the Faculty of Graduate Studies sessions.

I wish all participants an interesting, thought provoking and productive workshop.

Professor Sunil Chandrasiri
Dean, Faculty of Graduate Studies
Faculty of Graduate Studies

Abstracts

1. Integration of ICT Technologies to Enhance the Quality in Faculties of Humanities and Social Sciences in Sri Lankan Universities
   Page: 82

2. The impact of government interventions on the Government securities Market in Sri Lanka - Can policymakers make the market better?
   Page: 85

3. Qualitative inquiry on role stressors faced by commercial bank managers in Sri Lanka
   Page: 88

4. Adaptation and validation of the Resilience Scale on Sinhala speaking adolescents attending school in the Kandy District
   Page: 91

5. Cross cultural adaptation of the Repeatable Battery for the Assessment of Neuropsychological Status to a Sinhala speaking clinical population in Sri Lanka
   Page: 94

6. An assessment of Interests, Attitudes, and Future Aspirations of First Year Students of the Faculty of Arts, University of Colombo
   Page: 98

7. Green Marketing towards Customer Perceived Value Creation: Can Corporate Environmental Commitment Make it Happen?
   Page: 101

8. Factors influencing good governance in local government institutions for achieving quality of life
   Page: 104
Integration of ICT Technologies to Enhance the Quality in Faculties of Humanities and Social Sciences in Sri Lankan Universities

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“I never teach pupils, I only create conditions in which they can learn by themselves”

Albert Einstein

This paper discusses the usage of ICT and related technologies in educational activities among students in the Faculties of Humanities and Social Sciences in Sri Lankan universities. It proposes how to use blended learning\(^1\) modes to enhance the quality of learning of educational activities. Further, this study discusses the skills required for the 21\(^{st}\) century.

The Student to computer ratio, other relevant facilities including connectivity, availability and usage of related devices, are the factors that influence the success of technology use in education (Fernando, 2011). According to Wermer, Korte and others, (2006) internet, ICT embedded curricular, attitude and skills of administrators, teachers and students, selection of suitable software, financial constraints, policies, research and development are relevant here.

The Mobile phone is used by 70% of the population and the majority of them are in the 16-35 age group. Nearly two million (which forms 14% of the population) use internet in Sri Lanka. Among them 46% access internet using their mobile phones, 10% exclusively and 36% through a combination of modes including mobile devices. 42% are on social networking sites such as Facebook with 78% in the age group of 18 to 34, the majority being university students (Chamara, 2011). Among the students who sat the GCE (A/L), 6.5% or 22,110 students (UGC, 2012) were admitted to the national university system. Of the university intake 17.64% students are admitted to Faculties of Humanities and Social Sciences (or Arts) in Sri Lanka (UGC, 2012). According to the findings of a survey conducted by Hawagamage and Ishaka (2011) 69% of students admitted to the Sri Lankan university system have ICT proficiency (considering the results of e-test performance score more than 40%) in the areas of Fundamentals and Working with a computer, Word Processing, Spreadsheet, Presentation, Internet and Web Browsing with statistics of a maximum mark of 85.2%, average 54.3% and standard deviation reported as 15.9. There are however several barriers existing in the implementation of ICT in education (Khslid, 2009): Teacher level barriers (e.g. lack of confidence, lack of teacher competence, resistance to change and negative confidence) and university level barriers (e.g. lack of time, lack of effective training, lack of resource accessibilities, lack of technical support).

\(^1\) Blended learning - This is a mix of the traditional face-to-face teaching approach and the self-directed online approach
Information was gathered from 102 students, 32 lecturers and 4 administrators from 3 Sri Lankan universities using two questionnaires (one for students and the other for lecturers) and interviews for administrators. The survey results reveal that the Sri Lanka higher education system maintains a student to computer ratio of 13:1 in Humanities and Social Sciences faculties and other faculties (e.g. Education, Commerce and Law) while it is 3:1 in Computer, ICT, some Engineering and Science faculties (Sabaragamuwa, 2011). Further, it reveals that 67.9% of students mentioned that ICT literacy component was duplicated on at least 3 occasions: (i) ICT literacy component in the Arts stream curricular at the national universities (e.g. specially office package and fundamentals of computing) (ii) orientation program conducted by the Ministry of Higher education (iii) a majority of students after the O/L and A/L (through private computer institutions). In addition to this, 23% of students have learnt some statistical packages but only a few of them use these packages for their final year projects. The above facts highlight that students are given a considerable amount of ICT literacy and related technologies but duplicated on several occasions.

The sample survey reported that 57% of university lecturers (Humanities and Social Sciences faculties) mentioned that they did not have skills other than in office applications, internet browsing and e-mailing. Further, a majority of them have stated the following: they did not have skills to develop blended learning course materials and e-innovation; they have not been given awareness and motivation programs, and lack technical and ICT skills. Other barriers to the implementation of the ICT embedded teaching and learning process is financial constraints and selection of suitable software (Fernando, 2011). Further, the curricula of Humanities and Social Sciences in Sri Lankan universities have a few computer literacy modules but there is no clear driving force to introduce modern ICT technology embedded in their curricula. In the majority of teaching and learning processes in Humanities and Social Sciences faculties in Sri Lankan universities, they perform it in a face-to-face manner but this methodology is not adequate to face future global challenges and to face the 21st century (Harvi and Chris, 2011). Therefore, adaptive technologies (Oliver, 2011) (e.g. for education to use on-line learning, e-learning, mobile learning and virtual classroom concept as Blended Learning) should be used to actualize the expectations.

With the collaboration of ICT and Computer Science faculties in the same university or in close by universities, or industry experts, the adaptive learning technologies (Harvi and Chris, 2011) can be implemented in a phased manner. This study, recommends the following four models as primary stages of Integration of ICT technologies to enhance the quality of higher education and face the 21st century global competences in Humanities and Social Science faculties in Sri Lankan universities with the use of the existing ICT culture of students and teachers (Fernando and Ekanayake, 2009).

(i) **Peer-to-peer student group activity model:** students should be motivated to use online group discussion forums on subject matter through Learning Management Systems (LMS), on-line chatting, e-mail and through social networking (e.g. facebook), problem solving activities, e-books etc. This model will help share knowledge among different students in the faculties through peer-to-peer activities;

(ii) **Teacher and student oriented activities:** In a classroom or different locations teacher-student activities can be performed as follows: through the LMS, on-line tutor or
mentor activities, on-line discussions forums, Brainstorming online chats/discussions, on-
line assessments and examinations;

(iii) **Peer-to-peer teachers’ group activity model:** In a department, or faculties or
different universities teachers’ knowledge can be shared using the above mentioned (i) and
(ii) methodologies;

(iv) **Teacher Trainer-Teacher model:** This model can be implemented as a
knowledge transfer methodology at teacher training centers in the relevant universities
(e.g. present staff development centers in several universities or professional training
centers ) as pre and post teacher training activities using the face-to-face as well as
blended technologies mentioned above in (i) and (ii) models.

Further, to implement the above models successfully, motivation programs should be
implemented with students, teachers and administrators (e.g. Training leaders, Head of
departments, Deans) and resource and attitude barriers minimized.

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Introduction
Efficient Market Hypothesis (EMH) depicts markets as efficient. A new paradigm of thinking emerged in EMH literature after Andrew. W. Lo (Lo* August 15, 2004; Lo* March 8, 2005) introduced the perspective of ‘efficiency’ in markets to be time-varying and follow an evolutionary path. This simply means that markets react to changing environment, tend to change and while doing so, make systemic mistakes, learn and then adapt. On the other hands, governments could consciously influence market environment through specific policies and regulation. The questions then arise as to: What would be the impact of government’s determined changes (interventions) on a market’s natural adaptation and then on changing level of efficiency? Can the governments thus influence or generate efficiency? Answers to these questions seem non-concrete, though sometimes it is documented that government interventions bear a positive relationship with reduced investor biasness (Daniel, Hirshleifer et al. 2002). This study is designed to model association between government influence and market efficiency through principles nested in AMH. The uniqueness of the study comes in design, concepts and in context with the unique datasets hitherto inaccessible.

Purpose and Objectives of the Study
Purpose of this study is to better understand the impact of government interventions on financial market performance. This is done through measuring the degree of changing market efficiency overtime in the Government securities Market in Sri Lanka and then by relating the outcome to trends observed in government policy and regulation.

Objectives of the Study
1. To model government policy and regulation as intervening variables to market efficiency.
2. To regress government policy and regulation with market efficiency in a multivariate co-integrated test framework, using linear regression.
3. To test the regression model and then seek evidence of structural breaks and then to separate out regimes.
4. To find evidence to relate structural changes to trends in government regulatory function.
5. To better understand the government’s role in relation to market performance and evolution.
Data and Methodology

Data
Behaviour of treasury securities’ yields in the Government securities Market in Sri Lanka is assessed through a new methodology. The Market is divided into two distinctive classes or groups, namely Primary Dealers (PDs) and Non-Primary Dealers (NPDs). Transaction data (yields) from both groups for the period from 03/01/2005 to 31/12/2010 make two unique, new time series datasets, each of which consists of 10 maturity series (based on term-structure relationship). These two datasets are analysed independent of one another, by regressing against government interventions as explanatory variables.

Methodology
Interventions (explanatory variables) are regressed with each dependent dataset to assess relationships among chosen variables and to check whether changes in the time series data coincide with changes due to government interventions. Structural changes in the regression models are assessed by an empirical fluctuation process, using moving sums of regression residuals (MOSUM). This methodology borrows heavily from Zeileis, Leisch et al (2002), (Zeileis, Kleiber et al. (2003), Veichtlbauer, Zeileis et al.(2006) and Zeileis (2006). All computations are performed using R-system for statistical computing (R Development Core Team 2011) . A special software programme was developed in R language for analytical purposes.

Interpretation of Results
The two datasets make it possible to compare and contrast the impact of government intervention on each group of market participants. Strong graphical analysis in R enables visualizing structural breaks in each model separately. Breaks identified are matched with factor dynamics with the objective of assessing whether changes in yield dynamics coincide with changes in vector of regressors. Basic norm is to identify whether there are breaks in the series that cannot be explained by any factor alone. Thus, it is reasonably assessed whether breaks in the data series (yields) are brought about by government interventions and if so, whether government actions have higher influence on PDs over NPDs. Breaks points (m) common to all the series (after evaluating using Information Criteria) cut longitudinal full sample period into (m+1) non-overlapping ‘regimes’. Each regime is then assessed for weak-form efficiency using a random walk model (RWM) to map changing market efficiency over time.

Practical Implications and Further Research
The findings of the study are a necessary piece of information for policy makers of government securities markets, as well as for market participants. The government (regulator) could be reasonably assured whether its interventions re the market would have a significant impact on adaptation. Further, regulators could visualize whether evolution of regulation radiates from ex-ante rules regimes to ex-post policies regimes. At the same time increased efficiency means asset prices are matched with true fundamental values of those assets, a necessary condition for healthy competition among market participants. This methodology could be replicated for another emerging government securities market. Testing market efficiency in the semi-strong form (event study) is yet to be tested for this market. The results of this study provide a test-bed for that.
References


Qualitative inquiry on role stressors faced by commercial bank managers in Sri Lanka

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Introduction

As a result of rapid development in technology and increasing job and family demands stress among individuals has become a key factor in today’s society. If there is a gap between job or family demands and the ability to meet those demands then it results in stress. Stress is defined as a psychological state which is a resulting from a wider process of interaction between the individual and his/her work environment (Cox et al., 2000). Hence job-related strains are reactions or outcomes resulting from the experiences of stress (Ivancevich and Matterson, 1984; Yahaya et al., 2009).

Research Problem

Role stressors emerge as a result of individual’s job role and the demand generated from the respective job or from the individual’s family demands (Ivanchevich et al, 2006). As such individual’s reaction to role related stress and its outcome intensify generating psychological stress (Srivasatra, 1997; Moorhead and Griffin, 1999). The role stressors also create chronic conditions in the workplace that may negatively affect an individual’s overall wellbeing (Yahaya et al., 2009). As a result of that frustration psychosomatic, mental disease and general feeling of dissatisfaction develop due to high levels of stress (Srivasatra, 1997; Robbins and Judge, 2008; Yongqing et., al, 1993).

Stress can also result from family demands on an individual. Those who lack sufficient free time from work, for family matters experience stress, fatigue and strain, which can have adverse effects (Parasuraman and Greenhaus, 1990). The most prevalent type or form of work-family conflict occurs when the time demands of one role make it difficult or impossible to participate fully in the other role (Parasuraman and Greenhaus, 1990).

Scope and Objectives

The present study focuses on the banking and finance sector in Sri Lanka, which is vital for the economic growth of the country. The fierce competition to maintain market share, causes commercial bank managers to undergo huge pressure to perform. Hence, it is important to investigate the role stressors faced by the commercial bank managers in Sri Lanka.

In this study it is intended to investigate the causes of role stressors faced by commercial bank managers in the country and also to identify key role stressors which are affecting the managers’ performance which impacts in turn upon the success of a bank’s operations.
Two main themes identified in the present study as causes of role stressors faced by commercial Bank Managers are: (a) the combination of job demand and family demand generate role stressors, (b) role stressors such as structural complexities, functional complexities, role ambiguity, role conflicts and role overload generated by job demand and the family stress.

Methods
Using qualitative method data was gathered to capture the individual managers’ experiences on role stressors. In-depth interviews were conducted to investigate role stressors. Group discussions among respondents were not considered under qualitative study where respondents were not comfortable to discuss their opinion in front of a mixed audience, therefore the researcher selected in-depth interviews as the best possible qualitative research method (Sekaran, 2009 and Bryman and Bell, 2007). The interviews were conducted with a sample of 12 Branch Managers of six commercials banks in Sri Lanka (two respondents each from People’s Bank, Bank of Ceylon, Commercial Bank, Hatton National, Sampath and Seylan Bank) using a structured questionnaire.

Data was analysed by using Constant Comparative Analysis (Glaser and Straus,1967) which involves taking one piece of data (one interview, one statement, one theme) and comparing it with all others that may be similar or different in order to develop possible relations between various pieces of data. Finally the respective statements were reviewed to identify whether sufficient data exists to support responding to each research question.

Findings
The findings show that causes for role stressors among commercial Bank Managers were generated through job demands and family demands. Further, the findings confirmed that increasing job demands caused role stressors such as structural complexities through multi reporting structure operating in the banks where Bank Managers report to Regional Manager and functional departmental heads of the respective banks, Functional complexities generated through multiple responsibilities of Bank Managers such as Marketing and Sales, Finance and Accounting, Human Resources, Operations, Planning, Office Administration, Corporate Relationships, Internal Controls (Auditing) and Project Inspections, where the said functions are performed by separate functional departments in Head Office. Role Ambiguity is created through unclear instructions received from the Head Office; Role Conflicts are generated due to inadequate staff, from time to time receiving conflicting demands from Regional Manager and various departmental heads in the Head Office; Role overload is generated by difficulty in clearing day’s work, Manager on call during weekend banking, outstanding work taken home to finish, meeting deadlines, late hours of work, shortage of staff and staff transfers. Among the role stressors created through family demands, the main ones were: taking unplanned leave to attend to family matters, finding time to teach or do homework for children, difficulty in finding time to take old parents to doctors and not having permanent domestic servants are the crucial stress causing factors. Out of six role stressors in the study three main stressors namely functional complexities, role conflicts and role overload have a major influence on Bank Managers compared to the other three stressors.
References


Adaptation and validation of the Resilience Scale on Sinhala speaking adolescents attending school in the Kandy District

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Introduction

Adolescents are identified as those between the ages of 10 to 19 years (UNICEF, 2004). Adolescence is a developmentally stressful period leading to many being vulnerable to mental and physical problems, including psychopathology. Resilience, the antithesis of vulnerability, is the ability to bounce back; and resilient individuals are those who thrive despite adversity, and have positive mental health. Resilience is defined as “a personality characteristic that moderates the negative effects of stress and promotes adaptation” (Wagnild and Young, 1993).

In Sri Lanka 18.9% of adolescents, 13 to 18 years experienced clinically significant behavioral and emotional difficulties out of which the effects on education (15.5%) and peer relationships (12.45%) were most severe (Perera, 2004). Another study identified that stress affected the academic performance of 15% of boys and 11.6% of girls (UNICEF, 2004).

This study seeks to fill the void of a translated and validated psychometric instrument in Sinhala to measure resilience in 14 to 18 year old Sri Lankan adolescents. This age group is documented to be especially vulnerable due to facing the two all Island General Certificate Examinations within 2-3 years. The study also hopes to understand any culturally specific resilience factors. Results can be useful in delivering target-based intervention and implementing programs for vulnerable youth.

The primary objective was to validate the Resilience Scale (RS) (Wagnild and Young, 1993) on the chosen sample by translating it, pre-testing it, and evaluating its reliability and validity.

Research Design and Methodology

In a cross sectional, correlational factor analytic study conducted among four mixed and single sex government secondary schools in the Kandy district, a simple random sample of students (N=150; Girls=73, Boys=77) self-completed the Sinhala translations of the Resilience Scale and the Strengths and Difficulties Questionnaire (Goodman, 1997) supervised by the principal researcher. The versatility of the Resilience Scale (Wagnild and Young, 1993), its robust psychometric properties, simplicity in administration, scoring, and interpretation, rendered it favorable for this study.

The scale was translated according to systematic scale validation criteria (Grammatikopoulos et al, 2010). The Delphi process was adapted according to Jones and Hunter, (1995). Content and consensual validity were independently rated and all items received acceptable ratings (≤ 7). The pre-test on N = 18 students (n = 6 declared; n = 12...
undeclared) indicated the scale was culturally and linguistically coherent therefore no amendments were made.

Test-retest reliability and internal consistency were estimated by Cronbach’s alpha and Pearson’s $r$ respectively. Concurrent validity was computed by Pearson’s $r$. Construct validity was assessed through Exploratory Factor Analysis using varimax rotation to assess if the intended original factors were present in the translated scale.

Data collection was conducted according to accepted guidelines and data were cleaned and checked for inconsistencies. Quantitative analysis was conducted using PASW version 18. Oversampling to reduce participation bias, repeating the study on $n=30$ two weeks following initial administration and using a single data collector ensured quality of data. The University of Colombo granted ethical clearance, educational authorities approved the study and the principal researcher ensured participant confidentiality and anonymity.

**Results**

Results showed strong content and consensual validity, high test-retest reliability (0.92; $n=30$), and internal consistency (Cronbach’s $\alpha = 0.89$, $N= 150$), and a weak negative correlation of $\alpha = -0.01$ on concurrence with the Strengths and Difficulties Questionnaire. Principal component analysis on 23 of 25 items with varimax rotation showed six components, ‘autonomy and ego strength’, ‘self-reliance a’, ‘perseverance’, ‘acceptance’, ‘self-reliance b’, and ‘equanimity’ as related to resilience and similar to those of the initial study. The results differed on the factor ‘existential aloneness’, likely due to cultural connotations. Moderately resilient students ($n=78$) exceeded those high ($n=39$) and low ($n=33$), and boys appeared more resilient as per current resilience research trends.

**Conclusions and Policy Implications**

The aim of the present study was achieved by the results of the validity and reliability tests, which indicate the usefulness of the Resilience Scale (Sinhala version) on an adolescent school going population. The weak negative correlation of Strengths and Difficulties Questionnaire and the Resilience Scale (Sinhala version) does not imply incongruence between the two scales, but is assumed to instead reflect the waning of student motivation, the structure of the test packet, and the lack of a larger sample, which would have enhanced the correlation between the scales. The modified 23 item Resilience Scale (Sinhala version) is likely due to cultural idiosyncrasies. In conclusion, the results reflect established findings of the versatility of the Resilience Scale on the adolescent population (Ahern et al, 2006), with special emphasis on Sri Lankan secondary school 14 to 18 year old adolescents.

Results from this research study point towards the urgent need for structurally geared awareness programs for parents, caregivers and teachers on the importance of resilience and the necessity for mental health consciousness in these changing times. The Resilience Scale (Sinhala version) can be utilized to assess resilience in clinical and non-clinical populations across many domains, to assess culture specific resilience needs that will lead to policies and programs aimed at improving adolescent quality of life. Furthermore by reducing risk and enhancing resilience in the lives of people, protective factors necessary for optimum mental wellbeing can be cultivated.
References


Cross cultural adaptation of the Repeatable Battery for the Assessment of Neuropsychological Status to a Sinhala speaking clinical population in Sri Lanka

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Background

Sri Lanka has a dearth of culturally validated neuropsychological tests. Hence, the purpose of this study was to validate the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) in a clinical sample (patients diagnosed with schizophrenia) of 20 to 50-year-old Sinhala speaking persons in Sri Lanka. RBANS seemingly possessed good psychometric properties, suitable for adaptation in the Sri Lankan setting, where the uses of locally developed psychometric tests, or globally validated international tests, are scarce. It is also apparent that cognitive assessment of individuals affected by psychiatric conditions (such as schizophrenia) has not become central to everyday clinical practice in Sri Lanka (De Silva and Gunatilake, 2002).

Objectives

For its adaptation in Sri Lanka, the purpose of this study was to pilot test the potential clinical usefulness of RBANS in a Sinhala speaking clinical population of patients diagnosed with schizophrenia. The specific aims to research were as follows: (a) Translate the RBANS into the Sinhala language (b) Assess Judgmental Validity of the translated instrument (c) Do reliability testing of the Sinhala RBANS (c) Establish convergent, concurrent and preliminary clinical validity in 20-50 years old patients diagnosed with schizophrenia.

Methods

Instruments

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) is a brief, standardised, cognitive screening instrument designed to assess global neuropsychological functioning that evaluates several domains of interest. RBANS is a cognitive screening test composed of 10 sub-tests that are combined to form five specific cognitive ability index scores: immediate memory, language, visuospatial/constructional ability, attention and delayed memory and a total scale score (Randolph, 1998).

Participants

The sample consisted of a group of 134 patients with Diagnostic Statistical Manual IV-TR (14) diagnosis of schizophrenia and a control group of neurologically tact age, education and gender matched 134 normal controls, recruited from the community. The group of patients was in-patients and out–patients of the Colombo South Teaching Hospital and National Institute of Mental Health. Informed consent was obtained after a description of
the study was provided to the participants. Ethical approval was obtained from the Faculty of Graduate Studies, University of Colombo.

**Translation of the RBANS**

First, bilingual translators followed a systematic translation procedure to back translate the original RBANS into Sinhala. The translation process ensured the retention of the conceptual meaning of questions and its semantic equivalence, by adhering to the ‘translation instructions’ developed for the RBANS.

**Establishing Judgmental Validity (content and consensual validation)**

Then Judgmental Validity was conducted through Delphi Method (Jones and Hunter 1995). Five experts from Clinical Psychology, Psychiatry, and Neurology determined the judgmental validity of the Sinhala RBANS by assessing content and consensual validity.

**Pre-testing the Sinhala RBANS**

Subsequently, the translated version of the RBANS underwent an empirical refinement, in the form of pre-testing (De Vaus 1991) on patients diagnosed with Schizophrenia (n=18). The first step in the process was to conduct declared pretesting of the instrument with six patients diagnosed with schizophrenia (3 men and 3 women; 1 each from ages 25, 35, and 45 years). Based on their feedback, the instrument was revised and pretested again with another group of twelve patients diagnosed with schizophrenia (6 men and 6 women, 1 each from ages 25, 30, 35, 40, 45, 50).

**Testing the reliability of the RBANS**

The internal consistency reliability was assessed after collecting data from all 134 patients. The test-retest reliability was assessed with 30 patients diagnosed with schizophrenia. The test-retest interval ranged between 25–30 days, for which the mean interval was 26.7 days, (SD=2.2). The study assessed both the Pearson’s r and the Intra-class Correlation Coefficient (ICC) to determine test-retest reliability of Sinhala RBANS.

**Establishing Preliminary clinical validity, convergence and concurrent validity**

**Preliminary clinical validity**

In order to establish preliminary clinical validity, performance of 134 schizophrenia patients and 134 age, gender, education matched normal controls were assessed using RBANS (form A). A Discriminant Function Analysis was performed to categorize and distinguish patients from that of normal controls, in order to determine test sensitivity.

**Convergent validity**

As a means of establishing convergent validity, the standardized Sinhala Mini Mental State Examination (MMSE) was used on patients diagnosed with schizophrenia. Furthermore, inter-correlations of the Sinhala RBANS Index scores were assessed as a means of supporting the construct validity of the instrument.

**Concurrent validity**

To establish concurrent validity, the study assessed if a patient’s performance on the Sinhala version of the RBANS could be used to indicate his/her functional outcome (i.e. employment status in this study). Functional outcome was measured by the patient’s
stated competitive employment or unemployment. A Discriminant Function Analysis was performed to assess the extent to which employment status can be associated with the RBANS. To determine if the between group (employed Vs unemployed) cognitive differences might be accounted for by differences in education level (i.e., number of years educated), an analyses of covariance was performed covarying years of education.

Results and Discussion

Adequate Judgmental Validity was determined for the Sinhala RBANS. The RBANS demonstrated good internal consistency reliability for both the patients (Cronbach alpha = 0.810) and control groups (Cronbach alpha = 0.856). It also showed good test-retest reliability (ICC =0.71 and Pearson’s r = 0.71), and inter rater reliability for the patients (ICC = 0.91).

Schizophrenia patients performed significantly worse (mean RBANS Total score = 60.0 (SD= 8.5) and showed more marked cognitive impairment than healthy controls (mean RBANS Total = 88.9 (SD= 12.2) on the Sinhala RBANS. The patient group was significantly different from the normal control group, on the total RBANS score (F=11.32, P <0.000). The highest Index score for patients diagnosed with schizophrenia are on the Language (88.8; SD=12.6) and Visuospatial/ Constructional indexes (67.2; SD=10.3). The lowest scores were for the Attention Index (55.6; SD = 11.0). The Sinhala RBANS was capable of classifying patients from that of controls 93% of the time or more using the RBANS Total score.

A moderate correlation was evident between the Sinhala RBANS and the MMSE ((r = 0.510, p< 0.01). Furthermore, it showed good patterns of inter-correlations within RBANS Indexes, supporting evidence for construct validity.

The results indicated that employed patients performed significantly better than unemployed patients on the Sinhala RBANS and the mean years of education were more for employed patients. It was possible to correctly classify employment status by equal to or more than 84% of the time by using the RBANS Total score, showing evidence for concurrent validity. Furthermore, analyses of covariance which was performed covarying years of education indicated that the group differences remained significant on the Immediate Memory(F=31.3,df=1,70,p<0.0000), Delayed Memory (F= 15.9, df= 1,70 , p < 0.000), Language (F= 10.7, df= 1 ,70 , p < 0.002), Attention(F= 6.7, df= 1,70 , p < 0.012) Indexes and on the RBANS Total score (F= 45.6 df= 1,70 , p < 0.000). The results predicted the Sinhala RBANS performance is related to employment status after education differences are controlled.

Conclusions

The Sinhala RBANS revealed coherence in identifying cognitive impairment in schizophrenia patients, and it is shown to be a reliable and valid tool for the neuropsychological assessment of Sinhala speaking patients diagnosed with schizophrenia. The evidence-based neuropsychological assessment instrument is valid in the Sri Lankan setting and can be used as a measure to facilitate remedial action.

Limitations of the Study

Despite the contributions of the present study, its limitations should also be acknowledged and caution must be exercised in interpreting its results. One of the main considerations is
the difficulty in generalizing the findings beyond Sinhala speaking 20-50 year olds. Future research would need to explore the adaptation and validation of the RBANS to other populations.

**Keywords:** RBANS; Delphi Technique; Reliability; Validity; Neuro-cognition; Schizophrenia

**References:**


An assessment of Interests, Attitudes, and Future Aspirations of First Year Students of the Faculty of Arts, University of Colombo

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Background and Justification

Sri Lankan society is now transforming into an aging population and the country is running out of time to harness the resource of ‘youth’. The most important fact is that youth unemployment is much higher than unemployment among other groups in Sri Lanka. It is about 30% compared to unemployment of about 10% in other age groups (Word Bank report 2008). Employment prospects of local arts undergraduates is an issue that continues to require the attention of all stakeholders. This study focuses on themes related to this broad issue.

In 1971, the Dudley Seers report (ILO) on Matching Education to Employment, argued that unemployment among the educated had partly resulted from their high aspirations on entering white-collar employment and a desire for academic education. Moreover, ILO report states that youth unemployment in Sri Lanka, being estimated at roughly 40% of the total amount of unemployment, has been recognized as a serious problem (IL0, 2004). The same results were highlighted in a study carried out in Sri Lanka that the graduate unemployment has loomed as a major problem facing the country during the last three decades. Due to this situation, results of non-availability of employment positions, as well as the desire to obtain employment in a certain sector or occupation, or heightened career aspirations are singly or in combination (Hettige et al, 2002).

Gunawardena’s study (1991) showed that employers listed communication skills, personality, interpersonal skills and general transferable skills such as adaptability, decision-making and organizational skills which they lack as important requirements from university graduates (Gunawardana, et al, 1991). Some of the researches done in this field identified that the relationship between education and aspirations did not emerge straightforward and in the case of university graduates, specific mention is made of private business owners and managers who have difficulty in employing young graduates due to their low proficiency in English, inadequate practical experience and very often negative attitudes to youth and work (Hettige, et al, 2002 and Samaraweera, 2007).

Objectives

Students of Bachelor of Arts degree programme have different aspirations regarding their studies and job prospects. The primary objective of the research is to examine the basic factors that affect Arts graduates when seeking employment. Consideration has been given
to both external factors such as socio-economic dynamics and internal factors such as motivation and interests of the students.

This study was conducted to assess: The level of satisfaction of students on being Arts undergraduates; their job preferences and their attitudes on being an Arts graduate; Problems they face in getting decent employment as Arts graduates and how their future aspirations depended on factors such as number of attempts at A/Ls, intentions of seeking foreign/local employments, gender, their parents’ education level etc. which were also examined.

Methodology
Students who entered the University of Colombo in 2011 to follow the BA degree programme were selected for the study (n=240). Study setting was the Faculty of Arts in the University of Colombo. The sample was selected randomly from the admission register. Data was gathered using a questionnaire and focus group discussions; 223 students responded to the survey while four focus group discussions representing all ethnic groups, gender and different socio-economic backgrounds of the student population was conducted during a three month period (January to March 2012) with their consent.

Results/Conclusion
Majority of the Arts faculty students are female (82%). Most of the parents of these students were A/L qualified (44%) and the monthly income of 77 % is below Rs 25,000. A significant association was found between gender and level of satisfaction in the Arts degree programme. Most of the female students were satisfied being Arts undergraduates. Among students, 65% were ‘satisfied’ regarding selection to the Arts degree programme and 18% was “highly satisfied’. Majority of the students had entered the university at their first attempt.

According to the survey many Arts undergraduates aspire private as well as government employment. A significant minority of students was interested in getting foreign and private sector jobs. Significant associations between private and government jobs were also observed. There were 20% of students who desired to migrate for a job, which was seen mostly among male students.

There were many limitations expected by the students. As they have mentioned the Arts Degree has the lowest recognition in this country. They believe that they will get a lesser salary and lesser demand in the system of employment. Also the fact that they have no extra qualifications or professional training is seen as a major setback in job seeking. Most of all, the lack of language proficiency (Tamil and English) and IT skills will affect their chances of getting decent employment. Most of the Arts faculty students have negative attitudes regarding future prospects as they have limited soft and technical skills.

The students had suggested few modes of improving their prospects including awareness raising through career guidance programmes and internship programmes to improve their employability.

The research finding reveals that the students should be encouraged to have an open discussion about their study related issues and to map out their needs towards the future prospects. Student counselling, personality development programmes and mentoring programmes could be highly effective in helping these students achieve their aspirations.
There is a need for a system to carry out some psychosocial interventions to minimize academic related problems and to meet personal needs during academic life. It is important changing attitudes towards employments among university students in other sectors while encouraging them to acquire the necessary technical skills, soft skills and language proficiency. This would be a great help in minimizing under employment and unemployment among Arts graduates in Sri Lanka.

**Keywords:** Undergraduate, interest, attitudes, aspiration, employment

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Green Marketing towards Customer Perceived Value Creation: Can Corporate Environmental Commitment Make it Happen?

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Background and Purpose of the Study

Going green has become an important strategic orientation to obtain sustainable development as well as creating customer value because of the popular environmental trends. Strict environmental regulations and popular environmentalism have changed the competitive rules in practices (Porter and van der Linde, 1995). However, deceptive marketing claims have resulted in poor or damaged stakeholder perceptions and distrust in green claims. A stronger integration between the green marketing and environmental commitment of firms can increase the likelihood of overcoming these obstacles which may prevent firms from realizing successful green initiatives and strategies (Crane, 2000). Green based environmental commitment is a major tool to differentiate service and create customer perceived value. However, the present body of knowledge does not conceptually explain how firm’s environmental commitment contributes to green marketing and customer perceived value. Hence, this paper attempts to develop a conceptualization that can elucidate role of the firm’s environmental commitment in influencing green marketing to create customer perceived value.

Method: Synthesis of Literature

The paper bases its conceptualization on literature review of past research studies and depends on resource-based view (RBV) of the firm as the major theoretical underpinning, which highlights competitive advantage resulting from the valuable resources and capabilities of companies.

Does Green Marketing Know Customer Perceived Value?

Green marketing is the holistic process of marketing activities within the firm that are aimed at reducing the environmental impact of products and services in a way that is profitable to the firm. Walker and Hanson (1998) characterize green marketing as reducing the long-term impact on the natural environment from the combination of inputs, outputs and consumer preferences. Customer perceived value is defined as a judgment by the customer of the comparison between the benefits or utility obtained from a product or service and the perceived sacrifices or costs (Zeithaml, 1988). The literature supports that being green positively influences customer attitudes towards the firm (Lee et al., 2010).

Can Firm’s Environmental Commitment create a supportive context for Green Marketing to enhance Customer Perceived Value?

A company’s environmental commitment is the level of importance put on proactive strategic environmental management, the degree of top management support and
involvement in environmental issues, the amount of intra- and inter-firm environmental reporting, and the level of employee environmental training and involvement. As dimensions of environmental commitment, Chen et al. (2012) identifies that “Environmental leadership” is a dynamic process in which one individual influences others to contribute to the achievement of environmental management and value generation. Such leaders within the company inspire a shared vision of the organization as environmentally sustainable, creating or maintaining green values throughout the company. “Environmental culture” is a symbolic context about environmental management and environmental innovations within which interpretations guide behaviors and processes of members’ sense making. “Environmental capability” is defined as a firm’s abilities to integrate, coordinate, build, and reconfigure its competences and resources to accomplish its environmental management and environmental innovations (Chen et al., 2012). A firm’s high environmental commitment would be expected to exhibit high levels of these components.

Firms are increasingly responding to the perceived rise in environmental consciousness among stakeholders by expanding their selection of products that are less harmful to the environment (Min and Galle, 1997), and by initiating changes in internal processes that reduce their environmental impact. Thus, environmental commitment should be regarded as a unique capability from the RBV logic (Chen, 2008a). Successful integration of this environmental commitment with green marketing can reduce and prevent wastes and pollution, encourage the development of product designs that minimize resources, assess product life-cycles, maintain supplier accountability for product and manufacturing environmental specifications, introduce reverse logistics programs, and promote the continuous review of existing processes and operations for efficiency improvements (Handfield et al., 2005). Thus, green marketing initiatives in a firm’s that are integrated and visible throughout the firm together with environmental commitment would have the potential to differentiate it from competitors and improve performance leading to a high customer perceived value in terms of functional and other values. Accordingly, the paper suggests the following propositions:

P1: Firm’s green marketing enhances customer perceived value
P2: Firm’s environmental commitment is a direct antecedent to firm’s level of green marketing.
P3: Firm’s environmental commitment contributes to customer perceived value.
P4: Firm’s environmental commitment and green marketing together generate increased customer perceived value.

Conclusion

Green has become a buzz word of corporate marketing strategy as a way of creating customer perceived value as a way of reaching sustainable competitive advantage. Environmental commitment provides a sound basis for integrating green marketing with corporate strategy and customer perceived value of the firm. Firms will also benefit by focusing decisions and resources through a better understanding the benefits of integrating, creating marketing campaigns with environmentally based leadership, culture and capabilities.
References
Factors influencing good governance in local government institutions for achieving quality of life

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Introduction
The new Local Government Institutions (LGI) created under the 13th Amendment to the Sri Lankan Constitution, namely provincial council system and the reorganization of the local government system, completely changed the structure of the local government system that existed for over a century. The objective of the reorganization of the existing system was promoting good governance which would improve the quality of life of the population.

Whether the new Local Government Institutions implemented good governance practices to ameliorate the living conditions of the population or whether these practices could achieve the desired ends, were the research problems in this thesis. The present study was launched with the purpose of studying the impact of good governance practiced by the Local Government Institutions (LGI) on the quality of life of the people coming under their jurisdiction. The study covered four LGIs, viz., three Pradeshiya Sabhas (PS) of Alawwa, Wariyapola and Kobeigane and one Urban Council (UC) of Kuliyapitiya. These institutions were selected with a purpose, depending mainly on practical experience and personal knowledge of the area and to represent local characteristics of the area.

Two types of data, qualitative and qualitative, were collected. Quantitative data were collected from a random sample of 320 households distributed in the four selected Local Government Institution areas by administering a pre-coded questionnaire to the head of the household/responsible household member. Qualitative data were collected by holding focus group discussions, in-depth interviews and interviewing key informants and also through participatory observations.

The hypothesis was that good government practices implemented by the LGI have a direct impact on the quality of life of its people. Indices were calculated to measure the quality of life and satisfaction, the level of performances of LGI and local politicians. Likert Scaling technique was mainly used in the questionnaire and the data thus collected was weighted and converted to an index. These indices were used to measure the quality of life and good governance practices.

The findings indicated that the majority of the households were in the middle class with a monthly income of around Rs. 13,000 and the inmates were employed mainly in the service sector. The majority were Sinhala Buddhists coexisting peacefully with a few Muslim and Hindu families in the area. Illiteracy and unemployment were low and the majority had secondary level education. There was sex discrimination, mainly in education. However, females entry into the labour force was limited due to traditional practices. However, it was found that a significant proportion of females tended to find
employment in the Middle East. Mother migration has caused some problems though there were economic advantages.

Indices indicated that in general, the quality of life as they perceived it, and in particular happiness and satisfaction derived from family life and parental care were very high. They did not want to move out of the village though some women went to Middle East as housemaids. Almost all had permanent houses owned by household members. The proportion of rented houses and encroachment of government land was very low. Majority of the houses had been provided with electricity. Access to transport and communication was high. There were no problems related to transport and communication. Although Pipe-borne water was available to a few, the main source of drinking water was wells.

Respondents perceived the quality of life and satisfaction to be high, but the impact of the LGI on the quality of life of the population was very low and people were not happy or satisfied with the performances of the LGI and the local and national politicians. Participation by politicians in village affairs was very low. People’s participation in LGI decision making was negligible. Accountability and transparency of activities of LGI seemed to be very poor, as tax payers were not aware of how their tax money was spent. There was no impartiality in the services provided and appointments were given, according to the respondents.

Although the quality of life of the population as they perceived it was high, LGIs had no impact on them. Good Governance practices and impartiality in LGIs were very poor. The trust people had in LGI services, various institutions and politicians was very low. The taxation system from which LGI derived income to provide services to the population was very unpopular. There was no regular interaction of people with local politicians or LGI activities. The study showed that LGIs had no impact on the quality of life of its people, contrary to the hypothesis and participation, transparency and accountability were very poor. The hypothesis was rejected as the satisfaction derived from the activities of the politicians and the LGI service seemed to be at a low level. There was a wide gap between the quality of life of the people and LGI performances.
Message from the Dean

At a time when concerns are expressed at a national level as to the due place of higher education in society, the role of universities and the responsibility of the State in that regard, it is indeed a pleasure to pen this message for the Annual Research Symposium of the University of Colombo. Approaching life as we see it through a framework of systematic inquiry and the production of new forms of knowledge is as old as mankind. That approach to life has brought about improvements in human lives and in the world in many areas of life, but there are many more questions to be asked and new knowledge to be produced. The University continues to address some of those questions this year particularly in relation to the concept of ‘sustainability.’

This event is not only an opportunity for our academic community to showcase their research but also provides a larger forum to emphasise the necessary link between academic communities in universities and the nation (or society) at large. The beneficiaries of the research that we undertake include the nation and therefore it is fitting that we organise an event of this nature where we reach out to a greater audience beyond our immediate academic circles. Relevant and dynamic research is an essential characteristic of an academic community. It is also a means of justifying the confidence institutions and individuals have placed on academics on numerous occasions.

This year’s symposium is organised under the theme of sustainability. At the Faculty of Law, we are hoping to explore the relationship between law and sustainability in contemporary Sri Lanka. ‘Sustainability’ has become a buzz word at a global scale as a suitable response to the challenges of contemporary living. Evaluating ‘the law’ in such a context requires critical reflection which is contextualised. Such a reflection should also be responsive to the development of international standards on ‘sustainability.’

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 mode of thought focussing on nothing but justice!

V.T. Thamilmaran
Dean, Faculty of Law
Faculty of Law

Abstracts

Department of Commercial Law

1. Who is Responsible for the Downfall of Companies: A Critical Study of Sri Lankan Law
2. Modern Challenges to the Principle of the Banker’s Duty of Confidentiality: A Critical Analysis
4. The right of farming communities to access improved plant and seed varieties: a critical analysis of the impact of the intellectual property regime on sustainable development
5. Balancing the Private Property Interests of the Foreign Direct Investors and Host States’ Right to Regulate in the Context of Environmental Concerns in the Public Interests
6. The Role of Accident Compensation Law in Sri Lanka and its Way Forward: An Assessment
7. Freedom of Contract vs. Exemption Clauses: A need for Predictability
8. The Impact of Advertisements on Consumers: A Comparative Analysis of Consumer Laws in Sri Lanka

Department of Private and Comparative Law

1. A Critical Evaluation of the Application of “Public Purpose Rule” in the Compulsory Acquisition of Lands in Sri Lanka
2. Should Positive Prescription on Land be Swept Away from the Sri Lankan Legal System as a Result of Introducing a Torrance system?
3. Domestic Workers’ Rights in Sri Lanka - Work Like any other, Work Like no other: Need for a Legislative Intervention
5. Rights of Children to Inherit Parents’ Intestate Property: A Critical Analysis in Thesawalamai


7. Muslim Divorced Woman’s Right to ‘Mata’a’: A Sri Lankan Perspective

8. A Proposal for a Dowry Prohibition Law in Sri Lanka: An Assessment in the Light of Indian Dowry Prohibition Act No. 28 of 1961

9. The Intersection of Contract Law with IP Law in the Protection of Undisclosed Information: A Sri Lankan Perspective

10. Using International Law as an Aid to Construction in order to Protect the Rights of The People: A Sri Lankan Perspective

Department of Public and International Law

1. Fighting against Corruption to Ensure Good Governance through Social Accountability in Sustainable Communities: The Need for an Effective Institutional Mechanism for Sri Lanka

2. Selecting an Electoral System to Enhance Representative Democracy and Respond to Challenges in Sustainable Communities: Proportional, First Past the Post or Mixed System - A Sri Lankan Perspective


5. Critical Reflection on Recognizing and Enforcing Disability Rights within the Sri Lankan Legal Framework

6. Responsibility to Rebuild: An Appraisal of the LLRC’s Recommendations Pertaining to Fostering Reconciliation in War-affected Sri Lanka
Who is Responsible for the Downfall of Companies: A Critical Study of Sri Lankan Law

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Background

The well-known saying that the ‘Private Sector is the Engine of Growth’ implies that a company is a creature of the law for the purpose of economic gain (other than the negligible percentage of non-profit entities) and not to sustain losses. However, in practice, many companies do not achieve their goal of making profit and cause hardship to all stakeholders. Is the law adequately covering the duties of responsible persons; who is responsible for the losses, if they can be identified; how can the duties posed on those personnel be enforced; can they be held liable; are there any ways to prevent company making losses or at least whether the damage can be reduced, are the questions for research. Downfall of companies is considered in three stages in this research for the purpose of analysis. Companies sustaining losses in certain transactions, but still stable and solvent is the first stage; companies in financial crisis and striving hard to survive by using the means available under the Companies Act of 2007 of Sri Lanka (CA 2007) is the second stage and the last stage is after the commencement of insolvent winding-up.

The role companies play at present is different from the historic era. The widespread acceptance of CSR has converted companies from the position of mere commercial entities to corporate citizen status which are legally and socially responsible for a wide range of duties. While shareholder value is retained, an expanded notion of stakeholder is given prominence. Companies owe a duty not only to shareholders but to employees, consumers, suppliers, society and the State. If these stakeholders enjoy the fruits of earnings, or in other words get benefit out of companies’ profits, are they not responsible when the company suffers losses?

Firstly, employees as stakeholders are not part of internal management of the company. They will learn about the downfall (the 1st stage referred above) only when the bonus is not paid. Even in such a situation the employees have no right to interfere in the management of the company. It is to be noted that Sri Lanka does not have a provision similar to s.172(1)(b) of Companies Act 2006 of the UK which provides that the directors of a company must regard interests of the employees.

Secondly, the consumers and suppliers are in no better position and they do not have any special information as to the company’s financial position. Suppliers may be alert when their bills are not settled, but their rights are limited to that of a creditor. The Companies Act of Sri Lanka has not provided for any right to the creditor during the life of the company. In the recent Australian case of McCracken v Phoenix Constructions (Qld) Pty Ltd [2012] QCA 129, the Queensland Court of Appeal reaffirmed the orthodox position that creditors, (or other persons whose interests are affected) are not entitled to claim damages against a director personally for contravention of s.1324(10) of the Corporations
Act of Australia, and unanimously held that the Act did not empower the trial judge to award damages to Phoenix Constructions (the creditor) and to do so was contrary to the intent of the statutory provisions.

Thirdly, the recipient of the benefits of the company is the society or the public at large. The Companies Act 2007 allows public inspection of certain records. (S.120 of CA 2007) and in addition, financial statements of all PLCs are published in the newspapers. These are sufficient for any smart citizen to become aware of a company’s plight. However, the people are too busy in this competitive world and have no time to spend on something in which they are not directly connected.

Fourthly, the State has given, by law, freedom for companies to do any business or activity or enter into any transaction (s.2 (2) CA 2007) and do not interfere unless there is crisis. In such situations of difficulties the State intervenes through its agencies such as CB or SEC in the interest of the public. The Seylan Bank financial crisis is a good example of how State intervention prevented the fall of the bank. Nevertheless it will not be possible for the State, through CB, to revive a non-banking company in crisis, but may be possible through the SEC which reviews the Annual Reports of all PLCs, although it is not a statutory duty. The SEC may be in a position to detect losses in the 1st stage that is referred above.

Fifth and the last category of stakeholder are shareholders who are important in the life of a company. Shareholders take part in the profits of the company by way of dividends, bonus shares and capital gain. They have the right to obtain copies of annual reports (s.167 of CA 2007) and right to inspect minutes and resolutions (s.119 of CA 2007). Hence, they are privy to company’s financial status. Although remedies are available under ss.224, 225 and 234 of the CA 2007 of Sri Lanka, the general trend in Sri Lanka is that the shareholders are not vigorous and very hard to find an active shareholder like the petitioner in Amarasekera v. Mitsui & Co. Ltd. Courts are also mindful about shareholder actions that are very costly as in Prudential Assurance Co v. Newman Industries [1982]. At the same time the shareholders do not owe fiduciary duty towards the company.

The whole responsibility ultimately rests on the board of the company. Directors are equivalent to trustees and bound by fiduciary duties. The directors statutory duties are mainly under ss.187,188,189 of CA 2007 and out of these s.187 speaks of acting in the best ‘interests of the company’ which is very wide and could hold any director responsible for breaching the same. In addition ss.219 and 220 are paramount duties on directors when they come to know that the company is not financially stable. Moreover, Solvency Test is another important mechanism introduced in the CA 2007 to curb situations of financial crisis. Civil and criminal liabilities of Directors provided in the Act for non-compliance/contravention are also mechanisms to urge directors to comply although the liability provisions are rarely enforced. PLCs are under a further stringent obligation to adopt corporate Governance. Nevertheless, the Sri Lankan statute lacks a provision similar to s, 172 of CA 2006 of UK which provides that the directors owe a duty to promote the success of the company. This is referred as one of the interesting innovations by authors who, at the same time raise doubts as to the interpretation of this requirement, as in Item Software (UK) Ltd v. Fassthi [2004].

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1 For example, the Seylan Bank PLC crisis during 2009/11 or NSB-The Finance PLC issues.
Methodology

The study uses Mixed Method Procedures, including both qualitative and quantitative methods. The approach is qualitative in the sense that it is an in-depth analysis of the stakeholders’ responsibilities and directors’ duties on a comparative basis from library and web sources. It is quantitative partly since the researcher’s intent is to do a case study of some PLCs that are not making profit. The focus of the research is limited to quoted public companies (PLCs) of Sri Lanka.

Conclusion

Society must play a more responsible role since the downfall of companies has an indirect impact on them. Educating public in this regard is necessary and the steps taken by SEC in this regard are insufficient in the opinion of the researcher. It is a commendable move that the inaugural meeting of the proposed ‘Investors Association’ took place on the 20th June 2012 with the participation of the SEC representatives. This association, once formed must perform as a watchdog. The SEC should take stern steps when annual reports are not submitted. Timely action of reprimand/warning or delisting when companies do not earn profits is necessary. These should be published in a simple manner for the public to understand. Easy methods to enforce directors’ duties should be introduced. Stakeholders should be informed of possibility of disqualification orders under ss.213 and 214 and especially under s.214(1)(d). As suggested, the current duty of directors should be to maximize value in the long term interest, taking into consideration the co-operation between shareholders and other constituencies as being the basis on which such value maximization can best be achieved.

Keywords: Stakeholder Responsibilities, Directors’ Duties

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Modern Challenges to the Principle of the Banker’s Duty of Confidentiality: A Critical Analysis

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Background

Banking confidentiality, a tradition and a cardinal principle under banking law is a moral as well as a legal duty. It began as an implied contractual term arising as a result of banker-customer relationship and is thus a fundamental obligation of the banker to observe strict confidentiality about the customer’s banking activities. The duty, though not absolute and subject to certain reasonable exceptions, prohibits the release of client account information and protects the financial privacy of customers to a great extent from unauthorized access by other individuals or the state. In most of the countries, the banking secrecy is governed by statute or common law. In Sri Lanka the law is statute and this is defined in Section 77 of Banking Act No. 30 of 1988 and subsequent amendments.

In a modern context, there is a conflict between the need for confidentiality and the need for disclosure of confidential information for the interest of the banks, customers, and the public. Banks have to comply with the duty as well as its exemptions, making it necessary for banks to do a balancing act. The banks need be careful and wise when striking a balance between these two spectrums as any mistake by banks would be costly.

During the last few decades bankers have significantly expanded their activities and services offered to the customers, which have greatly challenged the general law regarding banking confidentiality. In addition certain new challenges have arisen that challenge the said law. Such challenges are seen in the form of technological advancements and cross border banking. Even though those technological advancements are convenient to banking customers they simultaneously bring risks and opportunities for fraud. While the massive growth of cross border banking activities gives potential benefits to banks it also poses a key challenge to the said duty, as cross border banking activities have a free flow of data between two or more different geographical areas. Today money laundering and terrorist financing have become major threats to the banking businesses and therefore banks are implementing regulations to overcome these difficulties all over the world.

As there is no duty to maintain confidentiality by the banker regarding wrongful activities of the client, the exceptions to the duty of confidentiality are justified on grounds of public interest, economic stability and prevention of crimes and terrorism. However, the resultant erosion of a customer’s privacy cannot be ignored. Since the customer is the key component in banking law, it is vital to change the general principles introduced in the Tournier case to safeguard the customer and his confidentiality in this new era.

This study identifies the challenges faced by banks when balancing the duty of confidentiality and the duty of disclosure in various scenarios that would crop up as a result of the changing forms of banking. The paper discusses the two opposing arguments
for and against confidentiality, the proponents for each side, and discusses how the law relating to confidentiality as set out in *Tournier*, is challenged today more than ever before.

**Methodology**

The study was conducted based on articles published in the internet, law journals, law books and case reports (judgments) local and foreign, on the following lines:

- Identification of the problems which had arisen with regard to the duty of confidentiality and the duty of disclosure and providing a description of the current position of the statute and common law relating to this area of law.
- Analysis of the challenges faced by banks when balancing the duties of confidentiality and disclosure.
- Examination of the lacunas, gaps and inadequacy of law.
- Comparative analysis of selected jurisdictions.
- Based on these comparative studies, examining in what respect the law relating to confidentiality and disclosure can be improved in Sri Lanka and the developments that should be implemented in order to avoid inadequacies and constraints in the law.
- Proposing recommendations in order to strike a balance between protecting the interest of the different competing parties to achieve better results.

**Outcome**

Banks play a vital role in developing a country’s economy and its service plays a major role within modern society. Therefore how banks deliver their services is a matter of significance to the customers in their day-to-day banking transactions. The right to privacy is of fundamental importance to most customers. It is essential that banks maintain a high degree of confidentiality with their customers in order to ensure success in the banking industry. Customers have faith in the banking system and disclose information to banks on the understanding that it will remain confidential. They expect high standards of duty of confidentiality from their banks and believe that their financial affairs are kept secret and not revealed to its advisors. It is clear that modern developments such as money laundering and anti-terrorism legislation, international financial centers, credit information bureaus and technological advances etc. demonstrate the far-reaching impact of unauthorised use and hacking of customer information. Hence banks need to recognise their customers’ expectations and take this issue of confidentiality seriously for banks to build confidence and trust.

However, there are proponents that say otherwise and want to eradicate bank secrecy because they see it as working against legitimate inquiry about criminal activity and providing a gateway for organized crimes, frauds and corruptions such as money laundering activities, drug trafficking and narcotics etc. The social harm caused by these financial crimes has created consequences which have been detrimental to society. Therefore bank confidentiality is often a target of heavy criticisms for its cloaking of crimes and misconduct and arguments in favour of disclosure have increased.
Conclusions and Recommendations

When analyzing the above key challenges it is clear that the duty of confidentiality has been challenged by the new achievements of the banking sector. Some new concepts are totally contradictory to the duty of secrecy. On one hand, individual interest demands maintaining bank confidentiality, and public interest favors disclosure in selected circumstances to combat criminal financial activities, on the other hand. Therefore, the law must protect customer from unauthorized disclosures and at the same time allow banks to release certain information to certain persons in certain circumstances. It is the task for the law to achieve an appropriate balance between the confidentiality laws vis-à-vis civil rights and public interest. The balance between public interest and private rights should not move too far in the direction of disclosure. While accepting that there is justification for the diminished duty of confidentiality, it is essential protecting privacy and preventing banks from unlawfully disclosing information pertaining to the accounts of customers.

Today in Sri Lanka, the duty of confidentiality is subject to a number of statutory exemptions which allow certain governmental authorities to have access to banks records. Further, there are various other statutes which empower an investigation for the purpose of discovering information as to a customer’s banking transactions. Undoubtedly this has resulted major disclosures on customers information. However, our law is not consonant with the most other developed jurisdictions and needs changes to suit the changing times and circumstances. Due to the impact and the social harm caused by the financial crimes there is an imminent need to disclose information pertaining to customers as an effective way of actually curbing or restricting the growth of crime. Archaic banking secrecy laws cannot successfully counter such threats of global terrorism, money laundering and other serious crimes.

As per the general principles of the Tournier case, it is the duty of the banker to keep the confidentiality of the banking activities of the customer. But there is no duty to keep the confidentiality by the banker regarding wrongful activities of the customer. Therefore, there is no reason for keeping confidentiality for druggist and money launderers and other criminals and they should not be allowed to profit from their crimes.
Effective Utilization of Research and Inventions of Public Funded Institutions in Sri Lanka: A Patent Law Perspective

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Background

The scientific and technological progress of a country depends vastly on the government’s actual approach towards promoting these factors. The right to development, a human right of the people of a country which is expected to be recognized and upheld by direct intervention of government, can also be achieved, to a certain extent, through the government’s direct involvement in the promotion of research and development (R&D). In one way, advancement of science and technology could be accelerated by promoting R&D in the private sector by means of liberalization of tax principles, providing incentives and encouragements to local and foreign investors and investments, imposing viable and firm intellectual property right system etc. In another way, promotion of R&D of a country can be expedited by providing government funds to state-run research institutions and universities which are traditionally molded on the conventional research system that does not basically encourage patent oriented researches or market and industry oriented inventions. Effective handling of public funded research by these institutions will further help to build up university-industry cooperation, patent oriented research environment in universities and cooperative research culture among university academics and national/international research institutions and industries. Having a system for ownership and licensing of patents on outputs of public funded research is a topic that has resulted in much debate among both developed and developing countries today.

Objectives

There are several legislative attempts made by both developed and developing countries to streamline institutional framework to support the university-industry cooperative environment. These laws attempt to make university research, inventions and ‘discoveries’ to be patent qualified and industrially utilizable through providing public funds and recognizing ownership rights of these institutions and employees. Among these legislative attempts, the most prominent and authoritative one is US Bayh-Dole Act of 1980. The Act was supposed to facilitate patenting and licensing of university research in the US. In USA, this law was seen to be the much needed instrument that would ensure the best development and application of university generated research results. It is obvious that in late 1990s, the US Bayh-Dole Act has been used as a guide to formulating intellectual property polices in some of the other nations e.g. Austria, Denmark, China, South Africa, Japan and, most recently India. Along the lines of the US Bayh-Dole Act, India also has introduced a proposed Act called The Protection and Utilization of Publicly funded Intellectual Property Bill 2008, especially for ownership and licensing of patents on outputs of public-funded research.
While some developing countries in the Asian region including Malaysia, Singapore and Thailand are in the process of expanding their laws and regulations on university-industry interface and technology transfer from public funded research, Sri Lanka is yet to identify and determine these legal regulations towards an effective framework of intellectual property protection. This paper will analyze the need for such a legal framework for Sri Lanka in the face of promoting R &D in public funded institutions with special reference to the university system in Sri Lanka. This analysis will be made in intellectual property law perspective which requires some legal reforms/amendments in the law if government’s aim to promote marketable research out puts and products in universities.

**Issues/problems**

Several issues/problems in the area of patenting public- funded research and promoting marketability of research in collaboration with private sector and industries were identified and analyzed. Among them, most of the issues are relevant to intellectual property rights protection. Some salient issues can be identified as follows:

i.) What are the most imminent intellectual property principles in the present legal arena that require some broader classification, definition or interpretation, in the process of developing a research culture in public-funded universities in which more patentable inventions could be produced?

ii.) What are the most applicable intellectual property principles in the course of promoting transfer of technology between universities and industries?

iii.) Issues relating to the inventions that are generated out of public funded research which remain unnoticed by industry, and even when noticed, not picked up by them due to heavy development costs and their uncertain and “embryonic” nature (this is a common allegation made by many industries that follow-up research to be done on many inventions of universities to convert them into an utilizable or workable one).

iv.) Is there any possibility to justify the idea of promoting a ‘profit-earning’ research environment in universities against the common premise that the benefits or knowledge derived from university scientific discoveries and inventions would remain in the public domain in non-profitable status as they are run by public funds?

**Limitations**

Among the above mentioned issues, the researcher is of the opinion that the third and fourth issues should be answered in sociological and policy wise perspectives rather than in a legal perspective of intellectual property rights which emphasizes some aspects of patent law. Hence, the research mainly focuses on analyzing intellectual property issues which derive from the first two issues such as ‘Ownership of patent’, ‘Concept of Joint Ownership’, ‘Novelty determination’, ‘Disclosure requirement’, ‘Licensing of Patent’ and ‘Benefit sharing’ which require more conceptual and doctrinal clarification under the present patent law of the country.

**Conclusion/Recommendations**

This research discusses different intellectual property relationships among different organizations such as the government as a ‘funding agency’ for research and inventions,
universities/research institutions as ‘recipients’ of funds provided by the government for research and their commercialization and researchers/lecturers/professors or employees of universities as ‘creators’ or ‘inventors’ of public funded research in different perspectives of ownership of patent, joint ownership and equitable benefit sharing concepts. It is found that the existing intellectual property legislation of the country, due to its limited wording, non-explanatory nature of some vitally important concepts and inadequate interpretation clauses of the Act, is not sufficient to provide a broad meaning to the above concepts of patent law which are crucial in promoting the relationship between industries and universities. In a comparative analysis, some recommendations are made to broaden these patent law concepts.

**Keywords**: Research and Development, public funded institutions, university-industry interface, inventions, transfer of technology

**References**


The Right of Farming Communities to Access Improved Plant and Seed Varieties: A Critical Analysis of the Impact of the Intellectual Property Regime on Sustainable Development

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Background
The global population has exceeded the 7 billion mark, and this places severe constraints on the finite resources of the planet. One of the key factors in feeding this ever-increasing population is the development of new plant and seed varieties that are high-yielding, pest and weather-resistant, and that will mature over a shorter period of time. In order to produce these “miracle” crops, much money has to be spent on research and development. Consequently, the plants or seed so developed are expected to bring in profits for the company, as well as cover the costs of research already sustained.

The current intellectual property regime has fully supported the right of the innovator to a monopoly over the innovation. While TRIPS, the World Trade Organisation’s agreement on trade-related intellectual property rights provides a 20 year monopoly for most other inventions, it permits different standards to be used for the protection of plant varieties.

However, it is a fact that new plant and seed varieties are far more expensive than their ordinary counterparts, and many farmers in developing countries are unable to afford them. In addition, farmers in developing countries are used to being given access to low-cost (or free) newly developed seeds and plants where the innovator is a state agency. The option of having to pay for plants and seed is therefore, bound to increase production costs unbearably.

This study identified the key issues that surround the debate of allowing farming communities to access protected plants and seed, and proposed meaningful steps that would promote sustainable development through equitable benefit-sharing.

Methodology
The study was conducted using library and field research, on the following lines:

- Identification of the importance of new seed varieties in combating the food crisis and promoting sustainable development.
- Analysis of the international legal regime that operates to protect innovated seed.
- Description of the current position of the local law on the protection of new seeds and plants.
- Comparative analysis of selected jurisdictions.

1 Article 27 (3) (b), TRIPS Agreement
2 By “new” what is meant is “newly developed”
• Based on these comparative studies, proposition of a formula that might be workable from a domestic point of view, to enable equitable access to new plant and seed varieties.

Outcomes

The following results have been obtained:

• The importance of access to new plant and seed varieties to respond to the food crisis:

Traditional crops can no longer support the world’s food needs. While state-sponsored agencies in countries like Sri Lanka do develop new plants and seed, the seed developed by private innovators is more advanced in expected yield, resistance and nutrition, but also more expensive. As a result, farmers currently use sub-standard seed and low-quality plants resulting in waste of farming land and time. This could impact on sustainable development by causing farmers to destroy bio-diversity to increase the amount of farming land.

• The legal regime governing access to new seed varieties:

The operative local laws dealing with plants and seeds are the Seed Act, No. 22 of 2003 and the Plant Protection Act No. 35 of 1999. However, these laws do not deal with accessing or protecting new plants or seeds. The Intellectual Property Act of 2003 does not permit plants to be patented. Legislation for the protection of new plant varieties and breeder’s rights is in the pipeline. As for new seeds, they are capable of being patented under the IP Act, provided that they meet the criteria for patentability. Hence, very few foreign applications are filed in Sri Lanka as Sri Lanka does not provide a strong enough legal framework. This does not stimulate local innovation either.

On the global platform, several covenants are important. The WTO’s Trade – Related Intellectual Property Agreement (TRIPs) agreement allows members to exclude new plant varieties from patent protection, provided an effective sui generis system can be found. Accordingly, many countries have utilised the system proposed by the Union for the Protection of New Plant Varieties (UPOV). Sri Lanka is not a member of UPOV, but is reported to have contacted UPOV for assistance in drafting legislation on the protection of new plant varieties. The Convention on Biological Diversity (CBD), which Sri Lanka has ratified, mandates that genetic resources cannot be obtained without prior informed consent and mutually agreed terms. The International Treaty on Plant Genetic Resources for Food and Agriculture (IPTGRFA) considers plant genetic resources from the viewpoint of sustainable agriculture and food security. It recognises farmers’ rights and calls for a system of benefit-sharing and access. Unfortunately, Sri Lanka is not a party to this Convention.

A comparative analysis of the efforts taken by other countries

India faced a food crisis in the 1960’s but thanks to the Green Revolution, it achieved some sort of self-sufficiency and is now in quite a stable position. The means by which this was done was though the creation of new seeds and plants that were modified so as to

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3 Section 62 (3) (a)
suit the population’s needs as well as climate conditions. Incidentally, India is now moving towards UPOV membership and has a large research and development capacity in the breeding of new plant and seed varieties.

**Conclusions and Recommendations**

Sri Lanka could benefit greatly by joining the global initiative to solve food problems by recourse to new technology. This may become necessary in the near future, where arable land is no longer sufficient to support conventional farming methods. However, several safeguards need to be introduced. Legislation is needed to regulate rights arising from the creation of new plant and seed varieties, and to ensure that traditional knowledge will not be exploited unreasonably especially in the form of plant genetic resources and crop wild relatives from which new strains can be developed.

One feature noted in many countries that introduced plant variety and seed protection is that local innovation was initially stifled by foreign competition. This is a very real threat to Sri Lanka, and policymakers should make provision to deal with this eventuality.

Even if new plant and seed varieties are introduced, it is debatable as to whether local farmers would be able to access these varieties due to their high price. The government will then have to take steps to ensure that such varieties are available to farmers at subsidised rates, or through some other system of benefit-sharing. If not, it will be of no use to have many patented seeds, if none of them are actually used in the fields.
Balancing the Private Property Interests of the Foreign Direct Investors and Host States’ Right to Regulate in the Context of Environmental Concerns in the Public Interest

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**Background**

Under customary international law it is deep-rooted that either direct expropriations or indirect expropriations of property belonging to foreign direct investors should be accompanied by the compensation owed by the host state within whose territory such investment projects have been operated. At the same time, the customary international law doctrine of *police-power* obviously recognizes host states’ right to regulate or take other measures substantially disturbing foreign investors’ property interests without a finding of compensable expropriation in certain circumstances, such as public health and safety, anti-trust, consumer protection, securities, land planning and environmental protection.

Accordingly, in the context of International Investment Law the doctrine of *police-power* has been employed as the first and the foremost exception to the primary principle which insists the paying compensation in the events of expropriations, if such hosts states’ measures comply with the prerequisites namely, pursue a legitimate purpose, aimed at the general welfare, non-discriminatory and fall within the realm of the state’s general regulatory or administrative powers.

Amongst the well-defined grounds which fall within the ambit of the state’s general regulatory powers, environmental regulation has become the most frequent ground that is used by the host states to exercise their regulatory right in the context of Foreign Direct Investments (FDIs) during the past decades since most of the major trends of environmental degradations such as greenhouse gas emissions, deforestation, loss of biodiversity have been driven by increased economic activity, to which FDI is a noteworthy contributor.

Nevertheless, certain environmental regulations initiated by the host states have resulted in significant impact on the economic viability of the FDIs by raising project costs or reducing the value of project assets; as a result, such environmental regulations have been determined as compensable regulatory takings, undermining the rationale behind the doctrine of *police power*.

Consequently, preserving equilibrium between private property interests of foreign direct investors and host states’ right to regulate environmental concerns in the public interest within the parameters of International Investment Law has become a controversial issue which was addressed by three different lines of reasoning or approaches which delineate the *police-powers* exception in three different arbitral awards namely, *Compañía del*
Desarrollo de Santa Elena S.A. v. The Republic of Costa Rica,¹ Tectemd v. The United Mexican States,² Methanex v. United States of America.³

Being so, the main objective of this paper is to identify and rationalize the most appropriate approach for upholding equilibrium between interests of the foreign direct investors and host states amongst the three different approaches developed by the jurisprudence on regulatory expropriations in the environmental context. Moreover, the significance of adhering to such an appropriate approach in the context of accomplishing a sustainable community is the secondary objective of this research.

Methodology

This is a qualitative research solely based on a literature review on the relevant issues. Reference is made to a large collection of secondary sources on the subject such as textbooks, journal articles, foreign and local judgments, research or working papers and electronic databases.

Outcome

Accordingly, the foremost outcome of this research is the identification and the rationalization of the most appropriate approach which provides an appropriate sphere to preserve a balance between interests of the foreign direct investors and host state in the context of environmental regulation amongst the three existing different approaches towards police-power doctrine. For the purpose of accomplishing this ultimate result, the paper anticipates to meticulously and individually discuss the intrinsic worth and the drawbacks of investment arbitral awards which initiated the three different approaches; namely, Compañía del Desarrollo de Santa Elena S.A. v. The Republic of Costa Rica, Tectemd v. The United Mexican States, Methanex v. USA. Additionally, the significance of preserving a balance between interests of the foreign direct investors and host state in the context of environmental regulation in the modern scenario is expected to discuss in detail.

Conclusions

As one of the conclusions, this research is expected to conclude the discredit of adhering to the sole effect approach developed in the award of Compañía del Desarrollo de Santa Elena S.A. v. The Republic of Costa Rica which holds that a bona fide regulation or the environmental purpose for the taking of foreign property, no matter how laudable and beneficial to society as a whole, does not exempt the host state from its obligation to pay compensation under the expropriation law since it utterly disregards the rationale of police-power exemption, while severely restraining the states’ right and the competence of regulating environmental concerns.

As the second conclusion of this research the paper it is expected to castoff the approach developed in the award of Methanex v. USA which treats police-power as an absolute exception from compensation obligation under the expropriation law. Because an

¹ ICSID Case No. ARB/96/1 (February 17, 2000)
² ICSID Case No. ARB(AF)/00/2, Award, 43 I.L.M. 133 (2004)
³ Final Award, ICSID (World Bank) (2005)
approach which directly determines disputes involving conflicts between investor rights and environmental concerns in favor of environmental concerns and public purpose regulations provides an unruly regulatory authority which would be misused by the host state in order to jeopardize the private property rights of foreign direct investors in the name of public purpose environmental regulations which result in restraining the free flow of foreign direct investments throughout the world.

As the third and most impressive conclusion of this research, the paper expects to deduce the approach developed in the award of Tectem v. The United Mexican States which takes both the purpose and effect of host state measure into consideration as the most appropriate approach to maintain a proper equilibrium between the contending interests of foreign direct investors and host state. The proportionality analysis is employed in this approach in order to classify a particular state’s action as to whether a state regulation or an expropriation is a methodically sound criteria for disciplining tribunals’ attitude to the question of the requisite balance between public and private interest. Consequently, the police-power exception can only be utilized where the states’ regulations are proportional to the interest being protected, while making this approach a coherent one which provides greater space for host states to take environmental measures in the public interest, yet provide a satisfactory scrutiny to control misuse of public power.

Thus, the paper hopes to conclude by suggesting the approach developed in the award of Tectem v. The United Mexican States which takes both the purpose and effect of host state measure into consideration from a proportionality analysis as the most suitable approach that should be adhered to by the future investment tribunals to preserve a proper balance between the interests of the foreign direct investors and host state in the context of environmental regulation. This approach will result in enhancing the role of international investment law in accomplishing Sustainable Development which place environmental issues amongst other development issues in the contemporary society.

References
The Role of Accident Compensation Law in Sri Lanka and its Way Forward: An Assessment

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Background

Compensating road accident victims adequately and satisfactorily in Sri Lanka is a critical problem due to several factors. Primarily, ‘accidents’ do not involve the mental element of the doer as it is a sudden an unintended occurrence. Therefore, holding defendants liable for unintended acts requires a justifiable policy ground. Secondly, it is also noted that the major statute in this regard does not guide the courts with sufficient clarity. Thirdly, it is questioned whether collisions which occur on roads negligently can be considered as ‘accidents’. If so, can it be considered under the same policy or should it be considered on a different policy ground? This is interesting to research on as collisions on the road are always referred to as ‘accidents’.

Further, smooth function of compensating accident victims may be badly affected by the strict legal procedure that has been laid down for accident compensation in the Sri Lankan legal system. This involves the requirement of proof of fault, inaccessibility to the court, the difficulty in calling of evidence, lack of awareness of the proceedings, lack of money and the like. However, the most significant factor that follows is a ‘vulnerable empty handed accident victim’ at the end. Therefore, it is questioned whether the system that has been adopted to redress the accident victim in this country is inherently unfair. It does not seem to stand for an assured remedy for accident victims based on policy considerations despite all the above deficiencies. The issue raises serious concern of the welfare and responsibility of victims of road accidents who are vulnerable to various physical, physiological, economic and social problems subsequently.

Alternatively, it is much interesting to see insurance policies that are marketed in the marketplace in different facets in light of claims of accident. These are promoted with highest attractive benefits for the policy holders in the context of motor vehicles insurance particularly. Also, third party insurance is a statutory requirement for all vehicle owners in Sri Lanka. However, the victims who wish to seek remedy through third party insurance have to undergo court proceedings. Indeed, this is similar to suing the defendant in a normal civil case. Therefore it is clear that the victims are not protected through both alternatives of accident compensation. As a result, many of the cases have opted to

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1 Please note that this study limits its scope only to the area of motor accidents as otherwise it unnecessarily expands the intended discussion.
2 See, section 240 for the definition of ‘accident’, No 8 of 2009 Motor Traffic (Amendment) Act
3 Section 218 No 8 of 2009 Motor Traffic (Amendment) Act
4 Section 106, No 8 of 2009 Motor Traffic (Amendment) Act
settlements between parties out of court. However, it is noted that this settlement does not include real assessment of damages as seen in courts.

This research is significant in the current context as Sri Lanka is moving ahead with developing infrastructure facilities including highways and other roads. The rapid increase of the importation of vehicles into the country, unplanned traffic direction and underdeveloped road facilities are also noticeable. These new challenges are emerging in the light of road accidents.

In this background, it is clear that the present law on accident compensation has failed in the objective of promoting the well-being of accident victims without imposing a huge social cost. This approach necessarily discourages litigants of accident victims on the one hand and makes them feel vulnerable even under the statutory regime on the other.

**Methodology**

This research adopts a comparative study with other selected jurisdictions which are New Zealand and South Africa. The rational for selecting these jurisdictions is the similarity of the salient features of these legal systems and Sri Lanka and the significant development that has been taken place in the law of accident compensation in these countries for the welfare of the accident victims and smooth administration of the system. For this purpose comparative case law, relevant statutes, law journals and e-based legal documents will be used.

**Outcome**

When analyzing other jurisdictions, the scheme established in New Zealand for accident compensation is very significant as it has replaced the entire tort system for personal injuries. It is clear that the law reformists in a welfare society wanted the principled norms of tort liability to impart to a novel system and create new social contact among the society other than personalization of liability for accidents. However, the significance that can be observed in this regard in South Africa is that although they have opted to create a statutory based Fund called Road Accident Fund, it needs to be proved on the part of the defendant. Considering the drawbacks of the standards of liability in this system, law reformists have been convinced of the need to establish a non-fault based system of benefits operated by the Road Accident Benefit Scheme (RABS) as part of the Comprehensive Social Security system in the South Africa.

**Conclusion**

It is clear that major jurisdictions in this regard have adopted norms of social contact for redressing road accident victims rather than an individualistic approach based on proof of fault. For the operation of the system, they have opted to statute based social security schemes which are more accessible and guarantee a quick remedy. It is recommended that Sri Lanka too should establish this kind of a general social security scheme for road accident victims without taxing them with complicated legal procedure.

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Freedom of Contract vs. Exemption Clauses: A need for Predictability

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Background

The notion of freedom of contract is a fundamental one that gives parties right to incorporate any term they desire. As a result, contracts consist of terms to limit or exclude liability of one party to the contract. Such a party who gained by the inclusion of exemption clause (EC) has been generally the stronger party to the contract and it was even worse in standard form contracts. A large number of cases in this area of law resulted in the formulation of certain principles in dealing with them. Nevertheless it is hard to see some uniformity in the cases decided. Parliament intervened to regulate the EC and thus, the Unfair Contracts Terms Act 1977 of the UK (UCTA–UK) or the similar Unfair Contracts Terms Act No.26 of 1997 of Sri Lanka (UCTA–SL) were enacted and attempted to resolve certain issues by introducing the test of reasonableness into the law. However, have all the uncertainties been settled, and are these statutes striking a balance between the principle of freedom of contract and abuse of it by the acceptance of EC are the questions to be analyzed.

Under the common law the offeror is not under any obligation to draw the attention of the offeree to certain terms in the contract unless such terms are printed in such a manner so as to mislead a reasonably careful businessman, as decided in Roe v. R.A.Naylor Ltd. [1971]. However, when a contractual document is accepted by signing by the offeree, he cannot plead that he was ignorant with regard to certain terms unless there was fraud or misrepresentation, and that the knowledge of the contents of a document will be presumed if the contract was signed, as in L’Estrange v. F.Graucob[1934]. It can be noticed that more unreasonable or unusual the EC is, the greater the insistence by the court that the EC be drawn to the attention of the other party explicitly by printing in red with a red hand pointing to it. This red hand rule was found in Spurling v. Bradshaw Ltd [1956] and endorsed later by Lord Denning MR in Thornton v. Shoe Lane Parking Ltd. [1971] In the Australian case of MacRobertson Miller Airline Services v. Commissioner of State Taxation (WA) [1975]. It was suggested that if an unreasonable clause is included in a printed contract that is not read, and is not likely to be read, there is no acceptance for that clause. L’Estrange v. Graucob was followed by the HC of Australia in Toll (FGCT) Pty Ltd. v. Alphapharm Pty Ltd. [2004] by emphasizing that if a party to a contract has not read and understood all the terms, but signed is nevertheless committed to the EC contained therein by the act of signature. Still for all, one cannot come to a conclusion that when a signature is put by a party that he is bound by it because it may be interpreted as misrepresentation and it is important to note at this juncture the decision to this effect in the famous laundry case of Curtis v. Chemical Cleaning and Dying Co [1951]. After 1977 all the cases were subjected to the test of reasonableness put forwarded by the UCTA–UK. The latest development can be seen in Trident Turboprop (Dublin) Ltd v. First Flight Couriers Ltd [2009] in which international supply contracts excluding liability
for misrepresentation and the right to rescind were held not subject to the requirement of reasonableness.

It was said that the courts ‘lean against them’ when they interpret EC and therefore it was possible for a party to escape from liability only when the EC was clear and precise. This is known as contra proferentum and was adopted in many cases including Hollier v. Rambler Motors (AMC) Ltd. [1972]. Further, courts have been clear in not accepting EC that were introduced into the contract unilaterally after it was made and this includes exemption clauses found in a receipt. (Cases of Chapelton v. Barry [1940], Olley v. Marlborough Court Ltd. [1949] and Thornton v. Shoe Lane Parking Ltd [1971] are referred.)

In addition to the above common law rules, the doctrine of fundamental breach brought in great amount of uncertainty in the area of EC. This is said to be a rule of construction (and not a rule of law) and emphasize that the EC should not be constructed in a way to protect a party who suggested that such EC to be inserted into the contract if that party has committed a breach that went to the fundamentals of the contract, unless the EC was clear enough to indicate the intention of the parties that they wanted the EC to apply even in such an event. Although this was settled in the cases of Alexander v. Railway Executive [1951], Karsales (Harrow) Ltd v. Wallis [1956], Suisse Atlantique Societed’ Armement Maritime SA v. N.W.Rotterdamsche Kolen Centrade [1967] and Farnworth Finance Facilities Ltd v. Attryde [1970], a controversy arose after the judgement by HL in Photo Productions Ltd. v. Securicor Transport Ltd. [1980] which was after the enactment of the UCTA–UK. The court re-affirmed that the question whether and to what extent an EC is to be applied to a fundamental breach or to any breach of contract is a matter of construction of the contract and gave the judgement in favour of the defendant whose business was providing security services but relied on EC for the negligence of its own employees. How the EC of the defendant in this case passed the requirement of reasonableness is a question despite the fact that both parties are commercial entities. Courts were unsettled on the aspect as to who should prove that there was fundamental breach or not. In Woolmer v. Delmer Price Ltd [1955] and Spurling v. Bradshaw [1956] it was held that it was on the party who claims EC and contra decision can be found in Hunt and Winterbotham Ltd. v. BRC Parcels Ltd. [1962] and in some shipping cases.

The UCTA–UK does not apply to all the contracts and is only piecemeal to deal with unfair EC although the title is Unfair Contract Terms. It applies mainly to business liabilities and the Schedule 1 to the Act contains a list of contracts to which certain sections of the Act do not apply. After the enactment of the Act it is no longer possible to exclude or restrict liability in negligence for personal injury or death, s.2 (1). Further, if a party suffer losses or there are damages resulting from a contract that has exemption clause restricting liability, such an exemption clause is void unless it is fair and reasonable, having regard to the circumstances known to the parties when the contract was made, s.2(2). The requirement of reasonableness was a subject for consideration in many recent cases including Britvic Soft Drinks Ltd v Messer UK Ltd [2002]. This case is an example for the application of UCTA-UK in the context of consumer protection and the court held that the supplier’s exclusion of liability for s.14 of Sale of Goods Act 1979 was unreasonable.
It is to be noted that the UCTA-UK did not eliminate the rules created by the common law. When the liability of EC is on the basis of misrepresentation, the Misrepresentation Act 1967 is applied. Another step in UK relating to controls upon EC is also found in Unfair Terms in Consumer Contracts Regulations 1999 of the EU. Sri Lankan courts did not have the opportunity to analyse any cases relating to EC.

Methodology
A qualitative method is used in this study.

Findings
While Law of Contracts is left to be decided by common law, the intervention by way of statute in relation to EC is seen in prohibiting or regulating certain types of contracts and not by making rules that can be applied to all types of contracts. The large number of complex situations and different issues within the small area of EC warrants that it is high time to codify rules that can be applied to all contracts whenever parties include EC while having in mind that a balance should be maintained between freedom of contract and very liberal ECs. A balance is also to be maintained in ensuring that the business communities who have no alternative other than making a standard form contact are not discouraged while the consumer interest is retained.
The Impact of Advertisements on Consumers: A Comparative Analysis of Consumer Laws in Sri Lanka

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Introduction

Consumer rights law in this age of globalization has generated new challenges for policy makers to ensure a stable and sustainable community. At the same time, the familiar doctrine ‘let the buyer beware’ is no longer the case with the introduction of consumer rights law. Most manufacturers or marketers introduce a product through television channels, newspapers, world wide websites, notices, exhibitions, and brochures. Advertisements are considered to be the most popular tool for introducing a new product as well as promoting an existing product. Thus, advertisements are expected to bring a positive aspect in the way a consumer would make his decision about the product. At this point, it provides an opportunity to the manufacturers/marketers to divulge prodigiously about the products they produce or market. It should be noted that according to the law of contract, advertisements are considered as mere trade puffing or exaggeration. However, if the advertisements mislead or had induced viewers to purchase a product or engage a service the misrepresentation law will apply. Further, advertising a product should ensure fairness and the free flow of truthful information which depend on credibility and trustworthiness on the part of the advertiser exponent of advertising law. As per Belch and Belch and Ohanian, credibility refers to the extent to which the source is perceived as possessing the expertise required for the communication of the topic and can be trusted to give an objective opinion on the subject. Expertise is derived from knowledge of the subject, and trustworthiness refers to the honesty and believability of the source (McGinnies and Ward 1980). Those dimensions of source expertise and trustworthiness are important to conceptualizing credibility that has been shown to be influential in persuading consumers. Consumers vary in size and knowledge and it is human psychology that influences decision making. Advertisements can target a group of children, teenagers, women or the public at large. However, it is noteworthy what Franki J’s stated in Annand and Thompson v Trade Practices Commission that “the question is to be tested by the effect on a person not particularly intelligent or well informed but perhaps of less than average intelligence and background knowledge […]. The question is not whether the purchaser was deceived but whether the conduct was misleading or deceptive”.


2 (1979) 25 ALR 91
The Consumer Affairs Authority Act No. 9 of 2003 has provisions that protect consumers from misleading/deceptive trade practices by traders. However, the relevant provisions of the above Act needed proper implementation with regard to the advertisements. Many countries including USA, Singapore and India have regulations and laws to protect consumers from false/deceptive advertisements by establishing regulatory bodies to assess the standard of an advertisement.

**Objectives**

This research tries to identify how false or deceptive advertisements can have an impact on consumers and their rights and suggests the most suitable mechanism to be adopted to overcome these situations.

**Methodology**

The necessary data and information for this research study is mainly based on secondary sources. A number of published articles, books, journals and decided cases have been used and analyzed to conduct this research. In addition, many internet articles and web sites have also been referred to for this work. The major analytical method of the study is descriptive and qualitative.

**Findings**

Communicational and technological advancements have led consumers to easily access information on many products and services. Further, telemarketing and telesales services also promote products and services between business to business and businesses to consumers. These advancements have both positive and negative impacts on consumers. The influence of advertisements in consumers’ choice is indubitable. In many occasions, advertisements have deluded the consumers by using various unethical tactics, inaccuracy, ambiguity or excessive information by omitting important and necessary information. Even though, consumer protection laws are wide enough to protect consumers from various market behaviors, it is observed that advertisements have an immense impact on consumer behavior. False or deceptive advertisements negatively impact consumers in various ways. Further, advertisements have induced buyers to consume the required goods and services more and have prevented consumers from buying a product/service of good quality. The manufacturers/marketers also have opportunity to raise the actual price of products. In addition, advertisements also have led to health issues. As these are considered to be unfair trade practices regulation is necessary to assess the credibility and trustworthiness of advertisements. The current statutes in Sri Lanka do very little in this regard and it is said that there is no specific advertising laws in Sri Lanka.

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3 There is no specific legislation deal with advertisements in Sri Lanka, some other statutes will be applicable, such as Intellectual Property Act 2003 which prohibit advertisement infringing Copyright, Trade Marks and ‘Passing Off’ products of others; National Authority on Tobacco and Alcohol Act No 27 of 2006 ban advertising Tobacco and Alcohol; the Cosmetics, Devices and Drugs Act No. 27 of 1980, and Regulation framed there under forbid Obscene and pornographic advertisement: for more details Weerasooriya, W., (2010) A Textbook of Commercial Law (Business Law), Postgraduate Institute of Management, University of Sri Jayewardenepura.
However, this situation varies in other countries. For instance, the USA, National Advertising Division (NAD) and the Children Advertising Review Unit (CARU)\(^4\) review national advertisements for the truthfulness and accuracy and foster public confidence in the credibility of advertising. Similarly, in Singapore Consumer Association of Singapore (CASE) and the Advertising Standards Authority of Singapore (ASAS)\(^5\) are functioning to review advertisements. Likewise, Advertising Standards Council of India (ASCI) tries to inculcate self-regulation among its members and it has drawn up a comprehensive advertising code for self-regulation. In India, during the financial year 2003-2004, ASCI received 182 complaints, out of which 123 were upheld; in 94 cases of these the advertisements were withdrawn or modified. Similarly, in 2010 ASAS has received 34 complaints in the beauty industry and of those 7 firms were asked to withdraw their ads. It is the policy maker to consider what mechanism should be adopted to assess the credibility and trustworthiness of the representation put forward by the marketer/manufacturer.

**Recommendations**

One of the ultimate objectives of advertisements is to increase sales turnover and to make maximum profit. Consumers needs vary and can focus on products or services. Thus, advertisements are considered to be the best method to reach the consumer, while well they can hugely impact on consumer rights. For instance, an increase in false advertisement in the beauty industry and the health product is worrisome. The challenge for policy makers is to determine how best to regulate advertisements as they are interconnected with the interest of the consumers. Credibility and trustworthiness should be assessed before advertising a product. For this purpose some kind of mechanism or authority should be adopted to avoid misleading or unacceptable advertisements. It also noted that the policy is towards safeguarding consumer rights; the advertiser will not be encouraged. On the other hand, the focus should not be on the advertiser suppressing consumer rights. A via media to balance the interest of both consumer and advertiser is necessarily in the long term interest of economic development. The Consumer Affairs Authority has the legal authority to initiate legal actions against traders who mislead consumers. It is productive if there is a separate authority with the inclusion of members from many organizations such as government agencies, advertising agencies, media owners and other supporting agencies to evaluate and assess advertisements and constantly instruct advertisers to self-regulate their advertisements. This would mean ‘regulate yourself or someone else will’ as prevalent in some countries.

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A Critical Evaluation of the Application of ‘Public Purpose Rule’ in the Compulsory Acquisition of Lands in Sri Lanka

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Background
The compulsory acquisition of privately owned land by the State exercising its right of eminent domain has been identified as a principle which coexists with the well known conception of absolutism of private property. It is a common feature in most of the jurisdictions, particularly in countries like India, United States of America, Australia, South Africa etc. to allow such right of the State to be exercised subject to the pre qualification that such acquisition should be for a “public purpose”. The Land Acquisition Act (as amended) No. 09 of 1950 (LAA) which facilitates the compulsory acquisition of lands in Sri Lanka is no exception to this common practice. The expression “public purpose” has been identified as incapable of a precise and rigid definition. What is meant by the term “public purpose” may vary from one society to another based on the socio, economic and political concepts that prevail in such a society. Even within a society, the term “public purpose” may take different shapes at different times. Therefore, the State or effectively the government of the day has been identified as the appropriate authority to decide whether a particular purpose is a public purpose or not.

Though public purpose provides the basic justification for the State interference with private property rights, the vagueness of the definition provided in the LAA and the limitless expansionary capacity of the term “public purpose” have resulted in the arbitrary exercise of power in relation to land acquisition. Ministers and other government officials have sought to make use of the public purpose rule for acquisition of land, driven by personal reasons and ulterior motives.

The emerging phase in the Sri Lankan economy with regard to infrastructure developments indubitably necessitates large scale land acquisitions. Thus, the existing position in relation to the public purpose rule would have to be understood in the light of the welfare notion of the state as adopted in Sri Lanka. Furthermore, the power of the executive to deprive people of their land to which they are intimately connected as individuals and as a community, based on the justification of “public purpose” would easily be misinterpreted and may result in the creation of unrest among different communities.

Hypothesis
The apparent vagueness of the definition given to the term “public purpose” in the LAA may be identified as an attempt to allow the public purpose rule to be developed and changed in accordance with the spirit of the times and the needs of the society. But such a vague definition together with the accepted notion that the determination of the public purpose aspect of the acquisition process is a policy decision to be taken by the executive, which should not be subjected to the scrutiny and observation of the judiciary, has limited
the ability of the public purpose rule to be developed in accordance with the needs of the society. The judicial approach towards issues involving acquisition of land has been to address the grievances of the affected parties by looking into the facts of each case and to develop ad hoc principles regarding the public purpose rule and its application rather than developing a framework within which such a rule may be applied.

In order to ensure a proper balance of interests between the individual property rights and rights of the State, it is hypothesized that the existing law in relation to public purpose rule in land acquisition process be amended in order to grant solidity to such rule and for such purpose the importance of establishing a mechanism of scrutiny and observation by an independent third party would also be addressed in this study.

**Outcome**

The expected outcome of this study is to identify the manner in which the public purpose rule has been applied in the Sri Lankan context as a justification for the exercise of rights of eminent domain by the State. This study further aims to identify the positive features and the developments in relation to the public purpose rule as witnessed in other jurisdictions which have a similar legal framework in relation to the land acquisition process. Based on such developments, this study intends to propose recommendations to the existing legal framework in Sri Lanka as to the public purpose rule.

**Methodology**

This research will be conducted as a literature review based on the secondary sources including statutes, text books, electronic databases, journals etc. In order to ensure that the situation in Sri Lanka is understood in the light of the international developments in this regard, this study will carry out a comparative analysis of the law and practice relating to acquisition of land in India and South Africa.

**Conclusions**

The issues pertaining to the compulsory acquisition of land by the State would be an important element in the development of a sustainable land policy which would ultimately result in sustainable communities. Therefore, it would be important to amend the public purpose element in the land acquisition process in order to ensure that such a rule is capable of being developed and changed in accordance with the needs of the society.

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Should Positive Prescription on Land be Swept Away from the Sri Lankan Legal System as a Result of Introducing a Torrance System?

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Background

Positive prescription is not an unfamiliar concept to Sri Lankan land law. The history of this concept dates back to Roman days when it had originated as a mode of acquiring land ownership under Roman Land law. Positive prescription became part of Sri Lankan land law when Roman-Dutch law was received by the Sri Lankan legal system. However, Roman-Dutch law principles on positive prescription were changed and abolished by way of introduction of English law in 1871. Thus current Sri Lankan law on positive prescription is a mixture of both Roman-Dutch and English law principles. Prescription Ordinance 1871 contains specific provisions to regulate law relating to acquiring land ownership by adverse possession. By fulfilling these requirements an adverse possessor can acquire ownership to a plot of land.

The registration of documents system was introduced to Sri Lanka in 1863. There were previous attempts to introduce Title Registration to Sri Lanka; registration of documents system prevailed till 1998 as none of these attempts were successful. Title Registration Act which is operational now was enacted in 1998. The Act is currently being implemented in various parts of the country and is expected to be fully implemented by the year 2020, and till then, both systems will function as parallels. Registration of prescriptive title to a land based on adverse possession is accepted under registration of documents system and, Prescription Ordinance and Registration of Documents Ordinance were functional together without any conflict. Nevertheless, law of positive prescription was abolished by section 57 of Registration of title Act in 1998. Consequently prescription will not be considered as a method of acquiring ownership to lands in Sri Lanka after Torrance system is fully implemented. This paper intends to research whether this is essential and justifiable in a Torrance system and also whether Sri Lanka should abolish prescriptive ownership to land entirely. The paper would also bring suggestions to amend section 57 of registration of title act of 1998.

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1 Scope of this paper is limited to positive prescription on land
2 Terunnanse v Menike (1895) 1 NLR 200, Dabare v Martelis Appu (1901) 5 NLR 210, Fernando v Wijesooriya (1947) 48 NLR 320, Perera v Ranatunge (1964) 66 NLR 337
3 Regulation No. 13 of 1822, Ordinance No 08 of 1834, Prescription Ordinance No 22 of 1871
4 Section 03 of Ordinance No 22 of 1871 as amended by Ordinance No 2 of 1889
5 Ordinance No 8 of 1863, Ordinance No 3 of 1865, Ordinance No 14 of 1891, Ordinance No 23 of 1927
6 Ordinance No 8 of 1863, Ordinance No 3 of 1907
7 Some areas in Central and Southern provinces
Methodology

A comparative study method will be adopted to observe the possibilities of applying law of positive prescription in a Torrance system. Two similar legal systems, South Africa and Scotland are the preferable counterparts for the purpose as legal writers and judges in a few cases had mentioned that these three jurisdictions share common mixed legal systems. According Carry Miller, all three systems’ development of the law occurs through similar forms of law making. Thus a comparative research on these three legal systems is justifiable and findings could help to reach a better conclusion.

Outcome

Scotland

The positive prescription in Scotland is regulated by Prescription and Limitation (Scotland) Act 1973. Section I of the Act states: “A land possessed for a continuous period of ten years, openly, peaceably and without any judicial interruption will be entitled for prescriptive title”. The validity of such a title becomes unchallengeable if prescribed proceedings stated in the Act are followed in order to acquire the title. Development of positive prescription was mainly done by the Scottish legislature and bringing down the required period of adverse possession from forty years to ten years was a significant amendment which came about over the years. It is worth to spell out Para 3.8 of the Scottish Law commission discussion paper on “Land Registration: Void and Voidable Titles” which reads as follows;

“A positive system of registration of title is no substitute for positive prescription. Prescription makes a void title good beyond challenge. Registration of title makes it good but challengeable”

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9 Kodeeswaran v The Attorney General (1971) 72 NLR 337 Lord Diplock , Silva v Mohamedu (1916) 19 NLR 426 Pereira J in Fernando v Perera (1914) 18 NLR 150, 151 ,


11 Section 1 of Prescription and Limitation (Scotland) Act 1973

12 Johnston, Prescription and Limitation Para 1.26

In Scotland registration of rights to land is regulated by Land Registration (Scotland) Act 1979. This Act provides opportunity to register interests of possessors to a land even before they are entitled to bring a claim on positive prescriptive right to such land.\textsuperscript{14}

South Africa

The South African law on positive prescription is regulated by Prescription Act 68 of 1969. According to section 1 of the Act, “A person shall by prescription become the owner of a thing which he has possessed openly as if he were the owner….for an interrupted period of thirty years.....” Though this Act replaced some common law requirements\textsuperscript{15} stated in the previous Act\textsuperscript{16}, South African law still holds slightly adjusted common law requirements on positive prescription. Van der Merwe commenting on current law on positive prescription in South Africa, states that nothing more or less is needed for prescription than \textit{possessio civilis}.\textsuperscript{17} However, unlike its counterparts, positive prescription is not quite common in South Africa as a method of acquiring ownership. There could be two possible reasons for this trend. One could be the requirement of thirty year possessory period which is only ten both in Sri Lanka and Scotland. The other could be the Section 25 of South African constitution which protects right to property\textsuperscript{18} including right to lands. Section 25 of the constitution secures and protects land owners rights inter alia. However, positive prescription being a less popular mode of acquiring property in South Africa, its legal system still recognizes positive prescription as a pure form of original acquisition.\textsuperscript{19}

\textbf{Conclusion}

Though positive prescription gives the impression that it is an unfair and unjust method of acquisition of ownership, it contains deep and wide underlying principles. It is a fact that concepts such as positive prescription are regulated according to the domestic laws of each selected jurisdiction. However as this is a unique common law concept, legal framework on positive prescription in these three jurisdictions can benefit from each other.

Sri Lanka is a country with a mixed jurisdiction in which Roman-Dutch common law plays a major role. With the outcome of this comparative research, it will be proven that there is no stipulation to abolish law of positive prescription entirely from Sri Lankan legal system. If there is a need, if at all it should happen with reasonable justification but not merely because there is a need to implement Torrance system in the country. Most importantly, acquiring ownership by prescriptive possession is not based on owner’s faulty ownership at the time of the possessor’s entry. Similarly, the possessor need not

\textsuperscript{14} Section 1 of Prescription and Limitation (Scotland) Act 1973
\textsuperscript{15} \textit{nec vi, nec calm, nec precario}
\textsuperscript{16} Prescription Act 18 of 1943, s 2(1)
\textsuperscript{17} C G van der Merwe “Original Acquisition of Ownership” in R Zimmermann and D Visser (eds) \textit{Southern Cross: Civil Law and Common Law in South Africa}, 702-717 at 716
\textsuperscript{18} Constitution of the Republic of South Africa, Act 108 of 1996
have any title to the land at the entry. Therefore there is no need to abolish law of positive
prescription, just because the owner of a plot receives a title certificate under new
Registration of Title Act. There is a need to amend the existing law on positive
prescription so both systems can operate smoothly without any conflict, but there is no
need to sweep it away from our legal system especially without valid grounds.
Domestic Workers’ Rights in Sri Lanka - Work Like Any Other, Work Like No Other: Need for a Legislative Intervention

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Background
The phrase ‘work like any other, work like no other’ taken from the ILO Report on Domestic Workers is used in this paper in the context of domestic workers performing their work similar to other workers, but domestic workers are not protected by labour legislation, while other workers are protected. As the plight of the domestic workers has transformed from a domestic issue to global concern, the International Labour Organization (ILO) has adopted a Convention Concerning Decent Work for Domestic Workers (Convention No.189) on 16 June 2011. The Convention provides for working hours, minimum wages, overtime payment, daily and weekly rest, paid annual leave, social security, maternity protection, safe and healthy working environment, trade union rights and protection from all forms of abuse, harassment and violence. The Convention will come into force twelve months after the ratification of two members of the ILO. It is believed that Uruguay may ratify the Convention soon, and become the first member to ratify the Convention. However, as Sri Lanka is a state party to all important human rights conventions of the United Nations and core conventions of the ILO which protect the basic rights and interests of all workers, it has an obligation to protect the rights and interests of the domestic workers as well.

Methodology
This paper discusses, in the light of relevant international declarations, recommendations, covenants and conventions, the extent to which labour law regime consisting of legislation, regulations and decided cases protect the rights and interests of domestic workers in Sri Lanka. The scope of this paper is limited to rights and interests of domestic workers in Sri Lanka.

Outcome
Most of the domestic workers are females and children, and they are subject to forced labour, sexual abuse and harassment. The provisions in the Penal Code relating to forced labour, sexual abuse and harassments are applicable to all, including domestic workers. The Employment of Women, Young Persons and Children Act provides that minimum age for employment is fourteen years, and minimum age for hazardous nature of employments is eighteen years. The Act is also applicable to domestic workers without any distinction. A regulation gazetted under the Act provides that a young person who has attained the age of fourteen years but is under age of eighteen years cannot be employed as a domestic worker in such a manner to preclude at least three hours of leisure between the hours of 6.00 a.m. and 8.00 p.m. on any day, and enjoying at least seven consecutive days of leisure in every period of four months.
The Industrial Disputes Act is applicable to domestic workers as interpretation to the words ‘workman’, ‘industry’ and ‘industrial dispute’ in the Act would include a domestic worker as well. The Act also provides that relief for unjustified termination of services of a domestic worker is not reinstatement, but compensation. Hence, this provision in the Act also recognizes that domestic workers are covered by the Act.

The question arises whether a domestic worker can make an application to a labour tribunal to recover balance wages or arrears of wages. In *Karunaratne v. Appuhmay*, Pandita-Gunawardene, J. has stated that a workman cannot make application to recover balance wages in arrears *simpliciter*. However, in *Sirisena v. Samson Silva*, Rajaratnam, J. has stated that unpaid wages can be awarded by a labour tribunal when the tribunal makes a just and equitable order for termination of services. In *Wijedeera v. Babyhamy* also Rajaratnam, J. has stated that labour tribunals shall have regard to proved arrears of wages when they make just and equitable orders.

Hence, a domestic worker could recover balance wages or arrears of wages when he couples it with relief for termination of his services. If he wishes to recover balance wages or arrears of wages in *simpliciter* without coupled with relief for termination of services, the appropriate forum would not be a labour tribunal, but the Commissioner of Labour.

The Trade Unions Ordinance provides for registration of trade unions, and rights and immunities of the registered trade unions. Interpretation to the words ‘workman’, ‘trade union’ and ‘trade dispute’ in the Ordinance is broad enough to include domestic workers as well. The Industrial Disputes Act which provides, *inter alia*, for trade union rights of the workmen is also applicable to domestic workers. However, as domestic workers are generally illiterate, singly employed at households and neglected by the society, trade union rights cannot be realistically exercised by them.

The Wages Boards established under the Wages Boards Ordinance determine terms and conditions of employment in the trades covered by the Ordinance. As the word ‘trade’ has commercial connotations it cannot be interpreted to include ‘domestic service’. The Workmen Compensation Ordinance provides for payment of compensation for accidents in employment and occupational diseases. But, the interpretation to the word ‘workman’ provides ‘any person who … works under a contract with an employer for the purposes of his trade or business…’. The words ‘trade’ or ‘business’ in the Ordinance also cannot be interpreted to include ‘domestic service’ within their scope. The Maternity Benefits Ordinance is applicable to woman workers employed in any ‘trade’. Hence, the Maternity Benefits Ordinance is also not applicable to domestic workers.

Domestic workers are expressly excluded from the application of the Payment of Gratuity Act. However, it is possible for them to claim gratuity from a labour tribunal after termination of their services as they are covered by the Industrial Disputes Act. The Employees’ Provident Act is applicable only to the employees in covered employments. However, an Order published by the Minister under the Act expressly excludes domestic service from covered employment for the purpose of the Act. The Employees’ Trust Fund Act provides that the liability of an employer to pay contributions under the Act shall commence after the day fixed in relation to employment by the Minister by order published in the Gazette. However, an Order published by the Minister under the Act expressly excludes domestic service in any household from the application of the Act.
There is no legislation in Sri Lanka to provide for working hours, minimum wages, overtime payment, daily and weekly rest, paid annual leave, social security, maternity protection and safe and healthy working environment for domestic workers.

**Conclusion and Recommendations**

Domestic workers rights are not only a domestic issue, but also an international labour issue. However, the failure of the labour legislation to protect the rights and interests of the domestic workers make them domestic slaves even in the 21st century in a country where religious values have recognized workers’ rights (in the form of employers’ obligations) about 2,500 years ago. Hence, it is suggested to either amend the words that expressly or implicitly exclude the domestic workers from the application of existing labour legislation, or enact a special legislation to protect the rights and interests of the domestic workers.

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Terminating Relationships- Husband and wife, Employer and Employee: A Critique of Sri Lankan Law

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Background

This paper looks at the Sri Lankan legal responses to fractured relationships in the spheres of husband and wife and employer and employee. In examining the husband wife relationship we will confine ourselves to the General Law since an examination of the Special laws and the General Law cannot be done within the scope of a limited piece of writing. In the case of the employer employee relationship we will examine both the statutory and non statutory legal framework.

Justification

It will be argued that in both relationships which have a contractual underpinnings the law adopts an unduly interventionist stance which requires reassessment. Furthermore misconduct or fault looms large in the determination of whether the relationship should be terminated or not. In the marriage relationship the basis of the divorce law is the matrimonial offence principle which has been described as “deep seated in our jurisprudence”\(^1\) The law does not concern itself with whether the relationship between husband and wife is functional or not. The intransigence of the law has led to the “uncontested divorce “which in fact is divorce by mutual consent, a far cry from fault. In the employer employee relationship, once again fault or misconduct is an important factor in determining whether termination is justified. Unlike in the husband wife relationship it is not misconduct alone that justifies the termination of the relationship between employer and employee. Thus a bona fide closing of a business or the downscaling of a business justifies the termination of employment. In the Sri Lankan context such non-disciplinary terminations are strictly regulated and require the approval of the Commissioner of labour unless the employee consents to the termination.\(^2\)

Fault impacts significantly on the ancillary relief that can be obtained in a divorce action. Until 1977 alimony and property settlements could only be granted to the innocent spouse. In the case of alimony moreover it could only be granted to an innocent wife despite some judges observing that this was not a humane practice.\(^3\) The amendments to the Civil Procedure Code paved the way towards de emphasizing fault in relation to alimony and property division.\(^4\) Yet there is no indication that the section is widely used for compensating spouses at the termination of the marriage for their respective contributions.

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1. Tennekoon V Somawathie Perera 1986(1)SLR 90 at p 98.
2. Termination of Employment (Special Provisions) Act no 45 of 1971 section 2(1) a
3. Civil Procedure Code No 2 of 1889 (as amended). See also Ebert v Ebert (1939 40 NLR 388
4. Civil Procedure Code Amending Act No 20 of 1977 section 100 which brought into effect the amended section 615 which does not make any reference to fault in the ordering of conveyances, gross sums of money or annual or monthly sums of money on divorce or separation.
to the marriage. By contrast, in the employer-employee relationship compensation plays a key role. Principles relating to compensation have been developed in the context of both unjustified and justified terminations. In the case of an unjustified disciplinary or non-disciplinary termination a wide array of factors are taken into when awarding compensation. Nevertheless reinstatement remains at least in the statutory framework the preferred remedy. In the case of a justified disciplinary termination usually there is no compensation payable. In the case of a justified non-disciplinary termination compensation is based on social security and social justice. The law recognizes that an employer has a right to re-organize his business but equally an employee should be assured job security.

There is a distinct difference between the procedures involved in a divorce action and those involved in an action for termination of employment. A divorce action like any other ordinary civil action must be by way of plaint and answer. The court cannot grant relief beyond what the plaintiff has claimed. Pleas for matrimonial relief are normally combined with a claim for damages, custody, alimony, maintenance of children and a request for costs. The defendant has a right to answer the allegations and defend himself. An ex parte trial is possible in certain defined circumstances. Evidence maybe given by the petitioner in person, or through an affidavit. At the end of this process judgment will be issued. A decree for divorce must initially be a decree nisi and cannot be made absolute until the expiration of 3 months.

The process discussed above is a formal judicial process and stands in sharp contrast to the procedures involving a disciplinary termination of the employment relationship. It also stands in sharp contrast to the procedure which has to be followed where a termination of employment is sought on non-disciplinary grounds e.g. closure or rationalization of the business. Where there is an unjustified disciplinary termination the principal forum for relief is the labour tribunal. The labour tribunal is required to make all inquiries into the application and hear all such evidence as it considers necessary. Thereafter it can make a just and equitable order.

Significantly the Evidence Ordinance does not apply

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5 Jayasuriya v Sri Lanka State Plantations Corporation (1995)2 SLR 379
6 Caledonian (Ceylon) Tea and Rubber Estates Ltd v Hillman (1978) 79 NLR 421
7 Supra at pp 430-431
8 Civil Procedure Code section Section 40, 73 and 75
9 Ibid section 80 and 81
10 Ibid section 84
11 Ibid section 151 read with section 179.
12 Section 604
13 Industrial Disputes Act no 43 of 1950 section 31C (1)
14 Idem.
in Labour tribunal proceedings\textsuperscript{16} and the tribunal can map out its own procedure. Conciliation and mediation are also entrenched forms of dispute settlement found in the Industrial Disputes Act.\textsuperscript{17} Non disciplinary terminations are dealt with in an out of court setting with the Commissioner of Labour or his representative looking at all the circumstances surrounding the intended termination or the termination.\textsuperscript{18} Where the termination is found to be unwarranted the primary remedy is restoration of the employment.\textsuperscript{19} Yet compensation as we have seen earlier is an alternative that has received judicial sanction.

**Methodology**

Primarily this study will be based on legislation and case law. Law commission reports and other reports will be examined. Additionally books and articles which have looked at the marriage relationship and the employment relationship will be examined.

**Outcome**

The research will demonstrate that the legal responses to the terminated employment relationship or the relationship that is about to be terminated is far more pragmatic than the response to the marriage relationship that is in jeopardy. The procedures applicable in relation to the termination of the employment relationship are moreover more suitable for dealing with the issues arising from such terminations.

**Conclusion**

This research will establish that in relation to both the marriage relationship and the employment relationship the emphasis must be on the viability of the relationship and that of developing processes where the parties themselves are actively involved in resolving the issues arising out of the terminated relationship. If the marriage is found not to be viable then the law must develop policy guidelines on how the matrimonial property is to be divided and how a spouse is to be compensated for marriage generated needs. Similarly if the employment relationship is found to be untenable again the law should look at compensation rather than reinstatement or restoration of the relationship. Can reinstatement work should be the focus of the inquiry. In dealing with terminations that are sought to be justified on the basis of operational requirements the law must be more realistic looking closely at current economic patterns, the nature of the industry or enterprise and the demands of the particular enterprise. The current protectionist legislation may have been meaningful in the context of a closed economy with little or no scope for alternative employment. Its retention today without a modification of its basic tenets must be reexamined.

\textsuperscript{16} Industrial Disputes Act section 36(4)
\textsuperscript{17} Industrial Disputes Act Section 3(1) d and section 4(1)
\textsuperscript{18} Termination of Employment (Special Provisions ) Act No 45 of 1971 section 2
\textsuperscript{19} Ibid section 6
Right of Children to Inherit Parents’ Intestate Property:  
A Critical Analysis in Thesawalamai Law  

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Background

During the early years of British rule, by the proclamation of 23rd September 1799, the continued operation of the Thesawalamai was guaranteed. In the present context, the Constitution of 1978\(^1\) has guaranteed the continued operation of all existing written and unwritten laws after the enactment of the Constitution. Accordingly, Tamil inhabitants of the Northern Province continue to be governed by the Thesawalamai.

Though Thesawalamai has been influenced by many laws, this research will focus on the influence of Roman Dutch Law and Hindu Law. Two waves of immigrants came to Sri Lanka from India. The first immigrants called Malabar came from Malabar Coast. They followed a matriarchal life system. The second wave of immigrants came from Coromandel Coast and with the advent of Aryachakravaty, the Hindu Law was introduced. They followed a patriarchal life system.

The Dutch first codified the customs of Jaffna people and the British codified the Thesawalamai by the Regulation of 1806. In the early days of the British rule the provisions of the Thesawalamai Code was elucidated and supplemented by reference to Hindu Law, but later this policy underwent a change and when customary law was silent, the Roman Dutch law was applied. Since this Code does not provide for all matters in relation to the subject of marriage, the Tamils who are subjected to Thesawalamai are governed by the General Law of marriage in related to certain elements of marriage. However, the Code addresses the issues of matrimonial property. The case law establishes that Tamils governed by the Thesawalamai can contract a valid customary marriage.\(^2\) Yet the provisions relating to age and prohibited relationships in the General Law cannot be circumvented by such a customary marriage.

The earlier position in Hindu Law was that there was no prohibition against a person having more than one wife. Children born to different wives were treated as legitimate. Only a child born to a concubine was treated as an illegitimate child. There is evidence to suggest that a similar practice prevailed in Jaffna during the Dutch period\(^3\).

In the post-Vedic periods, Hinduism rejected the notion of polygamy and it is now considered as immoral. Furthermore, modern laws in relation to family emphasize that spouses must not marry during the subsistence of a valid marriage. Thus, under the Hindu Law and Roman Dutch Law extra marital children are considered as illegitimate children.

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1. Article 16 of 1978 Constitution of Sri Lanka
2. Chellappa Vs Kumaswamy (1915) 18 NLR 435 at page 437
3. MurugupillaivPoothathamby1917 20 NLR at page 204 and section 1 (18) of the Thesawalamai Code
and they have the right to inherit from their mother, but they are deprived of the right to inherit from their father. Thesawalamai Law has also adopted the same approach. Jaffna Matrimonial Right and Inheritance Ordinance reaffirmed the principle of customary law that in the event of parent’s intestacy an illegitimate child could only inherit from the mother not from the father.  

International Conventions, in particular ICCPR and UDHR, emphasize the principle of non-discrimination. Sri Lanka has ratified the Child Right Convention (CRC) and the core principle of this Convention is non-discrimination. However, the state has accepted its commitment to guarantee the rights granted by the Conventions. Furthermore, the Sri Lankan Constitution states that, any form of discrimination on children must be avoided.

The status of the illegitimate children has been improved by the adaptation of Legitimacy Act No. 3 of 1970 and Maintenance Act No. 37 of 1999. Sri Lankan Courts have also adopted the concept of the best interest of the child as a guiding norm. Despite such positive measures, discrimination in the area of inheritance rights continues to exist in Thesawalamai Law.

Similar developments can be found in Republic of South Africa in the area of child rights. In the judgment of Zondi v. President of the Republic of South Africa it has been accepted that extra marital children have the same succession rights as a legitimate child. This judgment was delivered with reference to the Article 09 of the European Convention on the Legal Status of Children Born out of Wedlock 1979.

To protect the children born out of void and voidable marriages, section 16(3) of the Hindu Marriage Act Amendment No 60 of 1976 and the Indian judgments in Jane Antony wife of Antony v.V.M.SiyathVellooparambil and Neelamma & Others v. Sarojamma & others recognise the extra marital children’s inheritance right to intestate property of self-acquired property of the parents. In Sri Lanka, Kandyan law recognises children’s right to intestate inheritance of the acquired property of their father’s intestate property with some limitations.

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4 Section 34 of the Jaffna Matrimonial Right and Inheritance Ordinance 1911
5 Article 2 of the International Covenant on Civil and Political Rights
6 Article 2 of the Universal Declaration of Human Rights
7 Article 27 of the Universal Declaration of Human Rights
8 Article 27(13) of the 1978 Constitution of Sri Lanka
10 (2002) 2 SA 49
11 No 25 of 1955
13 (2006) 9SCC 612
14 The Kandyan Law Ordinance No-93 of 1938 Section-15
Methodology

The research is mainly based on the literature review in relation to the Law of Intestate Succession. The research is particularly based on statutes, academic expressions and judicial decisions. The right of the extra marital children to inherit the property of the father in Hindu Law and Modern Roman Dutch Law are studied with a view to suggest recommendations to change intestate inheritance of extra marital children under the Thesawalamai Law.

Outcome

Jaffna Matrimonial rights and Inheritance Ordinance\textsuperscript{15} discriminates between marital and extra marital children in the area of inheritance and thereby the extra marital children have been made subject to significant disabilities.

The concept of the inheritance right of marital and extra marital children has changed in both Modern Roman Dutch Law and Hindu Law. However, Thesawalamai Law continues to follow the traditional legal norm. Under the CRC a State has a duty to take measure to prevent discrimination imposed on children and a change in the existing law in the area of inheritance is required to grant the right of inheritance to father’s intestate property for extra marital children.

Conclusion and Recommendations

It is a well-known phenomenon that customs and usages should be changed to the extent necessary in order to be in line with the modern legal and social set up. The evolution of traditional norms in relation to Thesawalamai is clearly visible in the way in which the society changed from matriarchal system to patriarchal system. The Dutch altered the Thesawalamai in two ways. They changed it by introducing modifications while codifying the Thesawalamai and also they applied Roman Dutch Law in certain areas. In Jaffna, the majority of the people who are governed by Thesawalamai are Hindus. Accordingly in the present context Thesawalamai could be amended in the area of inheritance right of extra marital children by considering new developments in South Africa and Hindu Law recognizing the extra marital child’s inheritance right to parent’s acquired property. This will help to avoid discrimination as presently witnessed in this area of law.

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Property Rights in Sri Lanka: A Means of Gender Discrimination?

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Background

Property has always been a privilege of a few and not a right of the humankind, and the lack of it makes men and women vulnerable.¹ Those who do not enjoy rights relating to property need the fundamental protection of the law in respect to security of ownership and user rights. Many domestic laws² and international and regional human rights documents³ recognize the rule to respect and guarantee the right to ownership, thus recognizing property as part and parcel of the autonomy and ethical integrity of a person.

However, the very concept of the rule of law, which has been introduced to counter arbitrariness of the powerful, can buttress arbitrariness via discriminatory laws. These laws change property into a ‘means’ to create a distinction among people and suppress the rights of some of them. Patriarchy has effectively used property as a means to disempower and discriminate women through law. Some property laws in Sri Lanka provide illustrations for the point.

Research Problem

Notwithstanding the recognition of gender equality in the national Constitution⁴ and international instruments⁵, an array of discriminatory laws find validity in the Sri Lanka legal system in the guise of legal pluralism and under the protection of Article 16 of the Constitution.

This paper critically analyses a selection of laws and some deeply entrenched social norms prevalent in the country that do not conform to the ideology of gender equality, with the objective of finding whether, in the socio-legal framework of Sri Lanka, ‘property’ denotes a ‘natural right’ vested in humankind which can become a ‘personal right where the

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² For instance the constitutions of the US and South Africa recognize the right against arbitrary deprivation of property.
³ The UDHR Article 17, European Convention for the Protection of Human Rights and Fundamental Freedoms, Protocol 1, s.1, African Charter on Human and Peoples’ Rights, Art.14 are a few examples.
⁴ Sri Lanka Constitution guarantees equality before the law and equal protection of the law, and prohibits discrimination of citizens on the basis, inter alia, of sex (Article 12).
⁵ The UDHR, recognize the right to own property (Article 17) without discrimination on the basis inter alia of sex (Article 2). Non-discrimination in respect of property rights finds recognition in varied forms in other conventions, specifically CEDAW[Art.1,2,3,5,13,15,16 (h)], which has been ratified by Sri Lanka without any reservations.
property is held by one’s own skill and/or work or a means of gender discrimination as in
the pre-historic society where property was vested in men who were naturally stronger.

The main research problem in this article is to critically analyze the underlying basis and
rationale of gender discriminatory provisions in some contemporary property laws in Sri
Lanka and to examine the legitimacy of retaining them in the context where on the one
hand, the Constitution recognizes equality between sexes and on the other, the state, under
several international instruments, is committed to eradicate discrimination on the basis,
inter alia, of sex.

The study reviews the concept of primogeniture in inheritance in the Land Development
Ordinance No.19 of 1935, which applies to all Sri Lankans with regard to state land; the
Matrimonial Rights and Inheritance (Jaffna) Ordinance No. 01 of 1911 with special
emphasis on ss. 6 and 8, which makes it mandatory for a married woman governed by
Tesawalamei to obtain her husband’s consent, which could be replaced by the court’s
authorization in prescribed instances, to alienate her immovable property; ss. 11 and 12 of
the Kandyan Law Ordinance No. 38 of 1939 which recognize discrimination against
Kandyan widows and daughters married in deega; discrimination against females in
respect of intestate succession in Muslim law, which limits women’s entitlement only to a
half of what a male is entitled to; and the influence of the concept of ‘male head-of-
household’, which has gained recognition in some administrative procedures, in respect of
property rights.

The study further explores the historical background of these laws and practices, with the
objective of examining the varied influences that may have impacted the enactment of
these discriminatory laws, and also gains insights from other Sri Lanka laws where
women have been accorded equality through law reform. The analysis is done in light of
philosophical/jurisprudential theories on the one hand and international standards and
obligations on the other.

Methodology

This is a qualitative research based on laws, International Conventions and personal
interviews as primary sources, and published and unpublished work as secondary sources.

Hypothesis/Conclusions

(1) As reflected in the selected laws and social norms in Sri Lanka, rights relating to
property are subjected to restrictions based on gender;

(2) property has been used in Sri Lanka as a demarcation of roles, rights, social and
economic limits, relationships, etc. between men and women in a family,

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6 For instance John Locke (Two Treatises of Government, 1690, bk. 2, ch.5) and Lon Fuller (The Morality
of Law, 1969) recognize property as a basic human right. This view is reflected in the US Bill of Rights,
which recognizes right to life, liberty and property as fundamental human rights.

7 For instance the impact of Christianity, which was introduced to the island concurrent to the introduction
of some laws, and the positivist approach adopted by colonial rulers, the British in particular, and
misrepresentations of local laws and customs by male local leaders to those involved in codifying the laws.

8 Inland Revenue Act No.28 of 1979, Maintenance Act No.37 of 1999, Citizenship (Amendment) Act No.16
of 2003
community or ethnic/religious clan, and also as a powerful and effective means of establishing and/or reinforcing inequality between men and women;

(3) Legitimacy of rights ought to be based on morality and social reality rather than irrational sociological assumptions. Hence, laws which are contrary to these ideologies expressed in international instruments need timely reform.

**Expected Outcome**

Based on the premise that in Sri Lanka, property has been used to reinforce sex discrimination through law, the study emphasizes the necessity to recognize the right to substantial ownership of property with its essential quality of alienability. It proposes that unless the laws are re-written in the language of human rights, and interpreted with the aim of ensuring justice in its substantive meaning, property will continue to play the role of legitimising inequality between men and women of Sri Lanka thus reducing the equality clause of the constitution to a mere facade. It reiterates that while respect to cultural pluralism is integral to the country, it should not be at the expense of violating human dignity, self-worth and fundamental rights.
Muslim Divorced Women’s Right to ‘Mata’a’: A Sri Lankan Perspective

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Background

In the event of the dissolution of marriage, the maintenance of a Muslim divorced woman by the husband is a contentious issue in Sri Lanka and other countries. Although Muslim Law in most countries, including Sri Lanka, recognizes that a divorced wife should be maintained by her husband till the end of idda (waiting) period or if such a woman is pregnant, until she delivers the baby, and till the end of the nursing period of the offspring, this obligation does not extend beyond this stage. Thus, a divorced Muslim woman is worse off than her non-Muslim counterpart who is entitled to alimony. This issue should be considered carefully in the context of Muslim marriage, because a Muslim wife is under an obligation of obedience to the husband, which makes most wives dependents on their husbands. Not only that, this position also leaves divorced Muslim women in a vulnerable position in the community and challenges the sustainability of Sri Lankan Society.

Objective of the Study and Methodology

The objective of this research is to shed new light on the understanding of the concept of ‘Mata’a (compensation for a divorced woman under Islamic law) and to find out the extent to which the Islamic concept of ‘Mata’a’ has been incorporated and interpreted in the Muslim Law of Sri Lanka. It seeks to explore avenues to strengthen the right to Mata’a by investigating its definitions. Moreover, the research explores the efficacy and adequacy of a circular issued in 2005 by Ministry of Justice, giving powers to Quazis enabling them to order for mata’a.

This is a normative/Qualitative research based on secondary data analysis. Therefore, the author will mainly focus on the Holy Quran and Sunnah, statutes, cases and academic findings related to this issue.

Discussion

Islam discourages divorce. The pronouncement of divorce by the husband was condemned by the prophet as ‘the most detestable before God of all permitted things’. However, a man is not prevented from exercising his right to divorce. Therefore the Holy Quaran, in

1 For example, India and Bangladesh.


3 Maintenance of a wife may be forfeited or suspended due to actions on the part of the woman. Mainly, such actions include, ‘Nushuz’ or disobedience of the wife, ‘Riddah’ or apostasy of the wife. Some writers argue that disobedience may even consist in the wife’s leaving of the marital home without the permission of the husband. Hence the wife’s decision-making about her occupation is also limited.
several places, commands the man’s obligation towards his divorced woman.\(^4\) In Sura 2 verse 241 Quran particularly states that, “for divorced women maintenance (should be provided) on a reasonable (scale) [mata um bil ma’roof]. This is a duty on the righteous.” Hence it is apparent that the Holy Quran commands husbands to make provision before releasing divorced women in an honourable way (33:49) with kindness (2:229). Accordingly general ruling\(^5\) could be drawn that under Islamic law (Shari’a) divorced women are entitled to maintenance as a way of reasonable compensation in the event of dissolution of marriage, though Islam does not recognize the concept of alimony.

As mentioned above, though Quran commands for maintenance of divorced women, jurists have adopted various interpretations for the verse 2.241\(^6\). Therefore, the recognition and definition varies in respect of the term ‘Mata’a’. Some countries have recognized the payment of Mata’a in the event of dissolution of marriage, and have incorporated these provisions in their positive laws.\(^7\) However, there are some other countries, namely, India and Bangladesh, where maintenance of divorced wife under Muslim law has not been recognized as a positive rule, and progressive attempts made by the courts to recognize the concept of ‘Mata’a’ have been unsuccessful.\(^8\)

In Sri Lanka, even though the concept of ‘Mata’a has not been recognized by Muslim Marriages and Divorces Act of Sri Lanka (MMDA)\(^9\) there are several interpretations which explain the recognition of concept of ‘Mata’a’ within the Act. One argument is that since the Act does not specify the imposition of ‘Mata’a’, the order for payment of Mata’a is illegal. Another argument is that, even though the Act does not specify the imposition of ‘Mata’a’, it also does not prohibit it, therefore the principle “What is not permitted is

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\(^4\) In Sura Al-Baqarah states; “you will not be blamed [for not paying the dower money] if you divorce women when you have not yet consummated the marriage or fixed a dower money upon them, but make fair provision for them, the affluent according to his means and the straitened according to his means; this is binding on righteous men.”(2:236).

\(^5\) This general rule is debated. There are two interpretations for these sections one is that maintenance for a divorcee could not be paid beyond the period of iddah, which is three months or three menstrual cycles. Any maintenance beyond that period would be illegal. The second interpretation is that the holy Quran has not fixed any time limit for maintenance. Neither the amount of maintenance nor the period has been mentioned. Therefore if a husband does not maintain his wife she can get her maintenance allowance fixed through a court. This fixed maintenance allowance will not only be paid to her as a wife but also after divorce. See A.A.Engineer at pp. 130 & 131.

\(^6\) The Holy Quran (edited by Abdullah Yusuf Ali). But it should be noted that other scholars have translated the word ‘maintenance’ in different ways. They have translated ‘mata’a’ as ‘provision’, ‘something’ etc. They suggest that Mata’a is only a parting gift given voluntarily by the divorcing husband to the divorced wife before she departs, this being considered as an expression of kindness and piety and deemed most laudable. Therefore, these scholars argue that there cannot be a compulsion to husband to pay maintenance since it is a voluntary gift.

\(^7\) Tunisia, Indonesia, Philippines and Egypt are among these countries.


prohibited and what is prohibited, is not permitted” will not apply. Third position is that the concept of ‘Mata’a’ could be recognized within the scope of the Act. Because where the Act is silent the Quazis have the margin of appreciation of Islamic Law as per section 98 (1) & (2) of the Act which clearly state that the rights of the Muslims according to the Muslim Law governing the sect to which the parties belong are not affected by any provision of the Act. There are many cases where ‘Mata’a’ has been ordered based on second and third interpretation mentioned above. Despite the above arguments a circular issued in 2005 by Ministry of Justice gave powers to Quazi’s which enabled them to order for “Mata’a”.

Conclusion

As discussed above, despite the non-incorporation of ruling of divorced Muslim women’s right to claim ‘Mata’a’ in the MMDA, divorced women’s right to ‘Mata’a’ could be protected by Muslim Law of Sri Lanka within the scope of the Act. But the 2005 circular justifies the ordering for ‘Mata’a. But there are inherent problems, as the circular does not introduce any substantive law with regard to Mata’a, contrary views prevail and definition of mata’a is not clear. Since circulars could be challenged and consequently changed, their strength as law is also doubtful. There are other concerns which have been raised with regard to payment of ‘Mata’a’. Firstly, there is no guideline as to how this compensation is given and who is entitled to it. Secondly, with respect to procedural aspects, i.e. since Quazis are not allowed to record the reasons for the ‘Thalak’ (divorce by husband) it is difficult to decide whether all divorced women are entitled to this compensation regardless of their fault. Finally, the assessment of compensation and method of payment have not been uniform, and therefore leaves Quazi with unfettered discretion.

Therefore, the author suggests the following recommendations in order to ensure the rights of divorced women according to Islamic law without violating the rights of the husband: a substantive provision in recognizing the concept of ‘Mata’a’ should be introduced either by a fresh provision to the existing Act or by a new Act to order ‘Mata’a’ in the event of the dissolution of marriage. This compensation should be treated

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10 Fawziya v. Mohideen BQ/3969 QC Gampaha 179/T, the Board of Quazi’s Law Reports (BQLR) Vol:III (2009),pp.70.
11 Haleema v. Rizly (BQ/3862 QC Colombo West 080/T, the Board of Quazi’s Law Reports (BQLR) Vol:II (2008),pp.45. It was held that though provision for ‘Mata’a’ is not enshrined in the MMDA, the concept is enshrined in the Holy Quran and should be prevailed. Further it ruled that the economic status of the husband should be taken into account in ordering ‘Mata’a’.
12 In Sri Lanka the position of the Board of Quazi in confirming the award of ‘Mata’a’ has been recognized in several cases for examples; in case No.3969 (M.S.S. fawziya vs. J. Mohideen Order dated 06.08.2005), Zulfiqar v. Fathima Muneera, decided on 1.12.2007. Board of Quazi, Case No 1769/Mata’a. The Board of Quazis’ Law Reports Volume IV- 2010. MWRAF.
13 Razik v. Ummu Sareena BQ 4074/QC Kuliyapitiya 8114/Main, the Board of Quazi’s Law Reports (BQLR) Vol:III (2009),pp.138. it was held that Quazi’s doesn’t have jurisdiction to order for ‘Mata’a’ on Fasah divorce
as a right of a divorced woman who is divorced unreasonably and given even in ‘fas’ah’ divorce where husband’s misconduct is proved. In the event of ‘Thalak’ by husband, since Quazi cannot record the reasons of ‘Thalak’, a woman should be given an opportunity to prove her innocence to claim compensation. Where the misconduct of either party is not an issue to ‘Thalak’, compensation should be ordered by the Quazi even if the wife defaulted in claiming it. The assessment of the compensation should be determined according to the means of the husband and guidelines for Quazis should be made available. This compensation should be provided as monthly installments or at once, since this has to be considered by taking into consideration the best interest of the divorced wife.

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See Fawziya v. Mohideen BQ/3969 QC Gampaha 179/T, the Board of Quazi’s Law Reports (BQLR) Vol:III (2009),pp.70.
A Proposal for a Dowry Prohibition Law in Sri Lanka: An Assessment in the Light of Indian Dowry Prohibition Act No. 28 of 1961

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Background

Most of the countries including South Asian countries have started to include specific measures into their domestic laws to protect women’s rights in order to comply with international standards. Nonetheless, the tragic situation is that when implementing these laws, the objectives to promote and protect human rights of women are diminished or negated by the impact of some extraneous factors. Those factors are rooted in social, cultural, religious, political and some of other patriarchal social values. ‘Dowry’ is the one of the critical areas which contradicts international standards, but still prevails with the support of above mentioned extraneous factors. The matter of dowry is yet to be addressed by the legislature or the judiciary in Sri Lanka. This paper aims to propose a new policy to prohibit dowry in Sri Lanka in the light of Indian Dowry Prohibition Act of 1961 (hereinafter mentioned as ‘IDPA’).

The Sri Lankan context indicates that dowry has over time transformed into a marriage gift to the bridegroom in all communities. Dowry still prevails in the Sinhala and Tamil communities as a customary requirement and as a legal requirement in the Muslim community under the Islamic religious law in Sri Lanka. Dowry has both social and legal legitimacy in Sri Lanka and most of the times it is openly referred to in marriage advertisements in public newspapers in Sri Lanka. However, this practice of dowry in its manifestation undervalues women and commercializes the marriage relationship. Non-payment of dowry has result in harassment, violence against women, breakdown of spousal relationships and conflict with extended family. In addition, Sri Lankan judiciary has also not taken an effort to consider the matter of the legality or illegality of giving and taking dowry.¹

The dowry problem in India arose out of a complex social situation and it was further strengthened by tradition, myths, and religion. Nevertheless, the most problematic situation in India regarding dowry was that it led to a lot of dowry deaths and bride burning by the groom or his relations. In this scenario, the IDPA had come in to force to protect the rights of women in India in relation to the matter of dowry. The purpose of IDPA is to prohibit the giving and taking of dowry with a view to prevent dowry deaths.²

Although there are some problems relating to its implementation, the IDPA is a remarkable achievement of the legal system of India. As this legislation is enforced in multiple community which bears a gamut of personal laws and religious customs which contradict with the international standards. Therefore, this paper purports to identify the

² Dowry Prohibition Act - 1961, as amended 1984, statement of objects and reasons 1(i), 1(ii)
advantages and disadvantages of the IDPA and propose recommendations for legislative reform to prevent the harmful traditional practices on dowry in Sri Lanka using the Indian model.

Methodology

For the purpose of this paper, salient provisions of the IDPA have been evaluated to discuss its impact on the dowry in the Indian context and to make proposals for a new policy on dowry in Sri Lanka. This research is a qualitative research mainly based on domestic legislation and international conventions. In addition, the paper is sustained by secondary sources which are library and internet research of books, journal articles, relevant statutes and case law of India and Sri Lanka.

Outcome

Although, the IDPA is a benchmark Indian legislation, it has certain problems in its enforcement as it makes both giving and taking of dowry equally liable. This may be the only legislation where both the plaintiff and the defendant are treated as equally guilty. Due to this issue concerning the legal proceedings, brides are not encouraged to litigate as both families are liable in violating the Act.\(^3\) In addition, there are some provisions which are in contradiction with the purpose of the IDPA. The Act defines dowry as ‘any property or valuable security to be given by one party to the other party at or before or any time after the marriage in connection with the marriage’.\(^4\) Accordingly, parties can exchange the property by interpreting these words fraudulently, mentioning that it is ‘without the connection of marriage’. Section 03 of the Act provides the penalty for giving and taking dowry, but it does not include the gifts that are customary in nature. In addition, the Act mentions about the reversal of the dowry to the woman or heirs, but it makes no provision to return the gifts to the bride or her family.\(^5\) Therefore, this can be used as a trick to retain property by the party of the groom as mentioned in Satish Chawla Case.\(^6\)

By considering the overall impact of the Act, the human rights of the women have been violated linguistically by some of the sections of this Act. For example, the section 03 and 04 mentioned that ‘he shall be punishable’ and most of the other sections use the word ‘woman’. If the Act is gender neutral and respects the principle of equality it should not use the words which can be gender biased. Accordingly the Act should be subjected to certain amendments especially in sections 02, 03, 06, 07, 08(B) and 09 to abolish the male dominance and enhance the human rights of women. Therefore, IDPA can be used as guidance in the moderation of a new policy in Sri Lanka. However, the legislature should pay attention to the above mentioned loopholes in the IDPA. Apart from the above mentioned concerns, the IDPA marks a significant stage in the legislative history in a country like India which has assembled plural legal systems. Besides the proposed law to prohibit dowry in Sri Lanka, such an initiative must comply with the fundamental rights


\(^4\) Section.02

\(^5\) Section.06

\(^6\) Supra.03.p.44
which are recognized under Chapter III of the Constitution of 1978 of Sri Lanka, especially with Articles 12(1) and 12(2) which describe the principles of equality and non-discrimination. Moreover, it should comply with the international standards on women’s rights which are described under the Articles 01, 02, and 16 of the CEDAW.7

**Conclusion and Recommendations**

Though Sri Lanka has ratified the CEDAW, there are some hidden malpractices which violate the rights of women in Sri Lanka. Dowry is one of those, which can be identified as a harmful traditional practice in Sri Lanka. The current evidence indicates that this is the time to adopt new laws and policies to eliminate the practice of giving and taking dowry. Though the DPA of India is a legislation to eliminate inequality it has not been implemented in a practical manner because of several factors. However, it is a significant improvement of the legislative history of India. As a concluding remark it is suggested that Sri Lanka should implement a better mechanism to prohibit dowry practices by introducing an effective transformation of law by adopting the DPA of India as a model with certain amendments. Further, it should be emphasized that a policy or a law cannot be realized without infrastructure and commitment. The commitment should be by the government, non-governmental institutions and the community as well. Therefore, solutions need to be implemented at the grass root level.

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The Intersection of Contract Law with IP Law in the Protection of Undisclosed Information: A Sri Lankan Perspective

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Introduction
Knowledge assets have a profound impact on the successes of business in the 21st century. From an economic point of view, the rights associated with any undisclosed information or trade secrets provide its owner an important advantage over other competitors. The term ‘trade secret’ refers to information that is maintained in secrecy and has a commercial value. Trade secrets may include formulas, business methods, recipes, designs, processes and customer lists. It is undeniable that trade secret rights are easier to acquire and lose than any other form of intellectual property (IP) rights. Interestingly, in many cases, business firms rely on contractual obligation to protect their trade secrets and treat such agreements as an effective instrument to prevent their employees walking away with trade secret and joining other competitors. These covenants generally take the form as either non-disclosure agreements or not to compete agreements.

The issue which then arises is whether such restraint of trade agreement is enforceable or not. According to case law jurisprudence of Sri Lanka, the legal position of such agreements is neither very clear nor well settled. This has, of course, triggered certain misconceptions creating clouds of uncertainty in the business environment. In Sri Lanka, Contract Law is a fine blend of the Common Law and the Roman Dutch Law legal principles. English Law recognizes this category of agreements as illegal and void, whereas under the Roman Dutch Law there is no principle that invalidates such contracts. As a result, contracts of restraining trade would be valid as the Common Law of the country is the Roman Dutch Law. Nevertheless, due to the English influence, there is a tendency in Sri Lankan judiciary to recognize these contracts as being unenforceable. In reality though, most employers who own confidential information tend to protect such information through contractual obligations despite the fact that present Intellectual Property Law provides a sound protection for confidential information. In this context, this research aims to investigate whether and to what extent the Contract Law helps businesses to protect their valuable trade secrets.

Objective of the Research and Methodology
The purpose of this research is to analyse the applicability of the restraint of trade agreements for the protection of confidential information in Sri Lanka. This is a qualitative research based on primary and secondary sources. Although the research is

mainly conducted through a literature review, the interview technique is also adopted to ascertain information from companies.

**Discussion/ Outcome**

The Protection of undisclosed information has deep roots in the Law of Equity. According to the equitable doctrine, *he who has received information in confidence shall not take unfair advantage of it.*\(^3\) Arguably, on the one hand, this principle is reinforced by Contract Law via restrictive covenants and labour law through fiduciary obligation/duty of confidentiality. And on the other hand, IP law provisions provide a sound basis for the trade secret protection. Thus, different legal norms intersect in creating a fascinating interface in this area of law. This research addresses this issue, having noticed that the protection of trade secrets and the law relating to restraint of trade are not mutually exclusive, but overlapping. In this context, this is an attempt to address the issue with special reference to protection of trade secrets through employment contracts.

In a typical scenario, an employee undertakes that he or she would not engage in business activities on his own or to enter into an employment contract with his employer’s competitor. This is a common practice of firms where there is a risk of confidential information being divulged by an employee. Generally, an employer cannot prevent an ex-employee from competing with him as it goes against the underlying rationale of Contract Law of promoting the public policy on the one hand and the free trade and competition on the other.

Sri Lankan courts, over the years, have heavily restricted the application of restrictive covenants emphasizing that such agreements must be reasonable and should not unreasonably restrict an employee’s right to continue employment and the ability to make a living. Furthermore, an ex-employee has the right to use his or her general stock of knowledge in exercising his or her profession. However, such a restriction may be justified if it is designed to protect a legitimate business interest such as confidential information, if it is reasonable between parties as well as in the public interest. It is arguable, therefore, that the mere fact that an employer has legitimate interests to protect does not allow the employer to have restraint of trade clause in the contract of employment. It may be reasonable, if the employer can show that it goes no further than it is reasonably necessary for the protection of the trade secret. Hence, each aspect of the clause must be justified in relation to the legitimate business interests. As a rule of thumb, the courts have to consider the scope of the activity, duration, territorial limitation and whether the covenant is fairly design to protect employer’s trade secret. In doing so, courts have to adopt a subjective test. In *Coats Thread Lanka (Pvt) Ltd v. Samarasundara*, J.A.N. de Silva C.J. has lucidly stated the Sri Lankan legal position on restrictive covenants. In that case, the restraint of trade clause in question was declared void as the employee was employed as a mere work study assistant as opposed to a manager or a similar high position making it is unfair to implement the covenant among the contractual parties.\(^4\)

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\(^3\) Lord Denning M.R. in *Seager v Copydex* (1967) 2 All E. R. 417 (CA)
\(^4\) 2011 BLR 37
Although, confidential information is protected under the intellectual property regime, the corporate world has shown an increasing interest in contractual defense to protect its information through confidentiality clauses. One possible explanation for this would be that such clauses provide additional arguments to make a strong case for the employer. Similarly, in order to invoke IP protection, the employer has to prove the criteria set out in Section 160 of the IP Act, No. 36 of 2003.

Conclusion

In analyzing the protection of trade secret through the lens of Contract and IP Law, one would reasonably argue that both regimes are not exclusive but overlapping. Obviously, they are complementary to each other and can stand side by side. From an industrial point of view, confidentiality agreements are the most used instrument in the protection of undisclosed information. The lack of awareness on the use of IP protection for businesses may be responsible for this scenario. All in all, however, neither Contract Law nor trade secret law should exceed its parameters set by sound public policy reasons.

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Finlay Rentokil (Ceylon) Ltd v. Vivekananthan (1995) 2 Sri L R 346

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Seager v Copydex [1967] 2 All E. R. 417 (CA)
Using International Law as an Aid to Construction in order to Protect the Rights of the People: A Sri Lankan Perspective

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Background

A legal system is based on basic norms and values which guarantee smooth functioning of the society it serves. These norms and values reflect communal morals rooted in the natural law tradition and they direct the “Black Letter” legal rules towards social justice. Justice is the ultimate goal of law and in achieving the same, judiciary plays a vital role. The courts fulfill a fundamental role in the process of interpretation. Under the laws of Sri Lanka, only the courts are entitled to give a final and authoritative interpretation of statute law. In the process of interpretation, International Law (IL) is sometimes used to interpret domestic legislation, and judges tend to use IL as a tool of inspiration. In Human Rights and Fundamental Rights (FR) jurisprudence, it can be observed that IL is often used to support the reasoning of cases. But it should be noted that there is a qualitative difference between “using IL as an aid to construction” and “incorporating IL into Municipal Law through judicial actions.”

In a dualist system, it is generally accepted that if IL is not incorporated into the domestic legal system it cannot be used as an aid to construction. Despite such conceptions, some jurists argue that even though an IL convention is unincorporated, if a country has ratified that convention, the judiciary can use it in their interpretation process. Bangalore Principles-1988 are also in support of such arguments. Further it is not realistic to expect the Legislature to provide for all contingencies and eventualities.

In this context this paper attempts to analyze the approach of judiciary of Sri Lanka toward using IL as an aid to construction and it evaluates the hypothesis given below.

The Sri Lankan judiciary does not effectively use IL as an aid to construction to protect the rights of the people.

Further, this paper examines the relevant judicial decisions in the light of Bangalore Principles -1988 and compares the position of selected commonwealth countries to make recommendations.

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1 “Whatever may have been possible in the world of 1945, the complete isolation of constitutional law from dynamic impact of IL is neither possible nor desirable today. That is why national courts... have a duty, so far as possible, to interpret their constitutional texts in a way that is generally harmonious with the basic principles of IL, including fundamental freedoms” Al-Kateb v. Goodwin (2004)HCA 37, Kirby J

2 “It is within the proper nature of the judicial process and well-established judicial functions for national courts to have regard to international obligations which a country undertakes-whether or not they have been incorporated into domestic law-for the purpose of removing ambiguity or uncertainty form, national constitutions, legislation or common law” Principle- 04
Methodology

This is mainly a library based research in which text books, journal articles, landmark judgments and internet information are used.

Outcome

Sri Lanka is a dualist country. IL applies in a dualist legal system, if the country has not only ratified a particular convention or covenant but has also incorporated those into the domestic law. For a convention to operate and be enforceable by individuals within the domestic legal system there must be an enabling Statute, which is a government action by the state incorporating IL norms into domestic law. This action is mandatory in order to grant force of law to such IL in the country. Under Article 4(d) of the 1978 Constitution of Sri Lanka, the state is bound to respect, secure and advance Fundamental Rights (FR) by all organs of the government and under Article 27(15) to Endeavour to foster respect for international law and treaty obligations. When reading above mentioned Articles together, it can be argued that the judiciary is able to ensure the protection of FR while incorporating IL which Sri Lanka has ratified, into domestic law through its creative interpretation.

Ratification is “a positive statement by the government of a country to the world and to the people (of the country) that the executive and its agencies will act in accordance with the Convention.” The purposive approach to interpretation makes this task reliable.

In the case of *Weerawansa v. AG* the court held that Article 27(15) implies that the State must likewise respect IL and treaty obligations in its dealing with its own citizens, particularly when their liberty is involved. The State must afford them the benefit of the safeguards which IL recognizes.

Again in the *Eppawala case* the court endorsed on a broad interpretation of Article 12(1) using International Standards which are regarded as “soft law” and considered purported agreement in the light of the principles set out in the Stockholm and Rio De Janeiro Declarations. This was a very positive move by the Sri Lankan judiciary towards the protection of FR of the citizen of the country. In this case, the Supreme Court insisted that though these IL instruments are regarded as soft law, as a member of the United Nations, Sri Lanka cannot ignore those documents. Further the court stated that “moreover, they would, in my view, be binding if they have been either expressly enacted or become a part of the domestic law by adoption by the superior Courts of record and by the Supreme Court in particular in their decisions.” According to this dictum, it can be argued that the judiciary encouraged the quasi monist system in this case.

In the FR case named *Sanjeewa v. Suraweera* the court referred to Article 12 of the ICCER as an external aid to interpretation and recognized the right of everyone to enjoyment of the

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4 (2000)1 Sri L.R 387
5 *Bulankulama and others v. Secretary, Minister of Industrial Development and others* (2000)3 Sri L.R. 243
6 2000 (3)Sri L R 243, Justice A.R.B.Amarasinghe
7 (2003)1 Sri L.R.317 this case is also known as the Gerald Mervin Perera ‘s case
8 International Covenant on Economic Social and Cultural Rights

164
highest attainable standard of physical and mental health. These cases demonstrate how the Supreme Court plays a creative role without encroaching on the territory of Legislature.

This tendency of using IL as an aid turned in to a different direction in a controversial case named Nallaratnam Sinharasa v. AG\(^9\) where the court held that Sri Lanka’s accession to the Optional Protocol to the ICCPR\(^{10}\) was unconstitutional. It is clear that in this case the Supreme Court has relied on the positivist ideology. Even though this was a legally sound decision, it can be argued that this was a major drawback of Sri Lankan FR Jurisprudence. According to the Presumption that a Statute will not be interpreted so as to violate a rule of IL or International obligation, it can be argued even if Sri Lanka has neither incorporated nor ratified ICCPR, IL norms included in ICCPR may still be applied or used by the courts. This is because the application of Customary IL would impose a duty on Sri Lanka to respect the basic HR norms in terms of protecting rights of people of Sri Lanka. The Indian Supreme Court referred to CEDAW in Vishaka v State of Rajasthan\(^{11}\) and recognized that the International Conventions and Norms are of great significance in the formulation of the domestic law. On that basis the creative role of the judiciary can always be used to serve the purpose of protecting the rights of the people.

**Conclusion**

The above analysis shows that the Sri Lankan judiciary has only in a very few instances used its interpretation process to recognize IL norms to ensure the rights of the people. Particularly in Sinharasa’s case the judiciary has taken a literal approach based on positivism. But the wealth of norms developed at the international arena would definitely enrich the interpretation process and it would help to ensure the protection of rights. This position may be encouraged by a purposive approach. In conclusion, this paper suggests that while taking into account local laws, traditions, circumstances and needs, the judiciary must use its creative role in interpretation; through a purposive approach, it should use IL as an aid to construction and reconciliation of the competing interests in the community and ensure social justice.

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\(^{10}\) International Covenant on Civil and Political Rights

\(^{11}\) 1997 AIR 3011
Fighting against Corruption to Ensure Good Governance through Social Accountability in Sustainable Communities: The Need for an Effective Institutional Mechanism for Sri Lanka

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Background

Many socio-political problems such as the increased cost of living and the waste of public money for various inadequate programmes that we have today directly or indirectly contribute to the existence and growth of corruption. In addition, it leads to increasing criminality, extreme poverty, stifling economic development and ultimately frustrates democracy and good governance. It also hinders social, economic and political potentials in Sri Lanka. In the present context, corruption has become an endemic issue and has many negative impacts for poor people in Sri Lanka. The augmenting nature of corruption is evident according to the increasing rates of the Government Corruption Perception Index of the country. In 2008, Sri Lanka ranked 72 and in 2011 it rose up to 86.¹ The Corruption Perception rate in 2011 is 3.3.

In such a situation, good governance is unattainable. Sri Lanka recently failed to meet the GSP qualifying criteria largely due to its dismal performance in the area of good governance. Good Governance should be participatory, transparent and accountable. It must also be effective, equitable and must promote the rule of law. Good governance ensures that political, social, and economic priorities are based on broad consensus in society and the voices of the poorest and the most vulnerable are heard in the process of decision making over the allocation of resources.²

Sri Lanka has ratified the United Nations Convention Against Corruption in 2004. But the convention does not include a definition of corruption. But in other parts of the convention, there are definitions of some of the main types of corruptions such as bribery and extortion, by both of public officials and private sector, embezzlement, misappropriation of funds and other diversion of property etc.

Sustainable communities are settlements which meet diverse needs of all existing and future residents, contribute to a high quality of life, and offers appropriate ladders of opportunity for household advancement, either locally or through external connections.

¹ The Corruption Perceptions Index ranks countries/territories based on how corrupt their public sector is perceived to be. A country/territory’s score indicates the perceived level of public sector corruption on a scale of 0 – 10, where 0 means that a country is perceived as highly corrupt and 10 means that a country is perceived as very clean. A country’s rank indicates its position relative to the other countries/territories included in the index

They also limit adverse external effects on the environment, society and economy,\textsuperscript{3} thereby ensuring that governance is a key element in sustainable communities.

In this scenario, the objective of this paper is to outline and evaluate corruption and its impacts on good governance in the country. Further, this research has emphasized the necessity of an effective institutional mechanism that focuses on the interdependence of the executive, parliament, judiciary, public institutions, private interests and civil society participation.

**Methodology**

A comprehensive literature survey on this regard had been carried out by the author. The necessary information was gathered from secondary sources accessible and available in the library such as journal articles, textbooks, research and working papers, government publications, newspapers, electronic databases and e–journals. Analyzing of data For the purpose of giving recommendations had been done by the author.

**Outcomes**

According to the survey, most public sector bodies dealing with the public such as Health, Education, Police, Inland Revenue and the Customs are extremely corrupted. The Parliamentary Committee on Public Enterprises (COPE) has revealed that the country had lost a large amount of wealth due to financial malpractices of many state institutions and departments. With regard to the allocation of money, for welfare programmes and other programmes, an imbalance can be seen by respective and responsible authorities in addressing burning issues of the country. In addition, utilized resources have failed to reach service providers or users due to expenditure tracking problems. There is no proper mechanism to monitor the weak initiatives for effective service delivery process. Therefore, service recipients too have encouraged corruption.

Though Sri Lanka has several Non-Governmental Organizations for fighting against corruptions, Commission to Investigate Allegations of Bribery or Corruptions is the only government supported institution. It is difficult to see any government supported institution in provincial council or local government level.

But initiating a public interest litigation process against the privatization of Lanka Marine Services and the Sri Lanka Insurance Corporation are evident in the process of fighting against corruption.

**Conclusion and Recommendations**

Strengthening the right to information law is very important for fighting against corruptions. The right to receive information should be a fundamental right. Then, people have a right to know why certain decisions are taken and why some decisions are not followed. Rulers should keep in mind the fact that they are the only trustees and government is created by the people for the benefit of themselves.

The development outcomes should be equally beneficial for the poor community as well. An intuitional mechanism is required to monitor leakages of public money. For the

\textsuperscript{3} Kearns, A., & Turok, I., Sustainable Communities: Dimensions and challenges, Available at http://www.communities.gov.uk/documents/corporate/pdf/146853.pdf
purpose of fighting corruption, this paper suggests ensuring social responsibility through Participatory Public Expenditure Management (PPEM). For achieving this target budget formulation, budget review, expenditure tracking and performance monitoring are essential.

National level institutions especially those providing basic services such as education, health, the Police, Inland Revenue and Customs can establish their own subsidiaries for fighting against corruptions. It will increase the participation of people in the process of complaint. In addition, by amending already existing legislations involving local government (Municipal Council Ordinance, Urban Council Ordinance and Pradeshiya Sabha Act) can create special branches to deal with complaints on corruption in local government level. Further, strengthening the role of the Ombudsman and giving him specific powers on dealing with complaints against corruptions of public officials will be a progressive step.

Sri Lanka is considered as an aid dependent country. In this context, external financing plays a vital role for formulating the development strategy of the country. Therefore, the mechanism that guarantees an effective use of international aid and investment is essential. Refining existing policies and regulating new policies in order to encourage peoples’ participation will be needed in this issue. The right to be free from corruptions should be considered as a right of the fourth generation.
Selecting an Electoral System to Enhance Representative Democracy and to Respond to Challenges in Sustainable Communities: Proportional, First Past the Post or Mixed System: A Sri Lankan Perspective

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Background
In the modern world, only a democratically elected government will gain the recognition as a legitimate government. A state can enhance representative democracy only by adopting an accurate and appropriate electoral system to their election laws. Presently to meet the challenges of this globalized world, most nations have begun to see the need for a suitable electoral system. Quintessentially parliament must mirror public opinion and each and every democratic state should focus on the integrity of electoral system.

As we are aware, in Sri Lanka, under the Constitutions of Donoughmore, Soulbury and the First Republican Constitution our electoral system was a ‘First Past the Post’ (FPP) system. Under the 1978 Constitution our electoral system has been changed into a ‘proportional representation’ (PR) system.

In this post-conflict era to give a sustainable solution to the ethnic conflict and to sustain democracy the need of enhancing people’s appropriate representation in parliament is essential. Therefore changes to the electoral system are determined as indispensable. So as a result, the main question which dominates the debate on electoral reforms is “should we abandon the present PR system and adopt the FPP system we have experienced previously or adopt some mixed or hybrid system?”

The purpose of this paper is to research on this question which is crucial to the present debates on constitutional reforms necessary to solve the present ethnic conflict and to respond to the challenges in sustainable communities. Accordingly, the main purpose of the author is to analyse the drawbacks and benefits of each systems. Apparently, both systems have failed to enhance the representative democracy in a meaningful way.

Methodology
This study is based on library research. The necessary information was gathered from secondary sources accessible and available in the library such as constitutions, journal articles, text books, research and working papers, government publications, newspapers, electronic databases and e-journals. In addition, for the purpose of providing recommendations for Sri Lanka, the author has done a comparative study using the electoral reforms in Germany, New Zealand and other relevant jurisdictions.

Outcomes
The PR system which is the election system we are familiar with in Sri Lanka is one of “simple plurality” of votes. As a result political parties are able to gain seats in parliament in numbers which do not resemble the votes polled by them nationally.
The proportional representation electoral system introduced by the 1978 Constitution, which makes the candidate dependent on the party for nomination, solidified party loyalty and diminished legislator responsibility to the electorate and voter. In an atmosphere where there was already a lack of internal democracy within parties this has led to the dominance of the party over the processes of nomination. Further, section 99 (13) of the Constitution states that a member of parliament who ceases to be a member of a recognized political party due to resignation, expulsion or any other reason is liable to lose his seat in parliament. This provision further erodes the independence of members of parliament and has enabled the executive, who is a member of the party that commands a majority in parliament, to have greater control of the legislature.¹

Like other former British colonies, Sri Lanka inherited a Westminster model of parliamentary government, with universal suffrage established in 1931 and full general elections in 1947, but over time found that First Past the Post (FPP) elections were incapable of representing minority interests (interests not supported by the majority). Under this system, the candidates who obtain a larger number of votes was declared elected. In this system if no one obtains the larger percentage of votes, a candidate, who only obtains 20% of the votes, will get the chance to be elected. This nature is thoroughly against the representative Democracy. Unless minority candidates compete in multi-member constituencies, they find it difficult to get representation. The possibility of a single party to obtain majority to govern on its own could in turn create an arbitrary government. There can be high degree of unused votes because other than multi-member constituencies minority voters will not show their attention on voting.

**Recommendations and Conclusion**

In 2003 the government appointed a Parliamentary Select Committee on Electoral Reforms which submitted a report in 2004. In 2006 a second committee was appointed to further consider the issue and it presented the interim report in 2007. The report proposes a mixed system (First Past the Post and proportional representation) for parliamentary and provincial council elections and the re-introduction of the ward system for local government elections. The most recent effort to reform the electoral system is as part of the process to formulate a political package to resolve the ethnic conflict through the All Party Representatives Committee (APRC) appointed by His Excellency the President Mahinda Rajapakse in January 2006.

It is clear that both PR and FPP systems have considerable benefits as well as certain drawbacks. Concentrating on those considerable benefits, this paper recommends a mixed or hybrid system which has been recommended by both the “People’s Alliance” and “United National Party” two major political parties in Sri Lanka in their election manifestos in 1994.

In suggesting a hybrid electoral system the study examines examples from Germany which has had substantial debate on electoral reform and has presently adopted a hybrid electoral system. In designing the electoral system of Germany, the framers of the Basic Law had two objectives. First, they sought to re-establish the system of proportional

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representation used during the Weimar Republic. The second objective was to construct a system of single-member districts, like those in the United States. The framers believed that this combination would create an electoral system that would not fragment as the Weimar Republic had and would ensure greater accountability of representatives to their electoral districts. Hence, a hybrid electoral system of personalized proportional representation emerged.

In 1993, almost after a century, New Zealand switched to a mixed-member system (MMS). New democracies like Ecuador, Hungary, Russia, and Taiwan have also adopted "mixed" electoral systems, believed to combine the best of both proportional and majoritarian systems.

Therefore, there is no single "best" system for Sri Lanka; these arguments represent irresolvable value conflicts. For societies which are divided by deep-rooted ethnic or religious differences like Sri Lanka, the mixed or hybrid system may prove more inclusive to enhance representative democracy, to meet challenges among sustainable communities, and to build-up a legitimate democratic government.

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Protection of Human Rights in the Criminal Investigation Process: Special Reference to Suspects’ Right of Freedom from Torture in Sri Lanka

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Background and Objective

The laws governing criminal procedure are based on a compromise between conflicting objectives of policy: on the one hand, effective law enforcement which concerns the security of the community as a whole and on the other, the protection of rights of the suspects. Criminal investigation is vested with the executive. And therefore the enforcement of the current criminal procedure in Sri Lanka is done by officers delegated with such powers. This has resulted in the creation of a tendency of exercising an excessive power during the investigation process. This tendency may get aggravated due to the nature of the criminal procedure adopted in Sri Lanka.

According to the Article 7 of the ICCPR, no one shall be subjected to torture, to cruel, inhuman or degrading treatment or punishment. The Convention against Torture (CAT) strongly discusses the same rights. International instruments as well as the 1978 Sri Lankan Constitutions Section 11 have expressed the same. Despite this setting, we can still see police officers torturing suspects in order to obtain confessions.

The extreme forms of torture used against suspected insurgents have become a habit within police stations and extreme forms of torture are used on persons suspected of petty theft, or even those arrested because of mistaken identity: some examples are Gerald Mervyn Perera case (SC.FR. App. No. 328/2002), the case of B.G. Chamila Bandara Jayaratne (SC. FR.App. No. 484/2003), case of Galappathy Guruge Gresha de Silva, Fr. Aba Costa case, and the case of Mulakandage Lasantha Jagath Kumara (SC. FR. App. No. 471/ 2000). In the case of Gerald Mervyn Perera, the suspected person was arrested because of mistake of identity. He was tortured to such an extent that within a few hours he suffered renal failure and had to be on a life support system for two weeks. Furthermore, there was serious damage to his arms due to hanging from the ceiling of the police station. Moreover, in the well-known case of the murder of 76 years Old Catholic priest Fr. Aba Costa, some suspects were arrested for murder, and within three days it was alleged that they were severely assaulted. Thereafter, they were charged with murder and remanded for a long time. Later on, once the actual criminals had reportedly been found, it was revealed that some senior police officers in the area were involved in the crime. Incidents of this nature happen in the process of Criminal Investigation. For these types of incidents Section 110 (2) of the Code of Criminal Procedure No.15 of 1979 is implicated by indicating police officers for torturing suspects.

Therefore this study seeks to ascertain the nature in which suspects get tortured in the criminal investigation process by police officers and to suggest improvements to the laws relating to this area in order to minimize these types of violations and to protect rights of suspects.
Methodology
The research is mainly based on reviewing literature in the areas of Law of Criminal Procedure and Human Rights law. In Sri Lanka, the research is particularly based on statutes, especially the Code of Criminal procedure No.15 of 1979 and the 1978 Sri Lankan Constitution, Academic Expressions, judicial officers’ ideas and recent judicial decisions. Further this study engages with International Human Rights principles as a whole.

Outcomes
This research reveals that we have sufficient legislation, provisions in constitution and signed International instruments. The problem however is that suspects get tortured in the criminal investigation process. Although there are no major lapses in these laws, discrepancies have occurred during the implementation of the law. This is a critical issue in our process. When comparing a suspects’ situation in the English law, it is different and advanced. British investigation laws are governed by several statues, such as 1984 Police and Criminal Evidence Act (PACE), 1996 Criminal procedure and investigation act and 1985 the prosecution of offence act. In the English law suspects’ human rights are protected from the above statues. Especially 1984 PACE; section 58(8), 28 and 58(1) try to maintain a balance between victims and suspects while PACE gives a suspect the right not to answers all the questions asked by police officers with regard to the alleged crime. It impedes the torturing of suspects in the criminal investigation process (R v. Toney 1993, 1 WLR 364). In 1996, the Criminal Procedure and Investigation Act also provided progressive legal provisions in this context. Its section 23(1) gave powers to the judge to interfere in the investigation. These types of provisions are an encouragement to protect the suspect and to be safe from torturing. There are several reasons for suspects’ torture: inadequate of laws, problems occurring in the implementation of laws, politicization of the police, lack of competence in criminal investigations, lack of awareness and as well as other social cultural and political issues.

Conclusion
To establish a sustainable community it is important to strike a balance between the rights of the society and the rights of the individual suspects. In this scenario, law has a significant role to play. Therefore the rights of the suspect in the criminal investigation process have to be discussed as well. But currently we can see suspects tortured in the criminal investigation process. Therefore, this paper makes certain recommendations in order to avoid such violations: minimizing the impact of other laws and regulations interfering with the investigation process( intended to be conducted by the main code), moving to an inquisitorial system which entails granting more powers to Magistrates for interfere in the investigations, and taking practical actions to protect the rights of suspects.

References

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Background

Justice and security are two significant interrelated components in a sustainable society. Law is a powerful instrument which is used to ensure justice and security to everyone the society. The administration of criminal justice through criminal law aims to control human behavior to the extent needed in maintaining the required degree of individual freedom, safety and social order. Therefore, an effective criminal justice system is of utmost importance in maintaining law and order and ensuring the protection of all the members of society from crimes and criminals. An effective criminal justice system should take care of rights, benefits, and the dignity of a law breaking offender, the victim of a crime, and the society as a whole.

The protection of an offender’s rights and dignity originated from the development of the classical school of criminology which resulted in the establishment of the modern criminal justice system. It was further developed with the emergence of the reformation theory of sociological school of criminology which comprised a human rights approach towards the offender. Under this theory, the offender is viewed as a victim of society who is needed to be fed, clothed and lodged at the expenses of the State. Due to this human rights approach, the accused has the privilege to enjoy the right to equality and equal protection of law, right against ex-post facto laws, protection against double jeopardy, protection against self-incrimination, right to have freedom from unwarranted arrest and detention, right to legal aid and defence and right to speedy trial. According to the policy of the present criminal justice system the victims’ interest is subservient to the interest of the society and the role of the criminal justice system is to help the society as a whole rather than recompense the victim on individualistic basis and bring the law breaker before the court and punish or refer him for rehabilitation. This policy pushed the victim of crime away from the justice process and the victim became a forgotten man in the process. The adversary system which is the traditional and conventional model of the judicial system of trial treats the victims of crime just as a witness. However, there are some modifications incorporated to the traditional adversary system which are favorable to the victims of crime and the inquisitorial system where the victims have some opportunity to participate in the prosecution, do not protect the rights of the victim of crime completely. Therefore, the rights of the victims throughout the criminal justice process have still remained relatively unchanged. This situation demands a great necessity of shifting from defendant-centered criminal justice jurisprudence to the victim-oriented one, where the rights of the victims of crime are fully recognized and provided.

The study intends to establish the strong case of restorative justice with a view to safeguard and provide meaningful justice to the victims of crime and focus on the issue of ensuring justice to them thereby guaranteeing their active participation in criminal justice system.
Methodology

The administration of criminal justice of Sri Lanka has not focused on the above issue adequately. Therefore, the study mainly considers the criminal justice system of Sri Lanka as a sample, to address the issue of the protection of the rights of the victim of crime. The method adopted to conduct the research is extensively based on books, articles, statutory provisions, international instruments and case law relating to the topic. The field research is based only on the interviews conducted with the judicial officers and lawyers from public and private bar.

Outcomes

Theoretically, this study found that modern criminal justice neglects the legitimate needs of victims of crimes: equal protection and fair treatment to protect the interests of the victim of crime are needed; the victims of crime should be given an opportunity for active participation in proceedings; a new sentencing policy should be introduced in order to provide the justice to the victims of crime and such policy should include restitution as an integral part of sentencing.

The study further found that the protection of victim rights and assistance provided to the victims of crime are also not adequately addressed by the substantive criminal law and procedural laws in Sri Lanka. There are no legal provisions to protect the victim of crime, or to empower the court to impose compensation order other than section 17 of the Code of Criminal Procedure Act No 15 of 1979 where the compensation order may be imposed as an ancillary order (Rabo v James 32 New Law Report 91) and the Penal Code (Amendment) Ordinance No 22 of 1995 where the court can impose a compensation order for the sexual offences against women and children as mandatory. The Sri Lankan courts have not tended to order compensation on the State where the offender is not convicted or unidentified or unable to compensate for the victims of crime.

Conclusion and Recommendations

Due to the absence of provisions for ensuring the protection of the rights of the victims of crimes, several substantive and procedural safeguards are required based on restorative justice and victim-centered criminal justice system. The study suggests that the sentencing policy should be changed as to incorporate reparation as an integral part of the prescribed punishment in substantive criminal law; the victim of crimes should be treated equally with the accused and procedural laws should be reformed accordingly; a Criminal Injuries Compensation Board should be established to compensate the victims of crime when the offender is not convicted of the alleged offence, where the offender is unknown, unidentified or cannot be apprehended and where the offender is not in a position to compensate the victim.

Keywords: victim of crimes, restorative justice, criminal justice system, Sri Lanka

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Critical Reflections on Recognising and Enforcing Disability Rights within the Sri Lankan Legal Framework

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Background

The use of law as a response to disability is arguably a recent development in Sri Lanka and is reflected primarily in *The Protection of the Rights of Persons with Disabilities Act* (hereinafter ‘the Act’).\(^1\) Even at a policy level the link made between the responsibility of the State towards disabled people and towards the protection of their rights remains weak. Most measures taken for the improvement of the conditions of disabled people remains both basic in quality and simplistic in its rationale. For instance, in the case of *Ajith CS Perera v Attorney General* (SC/FR) 221/2009 the Supreme Court ordered that the accessibility regulations issued under the Act in 2005 should be implemented. To-date however the implementation of those regulations is far from satisfactory. That example suggests that in the absence of a grounded understanding of the context (including models for understanding disability), law reform will not be effective in improving the enjoyment of disability rights in the country.

Therefore, in re-imagining disability law in Sri Lanka, it is necessary to draw on the existing understandings of the impact of disability on the quality of life of people with disability and the community in general and to also challenge some of those existing understandings. This paper seeks to advance four arguments in that regard.

Methodology

A qualitative method will be employed within a critical methodology in this paper. Martha Nussbaum’s ‘capabilities approach’ as interpreted in relation to the social contract theory, will be drawn on in assessing the nature of responsibility of the Sri Lankan State towards people with disability and in fleshing out the constitutional duties of the State to disabled people particularly under Articles 3 and 4.

Outcomes

The paper seeks to argue for a contextualised approach to legal mobilization regarding the rights of disabled people in Sri Lanka.

- **Responding to challenges relating to ‘Inclusivity’ in Sri Lanka**

It will be argued that the challenges for protecting the dignity of people with disability through law must be located within a broader Sri Lankan context wherein there is a greater challenge of understanding and/or internalizing the value of ‘inclusivity.’ That is a challenge that Sri Lankan society has in many cases failed to undertake. Comparisons will

\(^1\) No 28 of 1996 as amended
be made between inclusivity issues regarding gender and language with disability and what these approaches mean for understandings of ‘difference’ within Sri Lankan society.

It is only through a nuanced understanding of the causes and effects of the general problem of lack of inclusivity in Sri Lankan public life and in the implementation of the public law that a meaningful call can be made for the recognition and protection of the dignity of disabled people and for their inclusion in the ‘mainstream’ of public life.

• **Drawing from different frameworks of reference for understanding disability in the Sri Lankan context**

It is also helpful to understand the influence of the religions and philosophies practiced in Sri Lanka on the general understanding of disability. The different beliefs have resulted in different understandings of the causes of disability and also the responsibility of society towards them. An assessment of that influence will be crucial in developing policies for the recognition of the dignity of disabled people. This task with be assisted through the exploration of contested models for understanding disability such as the bio-medical models and social models of disability, the former viewing the impairment as the cause of barriers, whilst the later understanding the social environmental and relationships to produce exclusion.

• **Constitutional responses**

The Sri Lankan legal system could potentially play a decisive role in promoting the dignity of disabled people in Sri Lanka, particularly within the constitutionally recognised concept of ‘People’s sovereignty’. The general significance of constitutional values, the particular implications of the chapter on fundamental rights and the policy implications stemming from the chapter on directive principles of state policy require close analysis in this regard.

It is submitted that the political values that underlie the Republican Constitutions and particularly the Second Republican Constitution casts an open ended responsibility on the agents of the State to protect and uphold the dignity of the People. Those political aspirations are further reinforced through the constitutional provisions in Articles 3 and 4 which stipulate that in Sri Lanka sovereignty is vested in the People and is inalienable.

Both the chapter on Fundamental Rights and the Directive Principles of State Policy are silent on the rights of the disabled except for Article 12(4) which recognizes the constitutional validity of ‘affirmative action’ for women, children or disabled people. The recent interpretation by the Supreme Court of that provision in the Special Determination of the Local Authorities (Special Provisions) Bill and Local Authorities Elections (Amendment) Bill (07/2010) is problematic and seems to suggest a very narrow interpretation of the same.

Given the lack of specific provisions, the significance of the constitutional values becomes more significant and needs to be explored fully at an academic level so that the judiciary can be convinced of the possibilities that exist within the existing constitutional framework.

The ratification of the Convention on Disability Rights 2006 should also be considered as a matter of urgency. Even though the Supreme Court has recently affirmed the dualist
nature of the Sri Lankan legal system, ratification of the Convention will institutionalize State responsibility with regard to the disabled and therefore create a unique space for legal mobilization for the same.

- Relevance of the ‘rule of law’ to ‘disability’ in Sri Lankan society

The first specific law for disabled people, *The Protection of the Rights of Persons with Disabilities Act* and the regulations that have been issued under that Act provide, in theory, several guarantees for disabled people. However, the legislation and the regulations have not resulted in a significant improvement in the enjoyment of those guarantees.

A specific issue related to rule of law that is relevant to the question of disability rights is that of failures in law reform to bring about any significant improvements in Sri Lankan society. The failures of recently set up institutions and the failures of new legislation illustrate this point. It is essential to understand the causes for the failures in those law reform exercises if the same mistakes are not to be repeated in relation to future legal reform regarding disability rights.

**Conclusion**

Legal recognition for the rights of disabled people is an urgent need. However, the process of legal reform will be meaningful and effective only if it is contextualized and responded to ground realities of Sri Lankan society.

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Responsibility to Rebuild: An Appraisal of the LLRC’s Recommendations Pertaining to Fostering Reconciliation in War-affected Sri Lanka

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Background and Objectives

Sovereignty is no more an absolute right of a State in the contemporary world. Sovereign States possess rights, as well as obligations. Due to this transformation and increased State practice, the international community expects certain behaviour from sovereign States. Accordingly, sovereign authorities are responsible for the safety and wellbeing of their citizens. When they do not provide necessary protection and assistance to affected communities in their countries, the international community increasingly makes interventions to remedy the situation. Since the legitimacy of such interventions is controversial and at times has caused further problems, the International Commission on Interventions and State Sovereignty (ICISS) introduced the ‘Responsibility to Protect’ concept to the world in 2001. Accordingly, sovereign States embrace three types of responsibilities for their citizens: responsibility to prevent, to react, and to rebuild. Under the notion of ‘responsibility to rebuild’, States are obliged to provide, particularly after an armed conflict, full assistance to their citizens with recovery, reconstruction and reconciliation, addressing the root causes of the harmful situation. If the obligations are not discharged by the State concerned, the international community gets involved to protect and assist the affected communities in such a State.

At present, Sri Lanka is transforming from war to peace. The need of the hour is to respond effectively to challenges in sustainable communities. The Government of Sri Lanka (GOSL) attempts to foster reconciliation and to rebuild the war ravaged society. Since the end of the hostilities, the Government has taken several initiatives to achieve the above purposes. The main objective of this research paper is to examine and evaluate the most striking initiative taken by the GOSL pertaining to fostering reconciliation in the war-affected country: the Report of the Lessons Learnt and Reconciliation Commission (LLRC) from a legal point of view. Accordingly, the recommendations of the LLRC’s Report pertaining to reconciliation will be primarily appraised. The recommendations of the LLRC could draw the attention of a wide spectrum of audience locally and internationally. The most prominent observation has been the Resolution adopted by the United Nations Human Rights Council (UNHRC) in March 2012 pertaining to the promotion of the reconciliation and accountability in post-war Sri Lanka. The crux of the Resolution focused on the expeditious implementation of the constructive recommendations made in the LLRC’s Report and to take all necessary additional steps to fulfil the relevant legal obligations of the State in order to ensure accountability and reconciliation for all Sri Lankans. Although the GOSL opposed the adoption of this Resolution, the Government stated that it has already launched appropriate steps to foster reconciliation in the country.
The research problem of this paper is whether the full implementation of the recommendations of the LLRC will foster reconciliation in war affected Sri Lanka and to guarantee the fulfillment of the obligation of the responsibility to rebuild by the Sovereign authorities of Sri Lanka. The main objective of the paper is to examine the sustainability and realisation of the LLRC’s recommendations on fostering reconciliation and nation building in the light of the responsibility of the GOSL under her international obligations. Hence, this paper wishes to discuss the following issues: rationale for appointing the LLRC, reasons for the GOSL’s subsequent reluctance to fully implement the recommendations of the LLRC in the backdrop of the UNHRC’s Sri Lanka Resolution, impact of the LLRC’s recommendations on reconciliation and nation building, obligations of the Government arising out of the LLRC’s Report and the recent influences made by the international community on its full implementation.

**Outcome**

The contribution made by the LLRC through its findings and recommendations cannot be underestimated. The Commission has considered a number of issues that emerged in the context of reconciliation and nation building. It is of the view that resolving all such issues would obviously take time and requires significant resources and financing. The LLRC has further noted that the GOSL has demonstrated readiness and commitment to foster reconciliation and to build national harmony. However, the GOSL must adopt a more engaged and constructive policy in order to realize these objectives. Such a policy will help in meeting the challenges of reconciliation and nation building. Therefore, it is necessary to formulate a holistic vision to achieve the above stated objectives. It requires the involvement of the whole of society.

The outcome of the LLRC appears to be very striking. It has now handed over the responsibility to the State to take necessary steps. Rebuilding a ravaged society cannot be performed immediately and easily. Fostering reconciliation is also a multifaceted process. Therefore, the GOSL should examine the issues at hand diligently. The LLRC considers this as a prime opportunity to forge a consensual way forward to promote reconciliation, amity and cooperation among all communities. Nevertheless, the problem is whether the concrete implementation of the LLRC’s recommendations could satisfy the demands of the international community under the pretext of ‘the responsibility to rebuild’.

**Conclusion**

The notion of responsibility to rebuild is complex. The place for this concept in international law is still not clear. Striking a balance between the primary obligations of a sovereign State and the residual responsibility of the international community is particularly problematic. The legal framework that governs the issue at hand is confusing and uncertain. The case of Sri Lanka itself is complex in nature. The expectations of the affected communities, sincerity of the efforts of the authorities, time and space to be given to a country emerging from conflicts to discharge its obligations are to be discussed carefully. However, Sri Lanka cannot postpone her obligations towards fostering reconciliation and nation building indefinitely. Our country is now in a transitional phase. Healing the wounds marked by the war and capacity building of an affected society cannot be achieved in the short run. The author believes that a sound foundation can be laid to rebuild war torn Sri Lanka through fostering reconciliation and establishing the rule of law.
in the country. In the contemporary international environment, a country cannot sustain being alone. International solidarity is of utmost importance for any country. Therefore, Sri Lanka should thrive to discharge her obligations towards affected communities and to rebuild the nation without further delay by respecting her obligations. The beginning would be the implementation of the constructive recommendations of the LLRC Report.

**Keywords:** State sovereignty, reconciliation, Lessons Learnt and Reconciliation Commission, Responsibility to protect and rebuild

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FACULTY OF
MANAGEMENT AND FINANCE
Message from the Dean

I would like to congratulate paper presenters of the Annual Research Symposium of the University of Colombo-2012. As the premier university of the country, we were able to provide this opportunity for 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 and share their findings and experience with eminent academics in various faculties of the University of Colombo. This year the theme of the conference is converging technologies and sustainable communities. Under this theme, the Faculty of Management and Finance called for papers and after scanning and reviewing selected eight research articles to be presented at this conference. These research papers are in the areas of leadership, gender studies, culture, small business and entrepreneurship, family business and financial management. Once again, I would like to congratulate all these authors and participants of the conference.

Professor H.D. Karunaratne
Dean, Faculty of Management and Finance
Faculty of Management and Finance

Abstracts

2. Unawareness and Unfamiliarity about the Issue ‘Sexual Harassment at the Workplace’: A Case of Sri Lankan Working Women 189
3. Influence of Ethnic and Religious Values on Corporate Culture of Small and Medium Enterprises (SME) in Sri Lanka 192
4. Nonstandard Work and Structural Arrangements: Implications for Work Organizations 195
5. A Framework on Delineating Family-Controlled Businesses (FCBs) from Nonfamily-Controlled Businesses (NFCBs): A Sri Lankan Approach 197
6. Gender and Leadership: The Case of Presidential Election 2010 200
7. The Role of Democratic Leadership Communication towards Organizational Performance: The Case Study of a Sri Lankan Public Hospital 204
Colonialism in Democracy: a Study of the State Budgeting Process in Sri Lanka

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This study explores the role of the state budgeting system in exerting control over utilization of resources in the delivery of services by state sector organizations. This research is based on the observation that state budgets are currently used merely to control public sector expenditure within limits approved by the Parliament. This concurs with the theoretical explanation on the budget’s role of resource allocation (Wildavsky 1975). However, this paper questions whether a state budget can operate neglecting its role of controlling the provision of public services using such resources.

Currently, state budgets are prepared on PPBS (Planning, Programme, Budgeting System) approach and this paper argues that it is a good approach in allocating and controlling resource utilization in providing public services but in Sri Lanka, due to colonial legacies, the state budget deviates from the aspect of controlling public services, rendering the state budgeting practice merely a ritual.

Data for this research are obtained mainly from the analysis of current and archival documents and semi-structured interviews. Data are analysed on the basis of Gramsci’s (1971) hegemonic analysis. Findings of this research are useful to policy makers in finding direction for improving budgetary control over public services and in enhancing the knowledge of accounting.

Background

Currently, in Sri Lanka state sector organizations are controlled by bureaucratic rules as well as political directions in that the role of the budget is limited to show the allocated amount of expenditure. Existing literature recognizes the budget’s technical as well as social roles within organizational contexts. Technically, budgets operate as a tool in allocating and controlling the use of economic resources and exerting control over operations (Wildavski, 1974). In a social analysis, budgeting is recognized to be implicated in the construction of social reality rather than being a passive mirror of technical reality (Cooper et al., 1981; Covaleski and Dirsmith, 1986, 1988; Lindblom, 1959; and Wildavsky, 1964, 1975, 1979). Budgeting sometimes becomes a ritual or ceremony (Olsen, 1970). In the Sri Lankan context, state budget operates as a ritual (Abeysinghe, 2009, 2010).

Research Problem

The PPBS in its form supports democratic political interests. However, the state budget in Sri Lanka operates merely as a ritual and is underpinned by legacies of its past colonial rule (Abeysinghe, 2010). This paper addresses the problem of whether the deviation from intentions of PPBS has aggravated the practice of state budgeting merely as a ritual.
Literature
Budgets emerged in early 19th Century as a means of aligning interests of managers with that of employers (Hopper and Armstrong, 1991). State budget is an “attempt to allocate financial resources through political processes to serve differing human purposes” (Wildavsky, 1975). State budget links financial resources and human behaviour to accomplish the state’s policy objectives (Wildavsky, 1964). When state budget negotiations become political, formalities, state budgeting become ‘rituals of reasons’; in that ‘demands for, compilations and presentations of budget documents are carried out to give the impression that goal directed and rationalistic actions take place’ (Czarniawska-Joerges and Jacobsson, 1989). In developing countries budgets become mere routine responses, and are considered a rule bound mechanical process divorced from day-to-day management and operational control (Hoque and Hopper, 1994, Uddin and Hopper, 2001, Uddin and Tsamenyi, 2005).

Theory and Conceptual Framework
Hegemonic analysis of Antonio Gramsci (1971) explains how a dominant political group uses the state in exerting its dominance over the rest of society through state sector institutions. Budgeting in such a system becomes a tool of communicating political interests to bureaucrats, who operate as deputies of rulers, and a means of controlling the operation of public services for intended political purposes. The conceptual framework of the research is constructed on this theoretical foundation.

Research Method
Data needed for this research encompass colonial intentions of state budgeting and colonial state budgeting practice in Ceylon before independence, change of political interests post-independence, a political analysis of contents of PPBS, content of current state budget and opinions of current state budget setters and users. Sources for such data are archival sources, parliamentary publications, records and views of officials of the National Budget Department of the Treasury and officials of the Sri Lank Railway Department. Such data were obtained through content analysis of related documents and semi-structured interviews with relevant officials. Data were analyzed through referring to the conceptual framework described in the previous section.

Results
Results of the research reveal that the state budget in Sri Lanka still serves colonial interests of controlling public service expenditure rather than controlling the provision of public services. This is contrary to postcolonial democratic political interests, which is interested in the latter. Therefore in Sri Lanka, the state budgeting system does not serve the state’s intentions.

Contribution
Outcomes of the research may contribute to state policy making by communicating the need for a revision of state budgeting system in order to ensure a better control over public service operations. This paper contributes to the theory showing how hegemonic analysis can be used to better understand state accounting issues. This can lead to more research on exploring other state sector management control issues.
References


Sexual harassment at the workplace is an issue that has gained a lot of awareness around the world during the last four decades. While the few studies that do exist in Sri Lanka have indicated a high prevalence of the problem in Sri Lankan workplaces (e.g. Adikaram, 2005, 2010; Wijayatilake and Zachariya, 2001), whether employees are actually aware of this issue and the concept of sexual harassment at workplaces in Sri Lanka still remains a mystery. Prior research clearly indicates that when people are aware of the issue, more behaviours would be considered as sexual harassment, than when they are unaware of the issue (Brewis, 2001; Pickerill, Jackson, and Newman, 2006). This identification of behavior as sexual harassment, in turn, will determine how people construct the meaning of the term and how they react to such behaviours.

Thus, the main intention of the present paper is to explore how aware and familiar women employees of Sri Lanka are about the issue of ‘sexual harassment at the workplace’, as well as how knowledgeable and aware they are about the various legislations and anti sexual harassment policies that exist in the country and their organizations.

The main study from which this article is drawn, explored the meaning construction process of the notion of ‘sexual harassment at workplaces’, based on the social constructionist philosophical premise, and employing the grounded theory strategy of inquiry (Chamaz, 2003). Data for the present study was collected through 40 individual interviews and 4 focus group discussions of 4 to 5 respondents each. Purposive sampling at the initial stages of data collection and theoretical sampling in the successive stages was employed. The data analysis started simultaneously with data collection and thus with the first interview. In line with the process specified in the grounded theory approach, data were collected and analyzed in two main stages as open coding and selective coding (Charmaz, 2003).

The study revealed that although there is an increased consciousness and lack of tolerance regarding violence against women in Sri Lanka in the recent past (Jayaweera, 2002), respondents awareness about various forms of violence are clearly not sufficient. Some respondents have not even heard of the term ‘sexual harassment at workplaces’. Some have heard of the term, but not relating to workplaces. Some respondents were very quick to assume it to be sexual harassment in buses, because, that maybe the most common and frequent harassment of a sexual nature they had faced. There were also a number of respondents, who thought sexual harassment means more severe behaviours of a sexual nature such as physical acts. Few respondents were also of the view that sexual harassment is rape or sexual assault.
It was thought worthwhile to delve deeper and uncover why these respondents are not aware of the issue. Generally, publicity given to the issue is found to heighten people’s awareness and sensitivity about the issue (Pickerill et al., 2006). As research indicates, in many Western countries, which are considered to have individualistic cultures, much concern exists about women’s rights and extensive discussion appears in the media about the issue of sexual harassment (Sigal et al., 2005). On the contrary, it is stated that in collectivist cultures less publicity is given to the issue, and discussion of the issue in the media is low due to their concern about social harmony and group cooperation. As publicity on issues such as sexual harassment can harm these collectivist beliefs, open discussions of the issue are avoided. Having a collectivist culture, it appears that, in Sri Lanka, publicity given to the issue is very low.

In Sri Lanka when and if publicity is given to the issue, it is about more severe incidents of harassment such as rape or assault than everyday occurrences of sexual harassment. Attesting this fact, when talking about their understanding and awareness of the notion of sexual harassment, many respondents stated about the rape and assault incidents they have read in newspapers or heard/seen on television. Furthermore, issues such as sexual harassment being considered a taboo in cultures such as Sri Lanka, and the existence of cultural norms expecting women to confirm to feminine identity by showing sexual ignorance and not speaking freely about sex, sexuality, and eroticism, (Tambiah, 1996) might also have led to this unawareness.

It was also interesting to note that the respondents were also unaware and thus were not knowledgeable about the law that prohibits sexual harassment in Sri Lanka (Penal Code (Amendment) Act No.22 of 1995). At the same time, almost all the respondents whose organizations had anti sexual harassment policies stated that they were not aware of the contents of the policies, and sometimes even the existence of the policies.

All in all, the study indicated respondents’ unawareness and unfamiliarity with the whole issue of sexual harassment. This, in turn, clearly has significant implications for the way in which they construct the meaning of ‘sexual harassment’. There is a greater possibility for respondents to identify and think of a few behaviours as constituting sexual harassment as well as not to acknowledge and label instances of sexual harassment even when they experiences them. Furthermore, with this unawareness and ignorance, victims will tend to overlook and be passive when reacting to many instances of sexual harassment.

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Penal Code (Amendment) Act No.22 of 1995


Influence of Ethnic and Religious Values on Corporate Culture of Small and Medium Enterprises (SME) in Sri Lanka

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Many management writers argue that the problems faced by SMEs are due to no corporate culture for SMEs. Although most of the large organizations manage their business activities in a systematic way; in contrast small and medium scale organizations by nature are very informal and managed on a trial and error method. Large organizations develop a management system to achieve their plans and the system in general is called corporate culture. SMEs too have their own way of doing/managing organizations. By nature of SME’s owner and manager may be same person. Hence the owner manages the business the way he wants. The management system is mainly an outcome of his personal value system. Can anyone consider it as corporate culture? Is it his personal culture? There is a question of existence of a corporate/organization culture within small and medium scale businesses. This is the main focus of this research.

Culture and entrepreneur culture

A person’s behavior is culture bounded. As an individual belong to particular community or society his behavior is governed by the culture of that community or society. In other words culture is mindset of group of people (Hofstede 1984). An enterprise culture is the set of values, attitudes and beliefs supporting the exercise in the community of independent entrepreneurial behavior in a business context (Gibb 1987). It is clear that culture of an organization is a combination of societal and enterprise culture. The next issue is whether the SMEs have organizational culture or individual culture. Further as the SMEs are owned and managed by one person or a family it is clear that culture of SME is influenced by their individual behavior and it more or less close to the culture of the community which he belongs.

Corporate culture

Corporate culture has been defined as “as an interdependent set of beliefs, values, way of behaving, and tools for living that are so common in a community that they tend to perpetuate themselves: sometimes over long periods of time. This continuity is the product of a variety of social forces that are frequently subtle, bordering on invisible, through which people learn a group’s norms and values, are rewarded when they accept them, and are ostracized when they do not” (Kotter and Heskett. 1991).

This definition indicates that corporate culture is the group culture or community culture. Meanwhile the definition for organizational culture too seems to be same. “An organization’s culture describes the part of its internal environment that incorporates a set of assumptions, beliefs, and values that organizational members share and use to guide their functioning” (Shein1990). One can raise a question as to whether there is a difference between organizational culture and corporate culture? It is clear that these two terms have been used interchangeably to give the same meaning. Moreover, what was
apparent from the literature review was a clear gap, the lack of reference as to the effects of organizational culture on the development of SMEs.

**The Aim of the Research**

The aim of this research study is to examine how SMEs do their businesses and to understand whether they have a common (as a business group) behavior pattern and to what extent that common behavior pattern is influenced by their ethnic and religious values.

**Justification for the Research**

Although there is a great volume of research examining corporate culture, very little empirical research has been conducted to examine cultures of small and medium-sized organizations (Choueke and Armstrong, 2000). There is an underlying assumption in the literature that the aspects of culture that characterize large corporations apply to the same extent in small and medium-sized enterprises (SMEs). Some researchers argue that the findings concerning corporate culture may not be applicable to small organizations because of fundamental differences between large and small organizations (Dandridge, 1979; Julien, 1995; Welsh and White, 1981). This reveals that there is a theoretical and research gap in relation to the organizational culture of the SME sector.

Further except the research of (Gamini Alwis and R. Senadhiraja. 2003) there is no research related to organizational culture of SME’s in Sri Lanka. One of the objectives of this paper is to fill the theoretical, research and empirical gap about organizational culture of SME’s in Sri Lanka by identifying the existence of organization/corporate culture among SMEs.

**Methodology**


The researcher followed the grounded theory principle and basically the study is a qualitative research. The method of data collection will be in-depth interviews. For the purpose of in-depth interviews 10 entrepreneurs from different ethnic and religious groups (Buddhist, Christian, Hindu, Islamic, Sinhalese, Tamil and Muslims) will be selected on a stratified sampling method. For the analysis the researcher used the cause and effect concept.
Research Conclusions and Recommendations

The researcher was able to find many common values among SMEs to justify that they have a common behavior (corporate culture) based on common values. Further it was able to conclude that in Sri Lanka SMEs corporate culture is more influenced by religious values rather than ethnic values.

Contribution to Theoretical Knowledge

The researcher challenged the Hofstede (1990) model of understanding the formation of organizational behavior. According to that model organizational culture influences personal culture but personal culture would not influence organizational culture. The researcher showed that there is an interaction between these two cultures and organizational behavior is an outcome of this interaction between these two cultures. This argument is congruent with ideas of previous researchers like Lucas-Bachert (2001) and Swindler (1986). Western researchers argue that a religion like Buddhism will not support business activities (Yarnall, 2000, Dana, 1995). The research findings show that it is difficult to accept that argument fully.

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Nonstandard Work and Structural Arrangements: Implications for
Work Organizations

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Labor market surveys around the globe clearly give evidence of rising numbers of nonstandard workers (Fu, 2012; Houseman & Osawa, 2003; McCourt and Eldridge, 2003; Ozeki & Wakisaka, 2006; Wooden and Warren, 2003), while proving the increasing adaptation and facilitation of nonstandard work arrangements in the work organizations. Further, the trend toward greater use of nonstandard work is likely to continue (Gleason, 2006). Nonstandard work, which is also known as ‘non-regular work’ (Fu, 2012), ‘contingent work’, (Barker and Christensen, 1998; Lundy, Roberts, and Becker, 2006), or ‘shadow work’ (Gleason, 2006), continue to evolve in response to global economic challenges and consequent employer decisions (Zeytinglu and Cooke, 2002). Strategic staffing (integrating nonstandard workers into corporate plan) (Christensen, 1998) proves that arranging nonstandard work within organizations has become a strategic decision (Ghosh, Willinger, and Ghosh, 2009).

Structural arrangements within organizations determine organizational and individual performance outcomes (efficiency - profitability, productivity, market standing - morale, adaptability etc.) (Pugh and Hickson, 2007), internal health (Nadler and Tushman, 1984), and thus, assure proper functioning of organizations. Division of work, grouping of work, standardization, formalization, centralization or decentralization, and coordination and integration become focal concepts in arranging work effectively. The role structures (or different configurations) would be resultant to such arrangements (Mintzberg, 1979). Thus, the knowledge of diverse structural arrangements for work within organizations informs organizational practitioners the better use of their workforce. Ample writings in management and organization studies have been devoted to theorization and empiricism-based discussions of structural arrangements of standard (or regular) work in organizations. Structural dimensions, contextual dimensions, contingencies, configurations (Pugh and Hickson, 2007; Mintzberg, 1979; 1989; Donaldson, 2002; Burns and Stalker, 1961; Lawrence and Lorsch, 1967) stand to be some of the examples for them. However, the structural dimensions those facilitate or accommodate nonstandard work at work organizations remains yet to be investigated. The present study attempts to fill this void.

Accordingly, the research question addressed in this study is: What type of organizational structures would facilitate nonstandard work arrangements in work organizations. At the present stage, it is conducted as a review, which examines the theoretical underpinnings that would inform possible directions for understanding the structural dimensions and diverse configurations of nonstandard work. This review basically composites two sections, namely, the literature related to occupational categories, nature and characteristics, and functional, numerical, temporal and spatial flexibilities of nonstandard

195
work (Atkinson, 1984; Blyton, 1998; Lahteenmak, 2002; Skorstad, 2009; Smith, 1997; Voudouris, 2007), and the theoretical background of structural dimensions and organizational configurations.

This search will lead to reveal possible structural arrangements for nonstandard work, thus providing implications for organizational practitioners for better configuring their work organizations still adhering to cost effectiveness, while allowing diverse work styles for workers.

In line with that, converging two research areas such as nonstandard work arrangements and organizational structure, this study makes two major contributions to the existing practice and theory. First, it accords attention to the structural imperatives in designing nonstandard work arrangements. Moreover, the possibility of new arrangements of nonstandard work with new configurations (or role structures) will be suggested. Second, it opens avenues for researching into new directions of structural arrangements for diverse working styles.

**Keywords:** nonstandard work, organizational structure, configuration, flexibility

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Defining the object of study is the first and most obvious challenge in many social sciences and it is commonly applied to family-controlled business (FCB) studies as well. Although some scholars have made many contributory efforts to resolve the definitional problems of FCBs (e.g., Westhead and Cowling, 1999; Astrachan, Klein and Smyrnios, 2002; Miller, Le Bretton-Miller, Lester, and Cannella, 2007; Mroczkowski and Tanewski, 2007), the problem still remains. Miller et al (2007) stress that lack of definitional clarity remains in FCBs because they can range from mom and pop shops to large conglomerates. Shanker and Astrachan (1996) underline that though people intuitively recognize FCBs, even the experts in the field find difficulty in precisely defining FCBs. Astrachan et al. (2002) suggest that one way of overcoming this problem, especially in empirical research, is to specify levels and types of relationships as well as kinship ties of involved persons and another way is to provide from the outset a clear and concise definition of what is meant by a family. Allouche, Amann, Jaussaud and Kurashina (2008) hold the view that a consensus definition may not represent a pertinent research goal because, by nature, FCBs are contingent on the institutional and legal contexts, which differs from country to country. However, the absence of consensus regarding the definition of a family business makes it difficult or impossible to compare different family business studies in particular in an international context where families and cultures differ not only across geographical boundaries but also over time (Astrachan et al., 2002) and researchers seek more studies to resolve this lack of definitional clarity (Chua, Chrisman and Sharma, 1999). With this in mind, this study aims to address the lack of definitional clarity by exploring the ownership pattern of Sri Lankan businesses using Sri Lanka Accounting Standards.

With regard to Asia, Khan (2003) highlights that the predominant form of large and medium scale enterprises in developing Asia are family-controlled or family-owned. Similar evidence was found in Sri Lanka by Senaratne and Gunaratne (2007) that the ownership structure of Sri Lankan companies is largely characterized by family-controlled, pyramid, cross-holdings, with the controlling shareholder usually being another corporate entity. Listed companies in the Sri Lankan share market were used for the study.

Ownership control is a catalyst factor in delineating family controlled businesses from non-family controlled businesses. Existent literature suggests that a company is considered to have a controlling shareholder if a company or an individual directly or indirectly holds 20% or more of its shares (La Porta et al., 1999; Claessens et al., 2000). Sri Lanka Accounting Standards (LKAS) 28 also assumes that if a company owns 20% of shares in another company the former is presumed to have a significant influence over the financial and operating decisions of the latter. The idea behind using this threshold level is that this is usually enough to have effective control of a firm (Senaratne and Gunaratne,
2007), but at this level of ownership a company could have a single controlling owner or multiple controlling owners. Accordingly, three main shareholders can be identified in Sri Lankan companies at 20% threshold level, namely: Family, closely-held and nonfamily firms. However, prevalence of control-enhancing mechanisms highlights the hazardous problem of using ownership as a sole criterion for defining a FCB. The problem of ownership led to the development of a concept of “Control” ((Mroczkowski and Tanewski, 2007). According to LKAS 27, control is the power to govern financial and operating policies of an entity so as to obtain benefits from its activities and it is presumed to exist when the parent owns directly or indirectly through subsidiaries, more than half of voting powers of the entity or exceptionally by four means as specified in the standard. This gives rise to the concept of Power over Control (POC) of the firm which clarifies the means of achieving the ultimate control of it either directly or indirectly.

According to Mroczkowski and Tanewski (2000), participation of a dominant individual in the FCBs is an important aspect when the definition on FCB is based on the concept of “control” which is the capacity to dominate in decision making. Cyert and March argued that Dominant coalition (DC) is intended to include the powerful actors in an organization who control the overall organizational agenda (as cited in Chua, Chrisman and Sharma, 1999, p.18). Therefore, it is essential to identify the party who is exercising POC of the firm through a DC which is a group of shareholders who exert significant influence over it. In this process, family closely-held and nonfamily firms with significant influence are thoroughly investigated in order to trace their ultimate controlling parties under the concepts of POC and DC so that they can be grouped either as FCBs or NFCBs subsequently.

According to Chua, Chrisman and Sharma (1999), the list of controlling owners includes an individual (I), a nuclear family (NF), two persons unrelated by blood or marriage etc. and those definitions that are based on family ownership unanimously consider ownership by a nuclear family to be a qualifying ownership pattern. However, still some remarkable studies have defined firms as Family Business when there are individuals (For instance, Miller et al., 2007; Srear and Thesmar, 2007; Villalonga and Amit, 2006 etc.) and even extended families (EFs) (For instance, Yammeesri, 2004). Thus, controlling owner of a FCB may be three folds: I/I(s), NF/NF(s) or EF/EF(s). The defining framework is shown in Figure 1.

**Keywords:** Family Businesses, Definitional Problem, Ownership, Control, Framework
Figure 1: Framework on Delineating Family Controlled Businesses from Non Family Controlled Businesses

Public Quoted Companies

Ownership with Significant Influence

Non-Family/(s)

Family/(s)

Non-Family-/s)

Family/(s)

“POC” and “DC”

Family/(s)

or

Family/(s)

or

Family/(s)

or

I/ I/(s)

NCBs

EF/ EF(s)

NF/ NF(s)

or
Gender and Leadership: The Case of Presidential Election 2010

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Introduction
Research has shown that people perceive a good leader in terms of masculine characteristics (Butterfield and Grinnell, 1998; Powell and Butterfield, 2011; Powell, Butterfield, and Parent, 2002; van Engen and Willemsen, 2004). However, recent researchers and thought leaders argue that leaders and managers should be androgyny, a person who has strong masculine and feminine qualities (van Engen and Willemsen, 2004).

The main research questions this exploratory study addresses were what the young Sri Lanka voters consider as the ideal characteristics in their political leaders and whether their choice in the election matches the ideal characteristics. Whilst the image of the leader does play a part (Butterfield and Prasad, 1989), it should however be noted that factors such as campaign issues, campaign strategy, the opponent, and economy play a role in the determination of the election of a President (Butterfield and Prasad, 1989).

Methodology
This survey was carried out prior to the 2010 Presidential election on January 15, 2010. Four questionnaires were used. First questionnaire was to obtain the description of a “good president” (ideal) in terms of masculine and feminine characteristics. Second was to describe presidential candidate Mr. Mahinda Rajapakse. Third was to describe Presidential candidate Mr. Sarath Fonseka. Fourth was to describe former President Ms. Chandrika B. Kumaratunga. The four types of questionnaires were mixed and distributed to students in the researcher’s undergraduate class.

Bem’s Sex Role Index (1981) consisting of 60 items was used to measure masculine and feminine characteristics. The 60 items in the four questionnaires were identical, only the preamble differed in each type of the questionnaire. Questionnaire consisted of 20 items to measure masculine characteristics, 20 items to measure feminine characteristics and 20 neutral items. Scale items were measured on a response scale ranging from 1 (“never or almost never true”) to 7 (“always or almost true”). The 20 items for masculinity were averaged to create a single score ($\alpha = .77$) and similarly a single score was created for femininity ($\alpha = .83$).

Convenience sampling method was used. Each participant was given only one questionnaire. Sample size was 78 (a 100% response rate). The sample consisted of 10 males and 68 females of the age of 23 years.

Results
Paired samples and independent samples t-tests were used for analyses. The mean scores for each of the masculine and feminine characteristics for the two Presidential candidates, former President and the Good President are shown in Tables 1 and 2.

Paired sample t-test was used to test if the masculine and feminine scores were statistically significantly different for each of the two Presidential candidates, former President and the
Good President. The results show that “Good President” was described in more masculine than in feminine characteristics (see Figure 1). Results also showed that each of the two Presidential candidates was scored higher in masculine than in feminine characteristics (see Figure 1). Further, Ms. Kumaratunga was described as being more masculine than feminine, although her scores for masculine characteristics were the lowest as compared to the main two Presidential candidates and the “Good President” (see Figure 1).

Independent samples t-tests were used to test if the masculine and feminine scores of the two Presidential candidates and the former preside were significantly different from the respective scores of the Good president and from each other. The score for feminine characteristics of Presidential candidate Mr. Sarath Fonseka were statistically significantly lower than the scores obtained for Good President and Mr. Mahinda Rajapakse and not significantly different from Ms. Kumaratunga. His masculine score was not statistically significantly different from Good president and Mr. Rajapakse but significantly higher than that of Ms. Kumaratunga (see Figure 1). Hence, Mr. Sarath Fonseka did not meet the expectations of a Good Presidents in terms of feminine characteristics. The expectations of a Good President were also not met by Ms. Kumaratunga (t-test results for both masculine and feminine scores were significantly lower). Another interesting finding was that the respondents perceived Ms. Kumaratunga, a female, as having lower feminine characteristics than Mr. Mahinda Rajapakse, and similar to Mr. Sarath Fonseka (see Figures 1). However, the perceived masculine (5.29) and feminine (4.65) characteristics scores of Mr. Mahinda Rajapakse were not statistically significantly different from the perception of a Good President (5.24 and 4.69 respectively). Hence, he matched the characteristics of a Good President in terms of masculine and feminine characteristics.

Discussion and Conclusion
The results of the study indicated that a good leader is described as being more masculine than feminine. Further, irrespective of gender, the former President and the two main presidential candidates were also described as more masculine than feminine. This study’s results are similar to other study results in Western countries (e.g., Butterfield and colleagues). Even though researchers have put forth that leaders and managers should be androgyny, the perception of an androgyny person as a good leader has still not been accepted by the Sri Lankan voters. Interestingly, this study’s results seemed to have predicted the choice of the people in the 2010 Presidential election correctly.

References


Figure 1. Comparison of profiles

Note: CBK: Ms. Chandrika B. Kumaratunga; SF: Mr. Sarath Fonseka; MR: Mr. Mahinda Rajapakshe; GP: Good President

Table 1. Masculine characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>CBK</th>
<th>SF</th>
<th>MR</th>
<th>GP</th>
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<tr>
<td>Self reliant</td>
<td>4.00</td>
<td>4.35</td>
<td>5.86</td>
<td>5.35</td>
</tr>
<tr>
<td>Defends own beliefs</td>
<td>4.55</td>
<td>4.50</td>
<td>4.52</td>
<td>4.35</td>
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<tr>
<td>Independent</td>
<td>4.00</td>
<td>4.95</td>
<td>5.19</td>
<td>5.65</td>
</tr>
<tr>
<td>Athletic</td>
<td>3.25</td>
<td>5.50</td>
<td>5.29</td>
<td>4.12</td>
</tr>
<tr>
<td>Assertive</td>
<td>4.65</td>
<td>4.25</td>
<td>4.90</td>
<td>4.76</td>
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<tr>
<td>Strong personality</td>
<td>5.40</td>
<td>5.75</td>
<td>6.10</td>
<td>6.94</td>
</tr>
<tr>
<td>Forceful</td>
<td>4.55</td>
<td>4.95</td>
<td>4.33</td>
<td>3.56</td>
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<tr>
<td>Analytical</td>
<td>3.85</td>
<td>4.25</td>
<td>5.29</td>
<td>5.62</td>
</tr>
<tr>
<td>Leadership ability</td>
<td>5.05</td>
<td>6.00</td>
<td>6.29</td>
<td>6.59</td>
</tr>
<tr>
<td>Willing to take risks</td>
<td>4.50</td>
<td>5.85</td>
<td>6.24</td>
<td>6.29</td>
</tr>
<tr>
<td>Makes decisions easily</td>
<td>4.05</td>
<td>5.00</td>
<td>5.43</td>
<td>5.12</td>
</tr>
<tr>
<td>Self sufficient</td>
<td>3.60</td>
<td>4.85</td>
<td>5.14</td>
<td>5.94</td>
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<tr>
<td>Dominant</td>
<td>4.50</td>
<td>4.55</td>
<td>5.10</td>
<td>4.75</td>
</tr>
<tr>
<td>Masculine</td>
<td>4.60</td>
<td>5.65</td>
<td>5.38</td>
<td>5.12</td>
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<tr>
<td>Willing to take a stand</td>
<td>4.55</td>
<td>5.10</td>
<td>5.52</td>
<td>5.76</td>
</tr>
<tr>
<td>Aggressive</td>
<td>4.80</td>
<td>4.55</td>
<td>3.67</td>
<td>3.53</td>
</tr>
<tr>
<td>Act as a leader</td>
<td>5.00</td>
<td>6.20</td>
<td>5.95</td>
<td>6.12</td>
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<tr>
<td>Individualistic</td>
<td>5.10</td>
<td>4.30</td>
<td>4.00</td>
<td>3.47</td>
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<tr>
<td>Competitive</td>
<td>4.40</td>
<td>5.75</td>
<td>5.71</td>
<td>5.50</td>
</tr>
<tr>
<td>Ambitious</td>
<td>4.65</td>
<td>5.15</td>
<td>6.05</td>
<td>6.24</td>
</tr>
</tbody>
</table>

Note: CBK: Ms. Chandrika B. Kumaratunga; SF: Mr. Sarath Fonseka; MR: Mr. Mahinda Rajapakshe; GP: Good President
Table 2. Feminine characteristics

<table>
<thead>
<tr>
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<th>MR</th>
<th>GP</th>
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<tbody>
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<td>Yielding</td>
<td>3.45</td>
<td>3.65</td>
<td>4.19</td>
<td>3.88</td>
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<td>Cheerful</td>
<td>4.00</td>
<td>4.40</td>
<td>5.71</td>
<td>4.88</td>
</tr>
<tr>
<td>Shy</td>
<td>3.00</td>
<td>2.30</td>
<td>1.95</td>
<td>2.00</td>
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<tr>
<td>Affectionate</td>
<td>3.90</td>
<td>4.05</td>
<td>6.00</td>
<td>4.44</td>
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<td>Flatterable</td>
<td>4.50</td>
<td>3.35</td>
<td>4.48</td>
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<tr>
<td>Loyal</td>
<td>3.50</td>
<td>4.55</td>
<td>5.57</td>
<td>6.24</td>
</tr>
<tr>
<td>Feminine</td>
<td>4.35</td>
<td>2.00</td>
<td>3.14</td>
<td>3.71</td>
</tr>
<tr>
<td>Sympathetic</td>
<td>3.85</td>
<td>3.70</td>
<td>4.76</td>
<td>5.35</td>
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<tr>
<td>Sensitive</td>
<td>3.05</td>
<td>3.95</td>
<td>5.43</td>
<td>6.53</td>
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<tr>
<td>Understanding</td>
<td>3.70</td>
<td>4.55</td>
<td>5.25</td>
<td>6.71</td>
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<tr>
<td>Compassionate</td>
<td>3.95</td>
<td>4.21</td>
<td>4.52</td>
<td>5.47</td>
</tr>
<tr>
<td>Eager to soothe hurt feelings</td>
<td>3.90</td>
<td>3.80</td>
<td>4.71</td>
<td>4.53</td>
</tr>
<tr>
<td>Soft spoken</td>
<td>3.30</td>
<td>3.25</td>
<td>4.19</td>
<td>4.41</td>
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<tr>
<td>Warm</td>
<td>4.15</td>
<td>4.10</td>
<td>4.71</td>
<td>4.59</td>
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<tr>
<td>Tender</td>
<td>3.65</td>
<td>3.60</td>
<td>4.38</td>
<td>4.82</td>
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<tr>
<td>Gullible</td>
<td>3.60</td>
<td>3.05</td>
<td>3.00</td>
<td>2.18</td>
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<tr>
<td>Childlike</td>
<td>3.65</td>
<td>2.40</td>
<td>4.62</td>
<td>3.38</td>
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<tr>
<td>Does not use harsh language</td>
<td>4.10</td>
<td>3.75</td>
<td>5.00</td>
<td>5.35</td>
</tr>
<tr>
<td>Loves children</td>
<td>4.30</td>
<td>3.95</td>
<td>6.43</td>
<td>5.82</td>
</tr>
<tr>
<td>Gentle</td>
<td>3.50</td>
<td>4.37</td>
<td>5.05</td>
<td>6.24</td>
</tr>
</tbody>
</table>

Note: CBK: Ms. Chandrika B. Kumaratunga; SF: Mr. Sarath Fonseka; MR: Mr. Mahinda Rajapakshe; GP: Good President
The Role of Democratic Leadership Communication towards Organizational Performance: The Case Study of a Sri Lankan Public Hospital

K.A.S.P. Kaluarachchi

Department of Management and Organization Studies, Faculty of Management and Finance

Background, Issue, and Purpose
Renewed calls for understanding the nature of democratic leadership and its role in democratic movements in organizations are made by Gastil (1994). For the author, the existing definitions of democratic leadership are inconsistent and inadequate. As defined by the author, democratic leadership is “conceptually distinct from positions of authority; rather, it is defined as the performance of three functions: distributing responsibility among the membership, empowering group members, and aiding the group’s decision-making process” (p.953). For Gastil, many, most, or all members of a group are served by these functions in order to exchange the roles of leader and follower. Moreover, a limited number of practical and moral considerations are identified by the author in assessing the appropriateness of the democratic leadership model for different groups.

Since leadership plays a pivotal role in democratic movements in organizations, understanding the nature of democratic leadership is essential. Also, little research, so far, has defined democratic leadership within the context of democratic movements in organizations. The leadership literature has paid no or little attention to democratic leadership in such movements, focusing on democratic leadership within small groups and organizations (Choi, 2007). Choi emphasizes that although the available literature on leadership has underlined some characteristics of democratic leadership, it has ignored other demonstrated characteristics of democratic leadership for achieving democratic values on behalf of democratic movements in organizations. Moreover, Gastil (1994) argues that “the absence of a clear definition may have also contributed to the decreased amount of research on democratic leadership” (p. 956).

The limited number of empirical studies on democratic leadership to examine the aspect of democratic leadership and its role in democratic movements in organizations provides the opportunity to do fresh research on the topic, in particular to study the aspect of democratic organizational leadership’s role in the enhancement of organizational performance. When it comes to the Sri Lankan context, no or few past empirical studies have used the aspect of democratic organizational leadership to investigate its backing up of democratic movements such as the enhancement of organizational performance of Sri Lankan organizations. Therefore, this research was motivated to study the aspect of democratic leadership and its contribution to the enhancement of organizational performance in the Sri Lankan context. In particular, the intended aim or purpose of the research was further specified: to study how the enhancement of organizational performance of a Sri Lankan public hospital has been accomplished due to its democratic leadership communication over time. The investigation was theorized using the “ideal type communication principle” of Habermas (1984, 1987).
Methodology

The case method (Yin, 2003) was used as the strategy for conducting and presenting the research reported in this paper. A famous public maternal hospital in Sri Lanka, which has been performing well in its service over time mainly through its successful leadership, was selected as the case in which the researcher performed his empirical work. The democratic leadership communication of the hospital was considered as the democratic communication of its Director/CEO, which has been operationalized using the four types of communication variables: communication comprehensibility, communication objectivity, communication subjectivity, and communication validity. These communication variables have been originally developed by Habermas (1984, 1987) to describe the ideal type speech situations of societies.

The primary data of the present study were gathered through direct observations, short-time interviews, documentary evidence, participative observations, and in-depth interviews (Yin, 2003) which allowed the understanding of democratic leadership communication within the hospital and its role in enhancing the service performance of the hospital over time. The above data gathering techniques were employed in the director’s office, nursing sisters’ rooms, divisional heads’ rooms, doctors’ rooms, patients’ wards, waiting rooms, and the quality management unit. Some data gathering schedules were used as the guidelines to gather qualitative data for the study. The annual report prepared by the hospital for the particular period was used to gather quantitative data on its service performance. More importantly, the interviews to gather qualitative data were carried out by focusing on different employee categories of the hospital (i.e. Director/CEO, divisional heads, doctors, nursing sisters and nurses, paramedical staff, midwifery staff, clerical staff, and support staff).

The qualitative data analysis (Yin, 2003) mainly aimed to examine how the Director/CEO of the hospital has created and maintained the ideal type communication (Habermas, 1984, 1987) with different categories of employees in order to enhance the service performance of the hospital over time.

Outcome/Result

The democratic leadership communication of the CEO was evidenced with his democratic leadership values (i.e. teamwork, openness, responsiveness, forgiveness, practical orientation, and continuation) which have contributed to create and maintain the ideal type communication with different categories of employees (i.e. divisional heads, doctors, nursing sisters and nurses, paramedical staff, midwifery staff, clerical staff, and support staff) for a long period. Ultimately, this has led to improve the service performance of the hospital over time (Figure 1).
Figure 1 Review of service performance of the hospital

![Service performance of hospital](image)

Source: Hospital C (2008)

According to the data exhibited in Figure 1 the hospital has improved its service outcomes/performance gradually over time (i.e. reduction of Maternal Mortality Rate, Still Birth Rate, Neonatal Mortality Rate and Perinatal Mortality Rate). For example, during the period considered for analysis (i.e. 2000-2007), MMR reduced from 11.0 to 2.0 which is approximately an 82% improvement in the service performance. During the same period, it was able to reduce the Still Birth Rate from 11.2 to 8.1 which is approximately a 28% improvement in the service performance. Moreover, the Neonatal and Perinatal Mortality Rates have reduced from 7.9 to 7.7 and from 19.2 to 15.8 which are approximately 3% and 18% improvements in the service performance respectively.

Conclusion and Implications

According to the Habermasian ideal type communication principle (Habermas, 1984, 1987) adopted to identify the role of democratic leadership of the hospital towards the enhancement of its organizational performance, the CEO’s personal values: teamwork, openness, responsiveness, forgiveness, practical orientation, and continuation as a whole have created and maintained the ideal type/democratic type communication with different categories of employees (i.e. divisional heads, doctors, nursing sisters and nurses, paramedical staff, midwifery staff, clerical staff, and support staff) over a long period. This has mainly contributed to improve the service performance of hospital over time (Figure 1).

The findings of the paper help to understand the nature of democratic leadership and its role in democratic movements (Gastil, 1994; Choi, 2007) such as the enhancement of organizational performance, in particular to understand the issue empirically pertaining to public hospitals and other organizations in Sri Lanka.
Keywords: Democratic leadership communication, Organizational performance, Sri Lankan public hospital

References


Residential Mortgage Default at Housing Development Finance Corporation of Sri Lanka: EPF Security – A Review

D.L.P.M. Rathnasingha\textsuperscript{1} and Ali Khatibi\textsuperscript{2}

\textsuperscript{1}Department of Finance, Faculty of Management and Finance, University of Colombo, PhD Candidate, SGS, MSU, Malaysia
\textsuperscript{2}Faculty of Business Management and Professional Studies, MSU, Malaysia

Background

Housing is essential to man, and is recognized as one of the basic human needs. In current society it is offered at much higher standards than meeting the essential needs of humans, as a result of which many agencies have come to the field to work in this area. By now most governments accept that providing basic housing for all is often a priority for enhancing the social conditions of society. For an archetypal house-owner, the house is a foremost asset in his portfolio and for many households the purchase of a house represents the largest lifelong investment and a store of wealth. The provision of housing services depends mostly upon a well-functioning and affordable house financing system. Such financing systems however are often complicated and the beneficiary has to fulfill a set of criteria which are hard to meet as requirements for a housing loan. Further, the interest charged on the loan is exorbitant for the general working class of people, as it went up to 20\% per annum as shown in industry reports. In this situation it can be seen that housing represents a large proportion of a household’s expenditure and takes up a substantial part of lifetime income. According to the Census of Population and Housing 2011 in Sri Lanka, individual housing units in the country in 1981 was 2,943,610 units which has grown to 5,773,678 units by the year 2011 indicating a high growth of total houses in the country. Further the expansion of housing units in the last three decades from 1981 to 2011 is 96.1\% while growth from 2001 to 2011 was 23.2 \%. It is an appreciable growth but it is important to pay attention to how these housing units were financed. There are a number of banks and financial institutions playing a vital role in this area by providing mortgage loans for housing.

Housing Development Finance Corporation (HDFC) is a listed company and the main share holder (51\%) of the company is the government. Among the leading mortgage loan suppliers in Sri Lanka, HDFC is one of the market leaders in the country. Therefore, this study is focused on the HDFC loan portfolio repayment prototype for the sample period.

Objectives

This study aims to review and understand the situation in HDFC Equated Monthly Installment loans as at beginning of February and end of April 2012. With the intention of analyzing the core substance of the loan portfolio of the bank, this study employed the analysis of statements, document evaluation and personal discussions as means of gathering the necessary data. The analysis examines the position of the loan repayment

208
performance with the help of change ratios paying attention to compare EPF security loans and other security type loans.

**Results**

As per the District-wise summary, there were 70,380 loans granted and out of this 36,713 was under EPF security which is 52.16% of the total loan portfolio and the balance 33,667 under other security types. There were 24,178 loans (34.35% of total loans) which were identified as defaulted and out of them 19,588 loans defaults had been granted under the EPF security (81.01% of total default loans). There were 4,590 default loans on non EPF security loans. At the branch level, out of the total loans disbursed minimum default rate was 0.16% while maximum was 57.57% which indicates a huge gap in loan default between branches while the industry average was only 3.8 percent. However, excluding EPF security loans, this range is only 1.22% to 19.91% among the different branches. Out of the total housing loans contracted 52% had been allocated to the Western province and 11% to the Central Province while all the other provinces report less than 10 percent each. The highest residential mortgage default rates considering the branch network reports of Nuwara-Eliya, Kandy, Rathnapura and Ampara, are in branches located in remote areas. These defaults occur as the default option is in the money for EPF member customers.

Interestingly, at the end of the period considered, total number of default loans comes down to 13,065 showing a 45.96% reduction of default loans compared with beginning of the period considered. With this change total percentage of default loans comes down from 23.29% to 13.16%. A sizeable change of non EPF security loan default levels of the bank cannot be observed within the period. However, bank reports show over 20% default loans in the last few years, a very high level as compared to the industry average. This situation brings up two important points. First, how is HDFC bank facing this situation? The answer is almost certainly by getting transfers for the due amount from EPF account balance for the EPF funded customers. HDFC bank does not provide for EPF non-performing loans as they are backed by the Central Bank. Secondly, while the government owns 51% share capital of HDFC, how far is this mechanism acceptable and how does it secure the EPF benefits for its customers at their retirement.

**Conclusions**

Overall, a sizeable number of customers who have kept EPF balance as the security for the housing loans granted by HDFC bank and they have a higher probability of defaulting and allowing loans to be recovered from EPF fund account balance. As a result it is open to discussion whether the acceptance of EPF balances as security for housing loans at HDFC which has become an aperture for early withdrawal of EPF funds. This evidence need of reassess the expediency of accepting EPF fund balance as security for housing loans and need for recourse efforts for recovery and loan default minimization. Further, it makes it obvious that housing is a focal problematic area in Sri Lanka and policy level measures are needed to reduce this encumbrance on the population.
FACULTY OF MEDICINE
Message from the Dean

With the theme ‘Converging Technologies and Sustainable Communities’, a crystal clear message begins to unravel before us, the academic and scientific community of our University. That the time is now ripe, to leap out from the cosy confines of our respective domains and academic kingdoms and join hands with our fellow scientists, in pursuing our common goal, to make our University the epicenter of research and development in the region. The wise selection of this theme is certainly just the catalyst we need to sensitise our community to the dire need of converging technologies.

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 2012 our sincere good wishes for a very rewarding and productive event. My humble wish is that the boundaries of isolation will yield to the enthusiasm, need and vision of the participants and that this Symposium will help levitate our research ethos to another realm of academic excellence.

We at the faculty will also be conducting our respective programme under the patronage of our chief guest – Dr. Narada Warnasuriya, a distinguished alumnus of our Faculty, who was also the Professor of Paediatrics of the Faculty of Medical Sciences, University of Sri Jayewardenepura, its Dean and also its Vice-Chancellor.

The Faculty Oration will be given by Dr. Upul Senerath, Senior Lecturer in the Department of Community Medicine, who was the recipient of the University of Colombo award for Excellence in Research: 2008-10.

I am sure, that this two day programme will also build lasting and sturdy professional relationships, that will further strengthen the foundation that has been laid for the development of research through its PhD programme, which is receiving generous financial support from the University.

Professor Rohan Jayasekara
Dean, Faculty of Medicine
Faculty of Medicine

Address by the Chief Guest

Faculty Oration: Combating child malnutrition in Sri Lanka: Strategies for scaling-up proven nutritional interventions

Plenary 1: Nanotechnology in Healthcare: Applications, issues and challenges - Use of Carbon Nanotubes to build platforms

Plenary 2: Genetically Modified Foods: Implications for Health

Abstracts

1. Genus *Mycobacterium* as an etiological agent of pulmonary infection in Sri Lanka

2. Cord formation in a clinical Isolate of *Mycobacterium abscessus*

3. A narrative based exercise to introduce clinical training to medical students: a pilot study

4. Prevalence of toxoplasmosis in immunocompromised cancer patients attending a tertiary care hospital

5. Correlation between expression of Epidermal Growth Factor Receptor, Vascular Endothelial Growth Factor, Chemokine Receptor 4 and Vimentin by colorectal carcinoma cells

6. Assessing the quality of the overall training program and outcome of research for higher degrees at the Faculty of Medicine, University of Colombo, during the past 6 years

7. Survey on the prevalence of back pain, its related disability and common treatment methods used by back pain victims at Thimbirigasyaya Secretarial Division

8. Place of multiple choice questions (MCQs) as an effective study tool for long-term recall

| 11. | Attitudes on peer evaluation of teaching among academic staff of the Faculty of Medicine, University of Colombo | 235 |
| 12. | Serum anti-oxidant capacity and NOx levels in leptospirosis patients | 236 |
| 13. | Mental status of hypertensive patients attending medical clinics in the National Hospital of Sri Lanka | 237 |
| 14. | Comparison of skin fold thickness, waist circumference, waist hip ratio and BMI in predicting body fat percentage | 238 |
| 15. | Facebook usage among university students and its association with their psychological and social well being | 239 |
| 16. | Knowledge and usage of Child Health and Development Records by mothers with a single child attending Teaching Hospitals near Colombo | 240 |
| 17. | Pathological significance of Epidermal Growth Factor Receptor (EGFR), Vascular Endothelial Growth Factor (VEGF), Chemokine Receptor 4 (CXCR4) and Vimentin expression by colon carcinoma cells | 241 |
| 18. | Association between selected single nucleotide polymorphisms (SNPS) in chromosome 5 and anti-malaria antibodies in a malaria endemic area in southern Sri Lanka | 242 |
| 19. | Effectiveness of stretching exercises for leg cramps during pregnancy: a study at the de Soysa Maternity Hospital, Colombo | 244 |
| 20. | Effects of paraplegia caused by spinal cord injuries on functional status and quality of life of individuals and on family economy among patients admitted to two selected hospitals | 245 |
| 21. | Prevalence of reduced vision and its associated factors among school children of grades 6-10 in an urban school | 246 |
| 22. | Assessment of leadership skills among first year medical students using the authentic leadership questionnaire | 247 |
| 23. | Comparison of selected health risk behaviours and attitudes between newly entered and fourth year students of the Faculty of Medicine, University of Colombo in 2010 | 248 |
| 24. | Problems, inconvenience and satisfaction associated with the use of prostheses among below knee amputee Sri Lankan army soldiers | 249 |
25. Do learning styles and approaches to learning differ among medical undergraduates and post graduates?

26. HLA-DQ alleles in patients with cutaneous leishmaniasis in Sri Lanka: a preliminary report

27. Characterization of leishmaniasis vectors in selected areas in Sri Lanka

28. Adherence to the recommendation of exclusive breast feeding by mothers attending immunization clinics at the Lady Ridgeway Hospital

29. Clinico-epidemiological aspects of *L. donovani* cutaneous infections in Sri Lanka

30. Awareness about factors related to unintentional paediatric poisoning (UPP) among Sri Lankan mothers attending the Lady Ridgeway Children’s Hospital

31. Factors affecting the compliance to investigations of patients with Diabetes Mellitus attending a medical clinic at a tertiary care hospital

32. A pilot study on comparison of rapid immunodiagnostics for leptospirosis infections

33. Risk factors and prevalence of non fatal stroke in Sri Lanka – a community based study

34. Reliability of the 20 minute whole blood clotting test as an indicator of coagulopathy in patients envenomed by Sri Lankan Viperidae snakes
University teaching has to be based on scholarship. Scholarship and research are not synonymous. There are four aspects of scholarship, viz. discovery (research) synthesis (integration), application (service) and transmission (teaching, communication) of knowledge. A university teacher has to be involved in all four aspects. Depending on the stage of his career, his discipline (subject) and the institution or faculty in which he is based he may spend more time in one than the others. There is a synergy between the four aspects of scholarship. A university culture which gives pre-eminence to research and publication in the recognition of academic merit may undermine the importance of the other aspects of scholarship. Publication of one’s work in a peer reviewed, citation indexed journal with a high impact factor is the dream of every young academic. While this is to be encouraged it is also important to emphasize that it is not the be-all and end-all of academic responsibility or scholarship.

In a predominantly undergraduate oriented institution our primary responsibility is good teaching. Good teaching cannot be reduced to knowledge and technique. It comes from the identity and the integrity of the teacher. In a professional course teachers have to be good role models. Good teachers are passionate about their teaching. With depth of understanding of their specific subject and their wider scholarship they are able to weave connections between themselves, the subject and their students. It is said that irrespective of the context in which they teach, lecture room, bedside, laboratory or field “these connections are not merely in the methods they employ but in their hearts, heart in the old sense of the word as the place where intellect, emotion, spirit and will converge in the human self.”

Learning from a teacher who underpins his teaching on a base of research and scholarship in contrast to one who does not, has been compared to drinking from a flowing stream instead of a stagnant pond.

The Colombo Medical school being the oldest and most prestigious of such institutions in our country has produced role models who have displayed outstanding erudition, creativity, innovation and even entrepreneurship, a much desired characteristic in the present global knowledge economy. However these need to be balanced with a social conscience and a concern for equity and social justice, if they are to provide ideal role models for the younger generation. In this respect one may have to look beyond the conventional to some who are perceived as non conformists or mavericks.

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Former Vice-Chancellor & Senior Professor of Paediatrics
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Faculty Oration

Combating child malnutrition in Sri Lanka: Strategies for scaling-up proven nutritional interventions

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Background

Malnutrition is a complex and multisectoral issue that involves a wide spectrum of causes at individual, household, community and contextual level. Child undernutrition remains a significant public health problem in Sri Lanka despite its good mortality and morbidity indicators. The prevalence of low birth weight in 2006/7 was 16.6%, while stunting, wasting and underweight among children under 5 years were 17.3%, 14.7% and 21.2% respectively. Approximately 25% of children aged 6-59 months were anaemic. There had not been any substantial improvement of this situation over many years.

Objectives and Methods

The aim of this review is to recognize effective and sustainable strategies for scaling-up proven interventions to tackle undernutrition among children under 5 years of age in Sri Lanka. Results of intervention studies, programme evaluations, surveys and reviews pertaining to maternal and child nutrition were studied. Unpublished data in reports, presentations and dissemination seminars were obtained from the relevant investigators and/or organizations. Secondary data analyses were performed using the Sri Lanka Demographic and Health Survey (DHS) data.

Findings

According to the secondary analysis of DHS, 83% of mothers initiated breastfeeding within one hour after birth, and 76% of infants under 6 months of age were exclusively breastfed, with a median duration of exclusive breastfeeding of 4.8 months. Using the new global indicators of complementary feeding, the minimum dietary diversity was estimated to be 53%, minimum meal frequency 81%, and minimal acceptable diet 50% in children aged 6 to 11 months.

According to the review, effective interventions to reduce child malnutrition include: promotion of breastfeeding; education about complementary feeding; provision of food supplements; iron-folate supplementation for pregnant mothers; supplementation of Vitamin A, preventive Zinc supplements and universal promotion of iodized salt. In the long run, these interventions should be supplemented with improvements in underlying determinants of undernutrition such as poverty and food insecurity.
In order to scale-up the above, an integrated nutrition programme using the life cycle approach should be followed by the entire health system. Breastfeeding promotion strategies should continue, while a great effort should be made to promote complementary feeding. Special attention should be paid to the nutrition of adolescent, pre-pregnant and pregnant women. There should be more effective targeting of food assistance and supplementation programmes, with due attention for food insecure and nutritionally vulnerable populations including the post-conflict and estate communities.

Research would help produce new knowledge and technologies to tackle the most important development challenges, and make sure that country and the wider development community put the new knowledge and technologies into use. There should be effective communication to improve the uptake of research findings and the integration of research and policy.

**Conclusions**

Sri Lanka has already given high priority to many of the appropriate interventions, but should ensure their effective implementation with greater coverage and higher quality with special strategies to serve vulnerable populations. It is important that the whole health system should comply with national policies and guidelines, with only the exceptional situations being managed through an individualized approach using the best available evidence.
Plenary No 1

Nanotechnology in Healthcare: Applications, Issues and Challenges - Use of Carbon Nanotubes to build Platforms

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Modern society expects much from science and this is exemplified by the progress made in the health sciences due to technology. The current healthcare needs can be broadly categorised as diagnostic and therapeutic. At present the nanotechnology revolution is contributing to all sectors of society and the medical field is no exception. Within this talk I would like to describe to you the key attributes of nanotechnology and why it is ideally suited to tackle some of the challenges faced in modern medicine.

The scale of objects one can work with in nanotechnology avails itself to non-intrusively measure bio-potentials and analytes as well as act as nano-vectors to deliver cargoes for medicinal purposes. Therefore, if once could make some of the inorganic materials more frequently used for nanotechnology bio-compatible and acceptable to the human cellular structures, the possibilities in using this technology for the benefit of humans is immense. Within this talk I will develop two themes on firstly the use of carbon nanotubes for the measurement of bio-potentials and within this framework how it can be used to measure EEG signals and hopefully obtain a better understanding of the human brain. The potential to couple this to wireless communication systems and allow for 24-7 monitoring opens many doors in tele-medicine and home-care alternatives, particularly for an ageing population.

I will also examine routes within the therapeutic sector that allows one to use carbon materials to deliver drugs to diseased areas within the human body. How one can ‘dress-up’ nano-materials such that they can target areas precisely, efficiently and deliver payloads unobtrusively such that there are no side-effects to the immunology response will be explored. As examples I will use single walled carbon nanotubes that have been functionalised for anti-cancer therapies including delivery of si-RNA for gene-therapy and anticancer drugs such as doxorubicin. The dimensions of the nanotubes allows one to penetrate mammalian cell membranes and allow high drug loadings; but in the process the nano-vectors used must be bio-compatible and not stress the biological system it is operating in. The process of preparation, purification and attachment of drugs needs to be precisely controlled and designed for maximum efficacy, and models to deliver such drugs will be examined. Efforts to develop carbon nanotubes as nano-vehicles for precise and controlled drug and gene delivery, as well as markers for in vivo biomedical imaging, are currently hampered by uncertainties regarding their cellular uptake, their fate in the body.
and their safety. These aspects will be discussed with possible solutions to its effective usage. These findings provide crucial data for the development of biofunctionalization protocols, e.g. for future cancer theranostics, and optimizing the stability of functionalized nano-materials in varied biological environments.

Finally, some other more simple applications of nanotechnology for healthcare will be discussed and its potential to creating platform technologies for health and wealth creation! It is only by understanding the fundamentals associated with material complexity that efficient solutions to world problems can be discovered and science innovation used to improve the society we all live-in.
In modern times, advances in GM technology have resulted in the development and commercial release of Genetically Modified Organisms (GMOs) with traits that transcend the species barrier. Currently the most frequently grown GM crops (also known as transgenic crops) globally are soybean, corn and cotton carrying genes from microorganisms that express traits not normally found in these crops such as resistance to pests and herbicides. Many other transgenic crops carry an array of other traits. Transgenic animals and microbes have also been produced using this recombinant DNA technology. Foods produced from such organisms are known as Genetically Modified Food (GMF). Novel organisms developed through this technology are different to the new varieties produced through classical breeding. In the production of GMOs a new locus/gene is created in the genome, whereas in classical breeding only the mixing and recombination of alleles occur without any physical change to the genome.

Sri Lanka is a small island country rich in biodiversity, intent on conserving and using it for the benefit of the people. Production of transgenic organisms is still in the laboratory stages and therefore, there is a strong likelihood of GMOs and GMF being imported to the country, while our needs of this technology are indicated in the National Biotechnology Policy.

GMOs carry many useful traits such as pest and disease resistance, herbicide resistance, virus resistance, improved protein content and tolerance to environmental stresses in plants, enhanced growth in animals and a range of products of GM microorganisms (GMM) used in brewery, confectionary and pharmaceutical industries. GMF include food consisting of or containing living viable organisms (e.g. maize), foods derived from or containing ingredients derived from GMOs (e.g. flour, oil), foods containing single ingredients or additives produced by GMMs (e.g. colours, vitamins) and foods containing ingredients processed by enzymes produced by GMM (e.g. high-fructose corn syrup). However, as in any other technology, several risks and concerns have been identified, especially in relation to the environment and to human health which have to be assessed before use/exposure.

The potential risks of GMF to human health include toxicity, tendency to provoke allergic reactions, nutritional or other toxic properties, stability of the inserted gene, nutritional effects associated with the modification and any other unintended effects. Food safety issues are covered by the Codex Alimentarius Commission (Codex) which is a joint
FAO/WHO body and is responsible for compiling standards, providing codes of practice, guidelines for risk analysis and making recommendations. Risk assessment protocols for food allergy for example, include assessment of allergenicity, dose response, exposure and susceptible subpopulations.

In order to carry out food safety procedures, it is necessary to set up appropriate regulations and the necessary administrative structure. The Ministry of Health has already included regulations under the Food Safety Act to focus on importation of GMF to the country which includes mandatory labeling. The Biosafety Law which is expected to be enacted during the course of this year will eventually cover all aspects of biosafety relating to importation and local production of GMO and GMF.

Evaluation of safety with regard to food is not only about science but should also consider social, ethical and religious concerns of the population.
Genus *Mycobacterium* as an etiological agent of pulmonary infection in Sri Lanka

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Introduction

Only a few species of genus *Mycobacterium* are obligatory aetiological agents of pulmonary disease in humans. Among them, the *Mycobacterium tuberculosis* complex (MTC) causes *tuberculosis*, a disease responsible for high morbidity and mortality globally. Non tuberculous mycobacteria (NTM) are increasingly recognized as a significant cause of chronic pulmonary infections in both immune-compromised and immune-competent patients in the world.

Objectives

The aim of the study was to evaluate the importance of differentiation of MTC from NTM species in pulmonary infections caused by genus *Mycobacterium* in Sri Lanka.

Methods

Five hundred and thirty four acid fast bacilli positive sputum collected from Chest Hospital-Welisara and Chest Clinic- Colombo were used for the study. Lowenstein–Jensen (L-J), Middlebrook7H9 broth and paranitrobenzoic acid incorporated L-J media were inoculated using processed and concentrated sputum. Cultures were differentiated as MTC or NTM by phenotypic characterization of colonies, biochemical testing (nitrate reductase) and by PCR amplification of MTC specific 240bp fragment of the \(\text{IS}^{6110}\), insertion sequence.

Results

Four hundred and forty two (442) *Mycobacterium* cultures were isolated from 534 Acid fast bacilli (AFB) positive sputum samples. Thus, the culture positivity rate of AFB positive sputum specimens was 83%. Of 442 *Mycobacterium* cultures, 401 isolates were differentiated as MTC. The remaining, 41 isolates were identified as NTM, and were from patients suspected of primary TB (n=29) and secondary TB (n=11).

Conclusions

The prevalence of TB and NTM was 90.7% and 9.3% respectively among sputum AFB positive pulmonary infectious cohort in Sri Lanka. Although the percentage of NTM is small, it is of significant importance as NTM are resistant to conventional anti-tuberculosis drugs. Furthermore, patients with NTM, but suspected of having resistant TB, will be treated with high cost second line anti-TB drugs leading to higher adverse reactions in patients. Thus, the laboratory identification of NTM disease is a primary requirement in the diagnosis and treatment of pulmonary mycobacterial infections.
Cord formation in a clinical Isolate of *Mycobacterium abscessus*

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The species belonging to *Mycobacterium tuberculosis* complex (MTC) display characteristic serpentine cord formation in liquid cultures. The factor responsible for the cord formation is trehalose-6,6-dimycolate (TDM), a component of the mycobacterium cell wall that is responsible for MTC virulence. Thus cord formation is considered a definitive diagnostic character of MTC. Microscopic observation drug susceptibility assay (MODS), based on this character, is widely used for identification of multi drug resistant tuberculosis (MDR-TB).

**Methods**

A sputum sample was received from a young woman with a past history of pulmonary disease who submitted sputum for screening for AFB as a component of a medical test required for visa application. The processed and concentrated sputum was inoculated on to the 7H9 broth medium and 2 slopes of Lowenstein–Jensen (L-J) medium (one containing paranitrobenzoic acid-PNB). Once a growth was observed on L-J, L-J PNB and broth, smears were prepared from cultures for microscopic observation. PCR amplification of 240bp fragment of the \( IS\)\(^{6110} \) insertion sequence (specific for MTC) and 437bp fragment of \( rpoB \) gene (used for the identification of *Mycobacterium* species) was carried out using DNA extracted from cultures. The amplified fragment of \( rpoB \) gene was subjected to DNA sequencing.

**Results**

The L-J medium showed rough cream coloured colonies after 6 days of incubation (rapid grower). Cord formation was observed in the microscopic smear that was prepared from the broth culture. However, DNA amplification of \( IS\)\(^{6110} \) fragment was negative. Rapid growth, positive growth in the presence of PNB and failure to PCR amplify the \( IS\)\(^{6110} \) fragment confirmed the presence of non-tuberculosis *Mycobacterium* (NTM) species, although rough buff coloured colonies and cord formation are characteristic features of MTC. The analysis of DNA sequence confirmed that the isolate was *Mycobacterium abscessus* which is one of the most pathogenic and chemotherapy resistant rapidly growing NTM.

**Conclusions**

This clearly demonstrates that cord formation is not specific to MTC species and detection of cording in broth culture should be further investigated before arriving at a conclusion. This is the first report of isolating *M abscessus* from a clinical specimen.
A narrative based exercise to introduce clinical training to medical students: a pilot study


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Introduction

A narrative based approach was adopted in an activity conducted as part of a five day orientation programme for medical students in the third academic year, who were starting clinical rotations. Groups of students were allocated to patients to elicit their life stories, in the form of a narrative, similar to a biography.

Methods

An open, written feedback and responses to structured questions were obtained from the students regarding the activity. 154 responses were obtained from the open feedback which was then qualitatively analyzed using a grounded theory approach with identification of major themes. The structured questions were analyzed quantitatively using SPSS.

Results

The themes that emerged from the qualitative analysis were issues related to the initiation of medical students to clinical training, communication with patients, understanding about the patient and a holistic approach to care, students expectations of the activity and perceived relevance to future training and the impact of the logistics of the activity on the students’ experience. It was found that the majority of the students found this activity interesting and useful, stating that it improved communication skills and helped them to view the patient as individuals instead of ‘clinical cases’. They found it a good initiation to clinical training and history taking. They also felt it helped develop skills of empathy. Some students reported confusion in differentiating life story from standard medical histories. They also reported difficulty in communicating with the patient due to the large number of students in each group. Analysis of the structured questionnaire revealed that 97% of the students found the activity to be useful, and 98% found it to be helpful in learning the background of the patient.

Conclusions

This narrative based learning experience was found to be accepted by the majority of students at their first contact with patients and helped to introduce a more patient centered approach Therefore it is suggested to use this model in introductions to clinical training in the future.
Prevalence of toxoplasmosis in immunocompromised cancer patients attending a tertiary care hospital

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Introduction
Toxoplasmosis is caused by the intracellular parasite Toxoplasma gondii. Acute toxoplasmosis in an otherwise healthy person is often asymptomatic. However, in immunocompromised hosts toxoplasmosis can be life threatening. The reported seroprevalences of toxoplasmosis in Sri Lanka are mostly based on studies conducted on pregnant mothers.

Objectives
To assess the prevalence of toxoplasmosis among immunocompromised cancer patients

Methods
108 patients attending the Out Patients’ Department of the National Cancer Institute were recruited following informed written consent. All had a confirmed diagnosis of malignancy and had undergone at least one dose of radiotherapy or chemotherapy. Five milliliters of venous blood was collected from each patient. PCR was performed to detect a 193bp non variable region of B1 gene of T. gondii. Direct Agglutination Test was performed to detect anti toxoplasma IgG antibodies.

Results
The ages of the patients ranged from 19 to 83 years. The overall prevalence of toxoplasmosis was 11.1%. T. gondii DNA was detected in two patients. Ten were positive for anti toxoplasma IgG antibodies. The highest titre was 1/400. None of those positive by PCR showed seropositivity. Those patients positive by PCR had received both chemotherapy and radiotherapy. Testing positive for toxoplasmosis was not associated with any of the treatment methods.

Conclusions
This study confirms the presence of undetected toxoplasmosis in immunocompromised patients. A case control study based on a more representative patient population would verify the true magnitude of this infection. Regular screening by PCR would help in early detection of infection in those with impaired immunity.

We wish to thank Prof. R. S. Dasanayake of Department of Chemistry, Faculty of Science, University of Colombo for his support with the protocol of the PCR and Dr David S. Roos and Natalie Miller of University of Pennsylvania, Philadelphia, USA for providing us with reagents for the serological assay.
Correlation between expression of Epidermal Growth Factor Receptor, Vascular Endothelial Growth Factor, Chemokine Receptor 4 and Vimentin by colorectal carcinoma cells

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Introduction
Colorectal carcinomas are known to variably express multiple biomarkers. Increased expression of Epidermal Growth Factor Receptor (EGFR), Vascular Endothelial Growth Factor (VEGF) and Chemokine Receptor4 (CXCR4) or reduced expression of Vimentin has shown to be associated with a poor prognosis. However the correlation between expressions of these markers is hitherto not adequately evaluated.

Objectives
To study the correlation between expression of EGFR, VEGF, CRCX4 and Vimentin by colorectal carcinoma cells.

Methods
Ninety one consecutive patients who underwent colorectal carcinoma resection at the National Hospital of Sri Lanka were included. Immunohistochemical expression of four biomarkers was evaluated on representative paraffinized tumour tissue. Digital image analysis was performed using an Olympus F070 microscope and Neurolucida 7.50.4 software package. Average staining intensity of each biomarker was recorded for each case. Correlation analysis was performed. Pearsons Correlation Coefficient(r) was used to determine the strength of values indicating statistical significance.

Results
Correlation was moderate between EGFR and VEGF expressions(r=0.506, p 0.01) and between VEGF and CXCR4(r =0.639, p 0.01). Correlation was low between EGFR and CXCR4(r= 0.301 p 0.01) and between EGFR and Vimentin(r = 0.264, p 0.05). No correlation was observed between VEGF and Vimentin(r= 0.172) and CXCR4 and Vimentin(r = 0.087).

Conclusions
VEGF expressing colorectal carcinomas are also likely to express EGFR and CXCR4. Vimentin expressing tumours are less likely to express other biomarkers. Therefore, VEGF and Vimentin should be included in the initial biomarker panel used to assess prognosis in colorectal carcinoma patients, especially in resource limited settings.
Assessing the quality of the overall training program and outcome of research for higher degrees at the Faculty of Medicine, University of Colombo, during the past 6 years

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Introduction
Doctoral education is meant to create and sustain an intellectual community. It trains another generation of professional researchers and academics. Hence, with the enormous importance of assessing quality of doctoral education comes the need for accountability. It leads to development of strategies to improve the quality of research degrees produced by the institutions and provide a reliable guidance for selection of doctoral programs.

Objectives
To assess the quality of the overall training program and outcome of higher degrees by research, awarded by the Faculty of Medicine, University of Colombo.

Methods
All PhD and M.Phil candidates who completed their research degrees from the Faculty of Medicine, University of Colombo, during the past 6 years were selected as study subjects (n=18). A data form was used to collect information regarding the effective period for completion of higher degrees using past records maintained by the Research and Higher Degrees Committee, Faculty of Medicine. Data was also collected from the candidates via a self-administered questionnaire concerning program characteristics, placement after graduation, publications. Ethical clearance for the study was obtained from the Ethics Review Committee, Faculty of Medicine, University of Colombo.

Results
A total of 14 candidates (78%) responded to the questionnaire. A majority of candidates (over 70%) were satisfied with the overall quality of their program. However, only 50% reported that their research facilities and workspaces were “excellent” or “good”. Moreover, 70% were not satisfied with their computer facilities. More than 70% felt they benefited from the program’s intellectual environment. Almost 79% of the candidates are currently engaged in work similar to the field of their Ph.D/M.Phil degrees. However, only 40% were satisfied with the opportunities available for interaction between research students. Importantly, over 90% have published articles in refereed journals. Interestingly, 57% of candidates were found to be placed in academic positions. In terms of completion of the degree, the effective period for 57% (n=8) of candidates was 6-8 years, for 29% (n=4) it was 4-5 years. Only 14% (n=2) completed their degree within 3-4 years. The average completion time was 6 (range: 3-8) years.
Conclusions
In conclusion, the majority of candidates appeared to be satisfied with the overall quality of the program for awarding of higher degrees by research. However, provision of research facilities, workspaces and access to computers was less satisfactory. The outcome of the program was excellent with more than 90% have publications in peer reviewed journals and more than 50% currently placed in academic positions.
Survey on the prevalence of back pain, its related disability and common treatment methods used by back pain victims at Thimbirigasaya Secretarial Division


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Introduction
Back pain is one of the commonest musculoskeletal conditions posing a major burden on individuals and the health care system in Sri Lanka. No studies have documented the prevalence of back pain and its related disability in Sri Lanka.

Objectives
To describe the prevalence of back pain and its related disability in relation to gender and age and describe the common treatment methods used by back pain victims in the Thimbirigasaya Secretarial Division.

Methods
A community based cross-sectional house-hold survey was carried out at the Thimbirigasaya Secretarial Division in the Western Province. A pre-tested simple questionnaire was administered to 11396 adults (55.2% females and 44.8% males) in the age group of 30–60 years.

Subjects who were found to have back pain were provided with the Modified Oswestry Low Back Pain Disability Questionnaire. Disability was graded according to Modified Oswestry Low Back Pain Disability Inventory as mild disability, moderate disability and severe disability.

Results
The response rate was 93.9%. The point prevalence of back pain was 23.2% while among the study population 24.5% had experienced it at least once during the past year. Of those with back pain at the time of survey, 26% had mild disability, 63.5% had moderate disability and 8.9% had severe disability. Point prevalence in relation to gender was 13.57% in females and 9.58% in males. According to age categorization peak point prevalence was shown in 40 – 49y of age. Back pain victims had used different treatment methods. A majority of the study population (42.1%) had sought Western Medicine and 9.6% Ayurveda medicine. Of the participants with back pain, 34.7% had not sought any type of treatments.

Conclusions
Back pain has affected over one fifth of the population surveyed. Of the population with back pain at the time of the survey, 63.5% were moderately disabled.
Place of multiple choice questions (MCQs) as an effective study tool for long-term recall

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Introduction
Assessing students through MCQs is done in various examinations worldwide. Answering and discussing the MCQs are also considered as a very useful study tool by students. Allowing students to mark their answers on their own and giving feedback on the correct answers could be vital in this respect. However, it is important to find out whether it has a long-term positive impact on students performance.

Objectives
To examine the effectiveness of MCQs as a study tool for long-term recall and to identify the effectiveness of self assessment.

Methods
First year medical students were given a MCQ paper consisting of 10 MCQs with 50 statements to answer within 30 minutes. The test was conducted soon after completion of respective areas in Physiology. Correct answers were discussed and students were advised to mark their answer scripts by themselves, giving negative marks for each incorrect answer. Six weeks later the same MCQs were repeated without a prior notice while they were studying different areas in physiology and same procedure was carried out. Data was analyzed using SPSS (v.13).

Results
Students who participated on both occasions were selected for analysis (n=82). The response rate increased in the second attempt with a marked increase in the number of students attempting more than 40 statements (82.9%) compared to the first (46.3%). Average mark obtained by the group increased significantly at the second attempt (66.63%) compared to the first (52.56%, p<0.001). 81.7% students have scored higher marks than the first time. In both attempts average mark obtained increased with the number of MCQs answered despite negative marking (first attempt 20-29questions answered= 42.67%, 30-39answered =45.55%; 40-50 answered =61.42%). Accuracy of marking increased from 61% at the first attempt to 78% at the second attempt with 76% of students who have marked incorrectly the first time managing to mark correctly the second time.

Conclusions
Answering MCQs followed by feedback and self-assessment increased the response rate and the average mark which suggest a positive long-term recall effect of MCQs when administered as a study tool. It would be prudent to explore the possibility of incorporating regular MCQ discussing and marking sessions as a teaching/learning tool to improve student performance at examinations.
A study on the visceralization potential of Cutaneous Leishmaniasis in Sri Lanka

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Introduction
Cutaneous leishmaniasis (CL) in Sri Lanka is caused by L. donovani, the agent of visceral leishmaniasis (VL). However, the visceralizing potential of L. donovani in Sri Lanka is not known.

Objectives
To investigate the sero-prevalence of anti-Leishmania antibodies in CL, using a serological assay developed in the home laboratory.

Methods
An ELISA was developed using local Leishmania antigen and local anti-Leishmania antibodies. A total of 101 CL patients (presented between years 2001-2008) were tested using the new ELISA. Sero-positive patients were also tested by the rk39 assay (standard assay for anti-L.donovani antibodies in VL patients). Clinical and socio-demographical parameters were compared with the serological findings.

Results
Sero-prevalence of anti-Leishmania antibodies was 14.85% (n=15/101) in the study group and 2/15 were also found to be rK39 positive. All the sero-positive cases were civilians from Southern (53.3%, n=8/15), Northern (13.3%, n=2/15) and other provinces (33.3% n=5/15). A higher proportion of females (22.7%, n=5/22) as compared to males (13.5%, n=10/74) and patients < 20 years, (23.5%, n=4/17) as compared to older age groups (13.0% n=11/84) showed a higher sero-conversion rate (SCR). Also, a higher proportion of single lesions (16.9%, n=11/65) as compared to multiple lesions (8.3%, n=1/12), lesions within 7-9 months duration (30%, n=3/10) as compared to other groups were associated with higher SCRs. In spite of small lesions (<1cm) (35.0%, n=7/20) as compared to larger lesions having a higher SCR, ulcerating nodules had the highest SCR (22.7% n=10/44) when compared with non-ulcerating types.

Conclusion
This study provides early evidence for the ability of local parasite L.donovani to evoke a systemic immune response, which might indicate its potential to visceralize. A study is ongoing for careful follow-up of patients to detect time of onset of sero-conversion and evidence of visceral involvement.

We acknowledge the Consultant Dermatologists, Dr G. Sirimanna, Dr C. Udagedara, Dr PH Chandrawansa, Dr R. Ranawaka and Dr J. Akarawita for referring patients and the National Science Foundation, University of Colombo and WHO/SEARO research training grants for providing funding.
Prevalence and associated factors of diabetic neuropathy among young diabetic patients in Sri Lanka

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Introduction
Diabetic neuropathy (DN) deprives quality of life and is associated with considerable morbidity and disability. Although DN is found to be common among the older age group of the diabetic population, prevalence and characteristics of DN among young diabetic patients is much less studied. Studies in this area would be useful for prevention and early detection.

Objectives
To describe the prevalence and associated factors of DN among young adult diabetic patients in Sri Lanka

Methods
1007 young diabetic patients of age 20-45 years were assessed for neurological symptoms and signs and the diabetic neuropathy symptom score (DNS) was determined. Statistical tests including Chi square test were performed to describe known and potential associated factors of DN.

Results
42.3% of the population was males. Mean age, mean age of onset of diabetes mellitus (DM), mean duration of DM were 36.6 (+11.17) years, 31.8(+5.6) years and 4.8(+4.2) years respectively. 30.7% patients had DN according to DNS, of whom 45.5% complained of burning, aching pain or tenderness and 40% complained of numbness. Monofilament feel, big toe vibration sense and ankle jerk were impaired or absent in 7.5%, 7.2% and 4.2% of patients with DN respectively. Male and female prevalence of DN was 10.66% and 20.03% respectively (p<0.001). Demographic factors such as educational level and income were significantly associated with DN (p<0.05). The known associated factors for DN including poor glycaemic control, age, sex, duration of diabetes, co morbid hypertension, duration of insulin therapy and being tall were significantly associated with DN in young diabetic patients(p<0.001). In addition to conventional predictors of DN, presence of metabolic syndrome (p<0.05) and the waist hip ratio (P<0.001) were also DN predictors. Co existence of other micro vascular complications indicated by the degree of retinopathy and degree of microalbuminuria (P<0.001 & P<0.05) and co-existence of ischaemic heart disease and peripheral vascular disease (p<0.001) also predicted presence of DN among young diabetic patients.
Conclusions
The study defines the prevalence of DN, as predicted by DNS, among young diabetic patients in Sri Lanka. Associating factors of diabetic neuropathy among young diabetic patients appear to be comparable with the known associating factors in overall adult diabetic population though a few less known associations were observed during the study.
Attitudes on peer evaluation of teaching among academic staff of the Faculty of Medicine, University of Colombo

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Introduction
Teaching is a multidimensional task which needs continuous evaluation. Peer evaluation is considered superior to student feedback because peer critique usually encompasses expert subject knowledge and teaching-learning strategies. Though peer evaluation may be subjective, this can be minimized by using a pre-formed protocol for observation. Peer review of teaching promotes continuing professional development of individual teachers and is an integral part of quality assurance. Attitudes of academic staff regarding peer evaluation may contribute significantly to the success of the implementation and optimal outcomes of peer evaluation.

Objectives
To describe the attitudes on peer evaluation of teaching, among academic staff of Faculty of Medicine, University of Colombo.

Methods
In this descriptive cross sectional study, a pre-tested self-administered questionnaire was sent to all academic staff members with a covering letter. A self-addressed envelope was provided in which the completed questionnaires were returned by volunteering participants. Data was analyzed using SPSS software package using descriptive statistics.

Results
55 academic staff (male: female 1: 1.29) responded. 20%, 38.9%, 30.99% and 9.19% of responses were from preclinical, clinical, paraclinical and other disciplines respectively. Majority of responders were senior lecturers (50.9%). > 63% have served for >10 years. 41.1% have had formal training on and 85% had undergone peer evaluation.

Most agreed/strongly agreed that peer evaluation is important to improve teaching skills (92.7%), has added advantage over student feedback (70.9%), should be used as part of continuing professional development (85.5%) and the faculty needs the establishment of a practical peer review process (74.6%). Most disagreed/strongly disagreed that teaching is a highly personalized trait that cannot be analysed (85.5%), peer evaluation should only be for inexperienced probationary lecturers (92.7%), is too time consuming (72.8%) and can lead to violation of personal teaching style (58.1%) and their own capacity for judgment is better than peer evaluation (74.5%). 73% desired to be peer evaluated at least annually and most (67.9%) wanted multiple teaching activities to be evaluated. There was no specific preference for the seniority of the evaluator. Attitude on including peer evaluation results in promotion process was inconclusive.

Conclusions
Responding academics show an overall positive attitude towards peer evaluation which could facilitate the desired implementation of a more formalized peer evaluation process for enhancing teaching quality. However, current status of peer evaluation and the provision of formal training on peer evaluation are suboptimal and need improvement.
Serum anti-oxidant capacity and NOx levels in leptospirosis patients

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Introduction

Release of reactive oxygen and reactive nitrogen species (ROS and RNS) contribute to increased oxidative stress and also tissues damage which is thought to lead to multi-organ failure in Leptospirosis. The antioxidant capacity (AOC) of serum provides a measure of overall protection against oxidative damage. RNS (ie., nitric oxide (NO⁻) released is immediately converted to NO₂ and NO₃ (NOx) and serum NOx levels reflect the level of NO⁻ released.

Objectives

To assess the serum antioxidant capacity and NOx levels in severe leptospirosis patients.

Methods

Patients fulfilling clinical and epidemiological criteria for a diagnosis of leptospirosis were recruited in 2009 (n=75), 2010 (n=83) and 2011 (n=81). Confirmation of leptospirosis was based on microscopic agglutination test titre (>400) and/or presence of leptospira specific IgM antibodies. RNS and ROS levels were determined by measuring serum NO₂ and NOx and AOC levels respectively. Age, sex matched healthy controls and non-leptospirosis fever (NLF) controls were included.

Results

In all three sample collections, serum NO₂ levels of confirmed, acute leptospirosis patients were significantly higher compared to healthy controls (P<0.05). In both 2010 and 2011 sample collections, serum NO₂ levels (31.1-18.5 µM; n=50) of severe patients were significantly higher compared to mild leptospirosis patients, NLF and healthy control groups (19.3-14.3 µM; n=46, 12.7-12.3 µM; n=68 and 5.8-5.5 µM, n=43; P<0.05 respectively. Both severe and mild leptospirosis patients had comparable levels of AOC levels (1.05±0.04 and 1.03±0.09 µM/mg protein respectively) which were significantly higher compared to NLF and healthy control groups (0.97±0.04 and 0.92±0.03 µM/mg protein; P<0.05 respectively).

Conclusion

Serum NOx levels could be used as prognostic indicators in severity of leptospirosis infections. AOC levels as a biomarker of oxidative stress needs to be further investigated.

This work was supported by IBMBB, University of Colombo. This work was published as a 1) Poster at the Proceedings of the 6th Annual Sessions of the Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo, April, 2012, and 2) 2. Poster at the 6th Biennial Sessions of the Allergy and Immunology Society of Sri Lanka, 15th June, 2012.
Mental status of hypertensive patients attending medical clinics in the National Hospital of Sri Lanka

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Introduction
Growing evidence suggests high levels of co-morbidity between hypertension and mental health. However, there are no studies conducted to describe the mental health of hypertensive patients in the Sri Lankan setting. An insight into factors which contribute to the mental status of hypertensive patients will open new avenues for better and more cost effective management of hypertension.

Objectives
To describe the mental status of hypertensive patients who attend the medical clinics of the National Hospital of Sri Lanka (NHSL), and practices they adopt to improve it.

Methods
This study was conducted in the medical clinics of NHSL. One hundred and thirty two patients with hypertension between the ages of 40-60 years were randomly selected. Socio-demographic data of the patients was collected using an interviewer administered questionnaire. The mental health score (MHS) was calculated using a validated questionnaire which contained 11 questions about the patient’s current mental state. The patients were asked to describe various aspects of their mental status on a scale of 0 to 10 and the MHS was calculated out of a total score of 110. The data was analyzed to describe the above variables in relation to the MHS using SND and Chi square tests.

Results
The mean age of the population was 50.2 years and 54.5% were females. The mean MHS in the sample population was 62.79 (SD=16.04). Age, level of education, alcohol consumption and smoking showed a significant association (p<0.05) with the MHS while gender, marital status, religion, monthly family income, BMI, family history, duration and age of onset of hypertension, total number and the types of tablets and the frequency did not.

Conclusions
Young age, low educational level, alcohol consumption and smoking were found to be risk factors for poor mental health while engaging in health promotion activities was found to have a protective effect. Therefore it is recommended to closely monitor and follow up hypertensive patients who are young and those having a poor educational background. Smokers and alcohol users should be advised to change their problem behaviours. Mental health promotion activities should be encouraged in all hypertensive patients.

A poster presentation on this topic is to be presented at the Student Scientific Sessions (2012) of the Faculty of Medicine.
Comparison of skin fold thickness, waist circumference, waist hip ratio and BMI in predicting body fat percentage

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Introduction
Non communicable diseases have reached epidemic proportions all over the world. Body fat percentage (BFP) is a risk factor for many non communicable diseases including diabetes, hypertension and cardiovascular disease. Bio impedance analysis (BIA) provides an accurate way of measuring BFP but it is associated with a high initial cost. If anthropometric indices are found to be predictive of BFP, they can be used for clinical decision making with less cost.

Objectives
To compare skin fold thickness (SFT), waist circumference (WC), waist hip ratio (WHR) and BMI in predicting BFP in adults.

Methods
A sample of 1007 young adult diabetic patients (age 20-45 years) were randomly selected and their anthropometric measurements were obtained. BFP was measured using single frequency BIA. The association between anthropometric measurements and BFP was determined using the Pearson test and linear regression analysis.

Results
Of the 1007 patients, 42.3% were males. Mean age was 36.6 (±11.17) years. The majority were moderately physically active (68.3%). The mean body fat percentage was 28.6% (males 21.3%, females 33.8%, p<0.001). The mean SFT (triceps), WC, WHR and BMI of males and females were 10.5 mm, 88.2 cm, 0.92, 24.2 kgm⁻² and 19.3 mm, 86.6 cm, 0.91, 24.9 kgm⁻² respectively. All SFT measurements (p<0.001) and other anthropometric measurements (p<0.01) except WHR, showed a significant difference between males and females. BFP showed significant correlation with BMI (r=0.4, p<0.01) and SFT at triceps (r=0.67, p<0.01) but not with WC (r=0.226) and WHR (r=0.121). SFT in the triceps (r=0.67, p<0.01) and biceps (r=0.61, p<0.01) regions showed the strongest correlation followed by SFT in the suprailiac (r=0.42, p<0.01) and subscapular (r=0.4, p<0.01) regions.

Conclusions
SFT is a better indicator of BFP than BMI, WC and WHR. SFT should be considered as an important and useful anthropometric measurement when trying to gauge the body fat percentage of patients. SFT in the triceps and biceps regions is superior to subscapular and suprailiac regions in predicting BFP. If only a single SFT measurement can be taken due to time constraints, triceps SFT seems to be the measurement of choice as it shows the highest correlation with BFP.

A poster presentation on this topic has been presented at the 125th annual sessions of the SLMA.
Facebook usage among university students and its association with their psychological and social well being


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Introduction
Facebook is a social networking site introduced in 2004, having more than 400 million users up to date. In Sri Lanka, most users are in the age group 18-24 years. Many studies done in Western countries have found that Facebook has more positive consequences on an individual rather than a negative impact.

Objective
The current research explored the extent of Facebook usage among university students and its impact on their psycho-social wellbeing.

Methods
A cross sectional study was carried out among 288 students of the University of Colombo. Data was gathered through a self administered questionnaire. Extent of Facebook usage, self esteem, life satisfaction, and social health were measured through standardized tools.

Results
Among the participants, 63% were males. 49% were coming from hostel or boarding places. Majority were using the internet mainly for educational purposes. 79% of the students were members of some form of social networking site of which 99% were using Facebook only. The most common purpose of usage was to keep in touch with friends. 17% reported having had to face privacy violations through Facebook. The extent of Facebook usage was higher in males than females. The life satisfaction of the Facebook users was found to be negatively associated with the extent of Facebook usage (p = 0.014). There was no significant association between the extent of Facebook usage and self esteem, and social health.

Conclusions
The negative correlation of life satisfaction and Facebook usage could be because dissatisfied students are using Facebook more extensively or because increased Facebook usage reduces life satisfaction. These high frequent users may be in a state of addiction which is negatively affecting their psychological well being. Facebook usage was found to have no significant impact on the social well being of these students, which may be that, as university students, they already have good social interactions, which are not affected by Facebook. Among Sri Lankan university students, extent of Facebook usage was found to be more among males. Extent of Facebook usage was found to be significantly negatively associated with life satisfaction while there was no significant association with social well being.
Knowledge and usage of Child Health and Development Records by mothers with a single child attending Teaching Hospitals near Colombo

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Introduction
The Child Health and Development Record (CHDR) is a book documenting an individual child’s health history including growth, immunization, nutrition and developmental milestones from birth till 14 years of age and is an important tool in enhancing communication between health care workers and parents. Sri Lanka allocates a significant portion of its health budget to issue free CHDRs to all newborn children to improve their quality of life, and the outcome of this effort rests upon the knowledge and usage of it by all mothers which needs frequent monitoring to maintain a successful and productive programme.

Objectives
To assess the knowledge and usage of CHDRs by mothers attending Lady Ridgeway Hospital, Colombo, Colombo South Teaching Hospital, Kalubowila and Sri Jayewardenepura Teaching Hospital.

Methods
A descriptive, cross sectional study was carried out on 125 mothers, each having an only child aged less than 1 year with a government issued CHDR, in medical paediatric wards. They were selected according to the bed strengths of each hospital and ward. Interviewer based questionnaires and inspection of the CHDR was used to study the socio-demographic factors, general knowledge and usage, knowledge on growth, immunization, nutrition and development and sources of information inflow.

Results
When considering overall knowledge, 49.6% of mothers had a good level of general knowledge on the CHDR, but only 20% and 3.2% had a good knowledge on weight for age and height for age charts respectively. Knowledge on immunization was good among 87.2% and overall knowledge was high in 44% of mothers. When considering usage, majority (73.6%) showed a moderate level of usage while only 13.6% showed a good level of usage. Most mothers (65.6%) identified the Public Health Midwife as the main source of health education.

Conclusions
A majority of mothers showed a high level of knowledge on immunization, developmental milestones and general knowledge of the CHDR, but moderate and poor knowledge on weight for age and height for age charts respectively. The overall knowledge and usage of the CHDR was moderate. The main source of knowledge for mothers was the PHM but most had never received a separate education session on the CHDR.
Pathological significance of Epidermal Growth Factor Receptor (EGFR), Vascular Endothelial Growth Factor (VEGF), Chemokine Receptor 4 (CXCR4) and Vimentin expression by colon carcinoma cells

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Introduction
Colon carcinoma has a worldwide incidence of over one million with a 5 year survival rate of <20% for metastatic disease. Identification of metastasis related biomarkers will enable risk evaluation of metastasis in colon carcinoma.

Objectives
To correlate the expression of EGFR, VEGF, CXCR4 and Vimentin with the pathological tumour and nodal stage (pTN) of colonic carcinoma.

Methods
Ninety one consecutive patients who underwent resection for colon carcinoma are included. Information on (pTN) staging was obtained from the histopathology records. Four biomarkers were evaluated on paraffinized tumour tissue using immunohistochemistry methodology. Biomarker expression was assessed by two reviewers blinded to (pTN) staging. Positive staining was evaluated as high and low expression in VEGF, CXCR4 and Vimentin. EGFR was evaluated as positive/negative. Cross-tabulations were generated between T&N stages and biomarker expression levels. The Chi Square test was used to indicate statistical significance of the association.

Results
T2, T3 and T4 tumours accounted for 21(23\%), 60(66\%), 10(11\%) and N0, N1 and N2 tumours accounted for 54(61\%), 23(26\%) and 12(13\%) respectively. T4 tumours were associated with positive expression of EGFR($X^2=7.1, p=0.008$) and VEGF($X^2=3.9, p=0.048$) compared with T2+T3 tumours. T3+T4 tumours showed reduced expression of Vimentin($X^2=4.41, p=0.036$) compared to T2 tumours. N2 status was associated with positive EGFR expression($X^2=3.905, p=0.048$) compared with N0+N1.

Conclusions
EGFR expression was associated with advanced tumour and nodal stage. High VEGF and reduced Vimentin expression were also associated with advanced tumour stage. Advanced nodal stage was only associated with high EGFR expression. CXCR4 was not associated with pTN stage.
Association between selected single nucleotide polymorphisms (SNPS) in chromosome 5 and anti-malaria antibodies in a malaria endemic area in southern Sri Lanka

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Introduction
Malaria incidence, at present, is low in Sri Lanka and the cases reported from Moneragala District, which was a malaria endemic area, have reduced; but a study of host factors associated with protection is important to achieve targets for malaria elimination. This study planned to investigate the antibody profile of some specific anti-malarial antibodies and study its association with host genetic mutations in chromosome 5.

Objectives
To investigate the relationship between selected anti-malaria antibodies and polymorphisms in human chromosome 5

Methods
Based on the previous census, every household in eight villages near the Malaria Research Station, Kataragama was listed and every individual living in these households was selected. Blood was collected from 1011 individuals to extract sera and DNA. Data on age, sex, bed net use and history of malaria was collected and thick/thin blood smears were examined for malaria. 80 SNPs in 16 genes in chromosome 5 were genotyped using the Sequenom iPLEX Platform and antibody titres against P. falciparum AMA1, MSP1, MSP2, NANP and P. vivax AMA1, MSP1 were determined by ELISA. Antibody levels were analyzed in relation to age, history of malaria and association between antibody titres and SNPs were tested.

Results
Ages ranged from 14 to 89 years with approximately equal numbers of males and females (514:497). Over 99% of the population was Sinhalese with only seven being Tamil. The majority of individuals (>95%) used bed nets. Only 18.4% (186/1,011) had had clinical malaria within the past 10 years and none within the past five years. At the time of sample collection, blood smear examinations were negative for malaria in all subjects. Sero-positivity rate against P. falciparum and P. vivax was 80% and 97% respectively. A positive association between antibody levels and age was observed (which was highest at 59 years), but not with gender. Significant associations were seen between high levels of anti-AMA1 (Pf) with SNPs rs25882 (CSF2) and rs1881457 (IL13); anti-MSP1 (Pf) with SNP rs2706348 (RAD50); anti-NANP (Pf) with SNPs rs25887 (CSF2), rs156029
(P4HA2), rs272867 (SLC22A4) and rs1881457 (IL13). Levels of anti-MSP2 (Pf) was not associated with any of the tested SNPs. High levels of anti-AMA1 (Pv) was associated with SNP rs1801033 (C6) and anti-MSP1 (Pv) with SNPs rs156029 (P4HA2) and rs848 (IL13). High linkage disequilibrium was observed between SNPs rs1801033 and rs1881457 (D’=0.858, LOD=164.96, r2=0.646), rs25882 and rs2706348 (D’=0.86, LOD=146.5, r2=0.667), rs2706348 and rs272867 (D’=0.662, LOD=54.79, r2=0.279).

Conclusions

High anti-malaria antibody levels are maintained despite low malaria transmission. Positive association between sero-prevalence of anti-malarial antibodies with increasing age suggests an age specific acquired immunity. Genetic basis for serological response could be suggested with SNPs acting individually or together with evidence of strong linkage between these markers.

This work has been previously published in an international conference in early 2012.
Effectiveness of stretching exercises for leg cramps during pregnancy: a study at the de Soysa Maternity Hospital, Colombo

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Introduction
Leg cramps are a common complaint in pregnancy that could compromise sleep and the ability to work. Stretching is highly recommended to prevent leg cramps but supportive evidence is inadequate.

Objectives
The main objective of the study was to determine the effectiveness of stretching exercises in preventing leg cramps during pregnancy. Other objectives were to determine the frequency, severity, sleeping disturbance and daytime sleepiness, and disturbance of physical/mental/social activities due to leg cramps during pregnancy and also to determine whether participants take treatment for managing or preventing leg cramps.

Methods
A within subject experimental design study was carried out in uneventful, singleton, primigravid mothers with leg cramps in the third trimester of pregnancy who were attending antenatal clinics at De Soysa Maternity Hospital, Colombo, Sri Lanka. First 60 pregnant mothers who fulfilled inclusion criteria were recruited. Self-administrated questionnaires were distributed before and after one month of commencement of stretching exercises.

Results
Among participants 75% experienced leg cramps twice per week or more and 40.4% of them suffered from severe leg cramps prior to intervention. Furthermore 82.7% of mothers suffered from moderate or severe sleeping disturbance during the third trimester. Moreover 46.2% of participants physical/mental/social activities were moderately disturbed. In the study population 80.8% participants were taking some form of treatment for acute leg cramps. However 82.7% participants did not take any measures to prevent further leg cramps. Following the intervention a significant reduction (p<0.001) in severity, frequency, sleeping disturbance and disturbances to activities was seen after introduction of stretching exercises.

Conclusions
A considerable proportion of women in the third trimester of pregnancy experience sleep, physical, mental and social disturbances due to leg cramps. These are effectively mitigated by stretching exercises.

This study was presented at the Annual Research Symposium of the Allied Health sciences unit, Faculty of Medicine, University of Colombo on 15th December 2011.
Effects of paraplegia caused by spinal cord injuries on functional status and quality of life of individuals and on family economy among patients admitted to two selected hospitals

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Paraplegia results from spinal cord injury at the first thoracic vertebral level and below. It leads to paralysis of lower limbs and possibly also the trunk. This brings sudden and profound life changes causing the person physical disability, emotional disturbances and social isolation. In addition, it has profound effects on the patient’s family especially on economic aspects.

Objectives

The study was conducted to assess the effects of paraplegia caused by spinal cord injuries on an individual’s functional status, quality of life and family economy.

Methods

This descriptive study was carried out at the National Hospital of Sri Lanka and the Rehabilitation Hospital Ragama with a study sample of 100 traumatic paraplegic patients who were in the age range of 18 to 65 years.

Results

Traumatic paraplegics were mostly men (85%) in the 26-45 years age group (59%). Majority were married (73%) and employed (61%). The major cause for the injury was a fall from a height (63%) and the main lesion was complete transection of the spinal cord (55%). The commonest level was the upper thoracic region i.e. T1- T8 (40%). Functional status of the majority of paraplegics were “minimally assisted” for eating (48%) and grooming (38%) and “moderately assisted” for bathing and dressing, maximally assisted for toileting (37%) and totally assisted for bowel (78%) and bladder (77%) management. Transferring and ambulation also needed total to maximal assistance by the majority. Regarding quality of life, the victims’ family component (mean=67.4) and social, economic aspects (mean=63.1) were acceptable when compared to physical (mean=57.32) and emotional (mean=47.06) components. The study revealed that expenditure was significantly high (p=0.001) and income significantly less (p=0.001) after the injury.

Conclusions

Most of the traumatic paraplegics were physically active young men and the leading cause for the injury was a fall from a height. Their level of functioning was approximately half when compared with healthy individuals. Their quality of life was relatively good on family and social aspects whereas the physical and psychological aspects were somewhat poor. The family economic losses were significantly high and earnings were significantly less after the injury.

This study was presented as Oral presentations at 1) 10th Asian Spinal Cord Network(ASCON)-International Conference on spinal cord injuries, and 2) Annual Student Research Symposium, 2011: Allied Health Sciences Unit, Faculty of Medicine, University of Colombo.
Prevalence of reduced vision and its associated factors among school children of grades 6-10 in an urban school

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Introduction

Sight or vision is the ability of the brain and eye to detect electromagnetic waves within the visible range of light. A child’s vision is essential to his/her success in school. When vision suffers, chances are more for school work to suffer too.

Objectives

To assess the prevalence of reduced vision and its associated factors among school children

Methods

A cross-sectional study was conducted among 197 children in Grades 6-10 in urban schools selected using the cluster sampling method. Visual acuity was measured using a standard Snellen’s chart. Visual acuity of $\leq 6/9$ in at least one eye was considered as ‘reduced vision’. A self-administered questionnaire assessed the potential factors associated with reduced vision such as time spent on television, computer, video games, reading and studying, hours of sleep, family history of visual defects and past history of eye infection.

Results

Majority of subjects were male (73%) and in Grade 8 (34%). The prevalence of ‘reduced vision’ was 42% among the children. Of them, 42% (n=84) had visual acuity of $\leq 6/9$ and $\leq 6/18$ in 8.6%. Factors associated with reduced vision were being female (51%), less than 3 hours of daily television watching (43%); more than 1 hour/day of daily computer usage (45%), more than 1 hour/day of playing video games (55%), more than 2 hours/day of studying (46%) and more than 6 hours/day of sleeping (52%); past history of infection (48%); and family history (43%). Of these, only the longer video game playing was significantly associated with reduced vision ($p < 0.05$).

Conclusions

High prevalence of reduced vision among children, mostly due to playing video games, warrants parental restriction of continuous video game play to less than one hour.
Assessment of leadership skills among first year medical students using the authentic leadership questionnaire

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Introduction
With increased public interest to see doctors take on more significant leadership roles, it is essential to develop strong personal qualities and professional values through the medical curriculum, enabling them to become future leaders not only in the health sector but also in society in general.

Objectives
To assess leadership skills among medical students and their immediate leaders.

Methods
Self and Rater versions of the Authentic Leadership Questionnaire (ALQ) were distributed among 200 first year students at the Faculty of Medicine, Colombo. The score calculated for each of the 4 components of the ALQ (transparency, self awareness, ethical skills, and balanced processing) is the average of the score of 1 to 4 given for its items. An average of 3 or more for each component is compatible with good leadership skills. Each component was analysed separately using descriptive and comparative statistics using SPSS (v13).

Results
The overall assessment of leadership skills of the participants in all 4 components was <3 (transparency, n=146;2.82±0.44; ethical skills; n=123;2.51±0.51, balanced processing; n=115;2.90±0.06; self awareness; n=131;2.83±0.51). The skills of the leaders in all the components were significantly higher than self (p<0.001; transparency: 3.31±0.44; ethical skills: 2.94±0.56; balanced processing: 3.17±0.05; self awareness: 3.20±0.56). The females demonstrated significantly lower (p=0.019) ethical skills (2.36±0.52) than males (2.71±0.46). 85.4% rated themselves as good or average leaders and 76.3% rated their leaders as very good or excellent.

Conclusions
Majority of students have poor leadership skills and a discrepancy exists between their actual skills and how they view themselves as leaders. Females have lower ethical skills than males. The immediate leaders have been rated to have significantly higher leadership skills than self. It is important to determine contributory factors for poor leadership skills in this group and address them during their training to improve their leadership skills.
Comparison of selected health risk behaviours and attitudes between newly entered and fourth year students of the Faculty of Medicine, University of Colombo in 2010

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Introduction
Medical students are the doctors of the future, who will be considered as role models. Only with proper guidance for lifestyle modifications, can society overcome the currently rising burden of non communicable diseases. To deliver proper guidance, doctors themselves should be free of health risk behaviors and attitudes. Therefore it is worth measuring the prevalence of health risk behaviors among medical students and how it evolves during the course of medical education.

Objectives
To compare selected health risk behaviours and attitudes between newly entered and fourth year students of the Faculty of Medicine, University of Colombo in 2010

Methods
391 students participated in this descriptive cross sectional study representing newly entered and fourth year medical students of the Faculty of Medicine, University of Colombo in the year 2010. All the students in the targeted population were studied other than the non respondents. A self administered questionnaire on selected health risk behaviours and attitudes was used. Socio demographic data, selected health risk habits (physical activity, dietary habits, smoking, alcohol intake) and attitudes on individual health risk habits were analyzed using chi square test and odds ratio.

Results
The study population consisted of a diversity of students belonging to different ethnicities, different religions and family income. The total prevalence of smoking (newly entered 2.1% vs fourth year 5.9%) and alcohol intake (newly entered 7% vs fourth year 16.2%) was low. Significant differences were observed in skipping of a meal ($\chi^2=25.416; df=1; p<0.05$ and $OR=0.311; 95\%CI 0.196-0.495$), alcohol intake($\chi^2=7.998; df=1; p<0.05$ and $OR=0.387; 95\% CI 0.197-0.761$) and smoking ($\chi^2=4.840; df=1; p<0.05$ and $OR=0.261; 95\%CI 0.072-0.939$) among newly entered and fourth year medical students.

Conclusions
Between newly entered and fourth year medical students of Colombo Medical Faculty in 2010, statistically significant differences were found on the prevalence of smoking, alcohol, skipping meals and responses to some of the attitude questions. Our findings suggest the importance of considering interventions focused on promoting healthy student lifestyles within the medical school and the necessity for further studies in this area in order to plan successful interventions.
Problems, inconvenience and satisfaction associated with the use of prostheses among below knee amputee Sri Lankan army soldiers

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Introduction
Landmines and motor blast injuries during the three decades of separatist war in Sri Lanka have resulted in hundreds of trans-tibial (below knee) amputees among army soldiers. Many of them have regained independent ambulation with lower limb prostheses.

Objectives
To assess the level of satisfaction and level of functioning of prostheses among below knee amputee soldiers of the Sri Lankan army and to describe the problems related to trans-tibial prostheses they have experienced

Methods
One hundred unilateral trans-tibial amputee army soldiers who had used prostheses for more than 1 year were selected using convenience sampling from Ranaviru Sewana, Ragama and a Ranaviru village, Kalutara. The study instrument was a self administered questionnaire developed based on the Prosthetic Evaluation Questionnaire (PEQ). It contained 30 questions with numerical analog scales which belong to 12 categories, 6 individual questions and one open ended question.

Results
Mean age (SD) of amputees at the time of the study was 30.0 (6.7). Mean number of hours of prosthetic wear (SD) per day was 11.6 (4.9). Over half of the sample (53.4%) was satisfied with their prosthesis in general. A percentage of 79.5 were satisfied on the social burden scale and 68.2% were satisfied about prosthetic training. A percentage of 56.8 were satisfied regarding perceived response. Meanwhile more than half of the sample were unsatisfied (62.5%) about the appearance (ability to wear different foot wear) of the prostheses. At the same time 56% to 69% had a score below 65 in all four categories of Ambulation, Utility, Residual limb health and Squatting, and indicated a poor functional level. Main problems identified were, inability to squat, walking on slippery surfaces and walking up/down stairs, skin problems such as blisters or rashes, sweating inside the prosthesis, phantom limb sensation, residual limb pain and non-amputated limb pain.

Conclusions
Though more than half of the sample were satisfied with their below knee prosthesis, majority had a poor level of prosthetic functioning. A set of function related and health related problems were experienced by these amputee soldiers.

This study was presented as a poster presentation at the “Ethnicity, Race and Disability : State of the Science” international conference held at Arlington, Virginia, USA and as an oral presentation at the “Annual Research Symposium 2011” organized by the Allied Health Sciences Unit, Faculty of Medicine, Colombo.
Do learning styles and approaches to learning differ among medical undergraduates and post graduates?

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Objectives
To assess the differences in approaches to learning (deep, strategic and superficial) and learning styles (visual, auditory, read/write and kinesthetic) between first and final year medical students and postgraduate students using standard validated assessment tools.

Methods
We used self administered VARK and ASSIST questionnaires to assess the differences in learning styles and approaches to learning amongst medical undergraduates of the University of Colombo and postgraduates of PGIM. Comparisons were made using students t test. SPSS v15 was used for analysis.

Results
A total of 147 participated: 73 (49.7%) first year students, 40(27.2%) final year students and 34(23.1%) postgraduate students. Response rates were 98.6%, 88% and 94.1% respectively.

The majority of first year students had bimodal (30.1%) and unimodal (30.1%) learning styles. Among unimodal learners, the majority were auditory learners (50%). Among bimodal learners, auditory-reading (50%) and auditory-kinesthetic (31.8%) types predominated. Among final year students, the majority (32.5%) were unimodal learners with kinaesthetic approach (38.5%) predominating. Among postgraduates also the majority were unimodal (52.9%) learners with kinaesthetic approach (33.4%) predominating. Among all three groups, the predominant approach to learning was strategic. When comparing between groups, postgraduates had significant higher mean scores for deep approach and strategic approach than first years or final years (p <0.05 for both). Mean scores for the superficial approach did not differ significantly between groups. Mean scores for all three approaches did not differ significantly between first and final years. Regarding gender differences, majority of males were unimodal (37.7%) learners with kinesthetic style predominating (31%). Among females, the majority (34.3%) were unimodal learners, but dominant learning style was auditory (41.7%). The predominant learning approach in both genders was strategic, and no significant differences were observed between the two groups (P value < 0.05)

Conclusions
The learning approach showed a positive shift towards deep and strategic learning in postgraduate students. However a similar shift was not observed in undergraduate students during their transition from first year to final year. Thus the undergraduate curriculum does not seem to influence learning methodology over its five year period. Understanding the differences in the learning styles and learning approaches may have important implications in development of effective medical curricula for both undergraduates and post graduates.

250
HLA-DQ alleles in patients with cutaneous leishmaniasis in Sri Lanka: a preliminary report

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Introduction
Leishmaniasis is an endemic disease in Sri Lanka with localized cutaneous leishmaniasis (LCL) continuing to be the predominant form to be reported. \textit{L. donovani}, the parasite isolated from cutaneous lesions in Sri Lanka, is commonly known to cause the visceral form of the disease, in foci around the world. Polymorphisms of human leucocytes antigen (HLA) system have been implicated in susceptibility as well as the phenotype of leishmaniasis.

Objectives
The objective of this study was to determine the association of class 11 alleles of HLA with LCL in the Sri Lankan population. The preliminary findings are presented.

Methods
A DNA resource consisting of DNA extracted from the venous blood of 200 patients with cutaneous leishmaniasis and 200 age, sex and ethnicity matched controls has already been established. DNA of 40 patients and 30 controls from the above sample collection were genotyped for alleles of HLA-DQB1 by a PCR-SSP low resolution method.

Results
The allele distribution in cases and controls were as follows: Cases- HLA-DQB1*02: 12.5\%, HLA-DQB1*03: 28.75\%, HLA-DQB1*05: 25\%, HLA-DQB1*06: 33.75\%. Controls - HLA-DQB1*02: 6.7\%, HLA-DQB1*03: 26.7\%, HLA-DQB1*05: 35\%, HLA-DQB1*06: 31.6\%. The above allele frequencies did not differ significantly between cases and controls (P>0.05).

Conclusions
The preliminary analysis is underpowered to support or refute the hypothesized association. Genotyping the rest of the sample collection is ongoing in our laboratory.

\textit{This work was supported by National Research Council (Grant No: 09-01).}
Characterization of leishmaniasis vectors in selected areas in Sri Lanka

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Introduction
Leishmaniasis, caused by parasites that belong to the genus \textit{Leishmania} and transmitted by vector sandflies, is a major health concern in Sri Lanka. Majority of the cases detected at present are cutaneous leishmaniasis (CL) though a few cases of visceral leishmaniasis (VL) are also reported. Though there are several species of sandflies reported in Sri Lanka, the sandflies that belong to \textit{Phlebotomus argentipes} complex is presumed as the probable vector of Sri Lankan CL, through preliminary studies on distribution of sandflies in the country.

Objectives
The main objective of this study was to characterize the vectors of leishmaniasis in selected areas in Sri Lanka. The identification of species distribution of sandflies in selected disease-endemic areas, identification of the aggregation behavior within animal-baited traps and study of host preference through blood meal analysis were carried out.

Methods
The adult sandflies were collected from selected sites with known local transmission of CL in the Matara, Kurunegala and Hambantota districts using cattle-baited net traps and light traps. Hourly collection of the sandflies attracted to the cattle traps were carried out for a period of 12 hours (overnight) to detect the peak aggregation period. Manual collection of sandflies using mouth aspirators was carried out from resting places (latrines, abandoned buildings, temporarily shelters made for the collection of firewood).

Results
Morphological identification of both male and female sandflies revealed the dominance of \textit{Phlebotomus glaucus} (a subspecies that belong to \textit{P.argentipes} species complex) (n=6766; 74\%) in most of the selected sites (08/09). The only other sandfly species found in study areas was a non-human vector that belonged to genus \textit{Sergentomyia} (\textit{S.zeylanica}). Male sandflies outnumbered the female sandflies in a ratio of 8:1 within the cattle-baited net traps. Overnight hourly collections of sandflies showed the peak aggregation around 2000 hours and 2300 hours with highest number appearing within the cattle traps between 2100 hours to 2200 hours. A total of 106 blood-fed sandflies (\textit{P.glucus} 44, \textit{S.zeylanica} 62) were analyzed using PCR. Blood meals of \textit{P. glaucus} revealed the presence of blood from cattle (n=28), buffalo (n=6) and human (n=10). Majority of blood meals from \textit{S. zelanica} (46/62) were positive for human blood and rest were negative for mammalian blood.
Conclusions
The sandflies belong to *P. argentipes* complex is the most commonly distributed species in selected districts of Sri Lanka. The probable vector of CL in Sri Lanka (*P. argentipes*) demonstrates zoophilic behavior. *S. zeylanica*, though a non-vector species is likely to play an important role as biting nuisance due to their anthropophilic nature. Further studies are underway to confirm the findings using a bigger sample.

Authors would like to acknowledge financial assistance from National Science Foundation (RG/2005/HS/07) and University of Colombo (AP/03/2011/PG13).
Adherence to the recommendation of exclusive breastfeeding by mothers attending immunization clinics at the Lady Ridgeway Hospital

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Introduction
Breast milk is the best diet for human babies. World Health Organization has recommended exclusive breastfeeding up to 6 months in order to achieve optimal growth, development and health of the child. Available data suggests that urbanization and increasing economic demands can adversely affect exclusive breastfeeding.

Objectives
To identify the pattern of breastfeeding in the first 6 months and factors affecting the non-compliance with the recommendation of exclusive breastfeeding.

Methods
A descriptive cross-sectional study was carried out on mothers having infants between 4-6 months of age who are attending the immunization clinic at Lady Ridgeway Hospital. Mothers were chosen for the study using systematic sampling. Only those who fulfilled the inclusion criteria were included in the study. Informed verbal consent was obtained. The study instruments included an interviewer administered questionnaire and record sheet. The data obtained was analysed using SPSS 17.0 software.

Results
The overall prevalence of exclusive breastfeeding in our study population was 66%. The most commonly given supplement was water, and the most common reason for giving supplements was the feeling of inadequate breast milk. There was a statistically significant positive association between exclusive breastfeeding and mother being a housewife, living in a nuclear family, and having exclusively breast fed a previous child for 6 months (p<0.05). There was a statistically significant negative association between exclusive breastfeeding and grandmother taking care of the child at home and practicing expression of breast milk. (p<0.05).

Conclusion
The study showed that a significant proportion of mothers do not practice exclusive breastfeeding. Working mothers and mothers living in extended families were more likely to introduce supplements before six months.
Clinico-epidemiological aspects of *L. donovani* cutaneous infections in Sri Lanka

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**Introduction**

Human cutaneous leishmaniasis (CL), caused by the usually visceralizing species *L. donovani*, has recently emerged as an important public health problem in Sri Lanka. Furthermore, genetic studies showed that the local strain of *L. donovani* is different from the members of same species complex found in other endemic sites in the world indicating possible differences in the clinico-epidemiological characteristics too.

**Objectives**

Study aimed at identifying clinico-demographic characteristics, annual seasonal variation and spatial distribution of leishmaniasis.

**Methods**

Patients who were referred to us with a provisional diagnosis of CL were recruited for the study after informed written consent. Patients were clinically evaluated. A pre-tested interviewer administered questionnaire was completed. Laboratory diagnosis was established by light microscopy (LM) and/or PCR performed on lesion material. Data was entered and analyzed using SPSS.

**Results**

Highest number of cases were received from the districts of Matara (n=726, 40.3%), Hambantota (n=316, 17.5%), Anuradhapura (n=205, 11.4%) and Vavuniya (n=182, 10.1%). Over 90% of patients provided adequate evidence to conclude that the disease was contracted while based in the same province. There is bi-annual seasonal variation of case presentation with 2 peaks in April-June and August-October. Majority in laboratory confirmed group (n=467, 46.4%) was in the 21-40 year age group. Mean ages did not differ by gender (32.9 years, SD=18.4) for males and 34.1 years (SD=20.6) for females. Lesions were mainly single (n=845, 84%), presented within 6 months of onset (n=871, 86.6%), less than 2cm in diameter (n= 932, 92.7%) and rounded in shape (n=752, 74.8%). There were several types of lesions seen approximately in equal proportions (papules of less than 1cm diameter-22.6%, nodules -32.5%, ulcerating nodules-27.4% and ulcers 28.2%). Most of the lesions were found on exposed body areas (forearm and hand- 46.3%, head and neck region-37.1%).
Conclusions

Disease seems to be transmitted regionally within the island. Almost all the districts were affected. Local strain of *L. donovani* is mainly dermatrophic, but may possess the ability to spread. Appropriate control measures may be urgently required to minimize further spread.

*We acknowledge the National Science Foundation, Sri Lanka, Commonwealth Scholarship commission UK, University of Colombo research grants and WHO/SEARO research training grants for funding.*
Awareness about factors related to unintentional paediatric poisoning (UPP) among Sri Lankan mothers attending the Lady Ridgeway Children’s Hospital

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Introduction
Unintentional paediatric poisoning (UPP) is a major public health issue worldwide. Lack of caregiver awareness is an identified risk factor for UPP. Determining level and gaps of awareness among mothers is useful in developing prevention strategies.

Objectives
To describe the knowledge about factors related to UPP among mothers and to determine associated maternal factors.

Methods
A descriptive cross sectional study was conducted at the Lady Ridgeway Children’s Hospital. A random sample of 150 mothers was given an interviewer administered questionnaire and a knowledge score was assigned. Chi square test was used to investigate associations between maternal knowledge and demographic factors.

Results
Study population had a mean age of 32 years with 86.7% having more than primary education. 90.6% had overall knowledge score of >50% and 29.3% had a score >80%. Majority had an adequate knowledge (score >50%) for identification and prevention strategies related to the two most prevalent means of UPP in the developing world, kerosene and pesticides. Knowledge about poisonous plants was poor. 39.3% had a poor level of knowledge (score < 50%) about family factors. Majority believed that children are secure when mother and child are alone at home. 50% did not identify age groups most susceptible for UPP. Overall knowledge score associated significantly with family income (p<0.05) while knowledge score with respect to kerosene, pesticide and medicinal drugs associated significantly with mother’s education level (p<0.05). 88% of mothers used reliable media to gain relevant knowledge.

Conclusions
Sri Lankan mothers have satisfactory awareness regarding the two most prevalent types of UPP in SL; while they have limited knowledge regarding poisonous plants, medicinal drug poisoning and child/family risk factors for UPP. Practices and attitudes have to be focussed on developing strategies for kerosene and pesticide poisoning prevention. Reliable media and school curriculum are possible media to improve identified deficiencies in awareness.
Factors affecting the compliance to investigations of patients with Diabetes Mellitus attending a medical clinic at a tertiary care hospital


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Introduction
The prevalence of Diabetes Mellitus has increased rapidly in Sri Lanka during the last decade. Glycaemic control and complications of diabetes should be assessed regularly. Although health care is provided at zero user charge in the government sector, patients have to get many of the investigations performed in the private sector as they are not available in the state sector.

Methods
A cross sectional descriptive study was carried out in the clinics of a general medical unit at the National Hospital of Sri Lanka. 107 consecutive patients diagnosed with type II Diabetes Mellitus were recruited. Data was collected using an interviewer administered questionnaire. The awareness of patients regarding the relevant investigations (Fasting blood glucose, HbA1c, lipid profile, urine for microalbumin and retinopathy screening) and the factors affecting their compliance towards these investigations was assessed.

Results
56.1% of the patients were females. The mean age of the participants was 61 years. Majority (35.5%) were educated up to GCE Ordinary Level while 28% had only studied up to Grade 5. 42.1% had a income in the range of Rs.10,000-20,000 and 25.2% had a income less than Rs. 10,000. The majority (74.8%) performed investigations monthly, while 11.2% performed the test at a frequency of once in two months or less. The commonest reason for not doing fasting blood glucose (FBG) as advised was forgetting to do the test (25%). 22.5% did not do it regularly because of financial constraints. Compliance with other investigations was less than that for FBG. The main reasons for not doing lipid profile, HbA1c and urinary microalbumin periodically according to the patients were lack of awareness of the tests and the high cost involved. The majority of patients had not heard of the investigations HbA1c (77.6%) and urine microalbumin (50.5%). However these rates were considerably less for lipid profile (18.7%) and retinopathy screening (16.8%).

Conclusions
While monitoring the glycaemic control of diabetic patients and assessing complications is an essential part of management, the relevant investigations were often not done regularly due to factors like poor awareness about the investigations and high cost of these investigations which are not available to them in the state sector. Awareness regarding HbA1c in particular was poor.
A pilot study on comparison of rapid immunodiagnostics for leptospirosis infections

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Introduction
In Sri Lanka, leptospirosis is mostly diagnosed on clinical grounds. Serological confirmation is not obtainable during the acute stage of the illness. There is a need for rapid immunodiagnostics for confirmation of leptospirosis. Two immunodiagnostic assays, ie enzyme linked immunosorbent assay (ELISA) and immunochromatographic technique-Leptocheck-WB test (LCT) are used to detect leptospira specific IgM antibodies which are prevalent in the early stages of acute infections.

Objectives
To compare the efficacy of these two rapid immunodiagnostic assays with the microscopic agglutination assay (MAT) to determine their applicability.

Methods
A set of sera (n=83) collected in 2010 for which MAT titres were available was used to perform IgM ELISA and LCT. MAT ≥400 was used as the reference standard.

Results
Positivity for LCT and IgM ELISA were 55.4% and 48.2% respectively, and both assays detected acute infection by day 3 of the illness. For LCT, the overall sensitivity, specificity, accuracy, PPV and NPV (86.5%, 75.0%, 79.6%, 69.6% and 89.4% respectively) were higher compared to the respective values for IgM ELISA (50.0%, 62.3%, 57.1%, 50.0%, 62.3%). The highest of these values were observed during the first week for LCT and during the second week for IgM ELISA. The highest agreement was observed between LCT and MAT ≥400 (κ=0.568) and there was a good agreement between LCT and IgM ELISA (κ=0.520).

Conclusions
The high sensitivity and specificity, ease of use and the non-requirement of specialized skills and equipment, makes LCT a good choice for screening compared to MAT and its application needs to be further investigated.

This work was supported by IBMBB, University of Colombo. This work was published as 1) Poster at the Proceedings of the 6th Annual Sessions of the Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo, April, 2012, 2) Oral presentation at the 6th Biennial Sessions of the Allergy and Immunology Society of Sri Lanka, 15th June, 2012, and 3) Poster at the 125th Anniversary International Medical congress, 01st-06th July, 2012.
Risk factors and prevalence of non-fatal stroke in Sri Lanka – a community based study

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Introduction

Even though there is much published data on the risk factors and prevalence of non-fatal stroke in different communities, scientific data is limited in the Sri Lankan setting. Therefore new data on non-fatal strokes/TIA in the Sri Lankan community will be invaluable in policy making and in resource allocation in the health sector.

Objectives

To determine the prevalence and risk factors of non-fatal strokes/TIA in the Sri Lankan population.

Methods

A random sample of 4485 non-institutionalized adults aged ≥18yrs was selected and their anthropometric details and its correlates were collected as a part of the Sri Lanka Diabetes and Cardiovascular Study (SLDCS) which was a national level community based study on diabetes and cardiovascular disease. Diagnosis of stroke was made according to the WHO definition. Patients who had suffered a non-fatal stroke were identified by an interviewer administered questionnaire using the defined diagnostic criteria. Results were analyzed using independent T test and correlation.

Results

Out of 4473 participants 72 had suffered a non-fatal stroke/TIA giving a prevalence of 1.609% in the community. Occurrence of non-fatal stroke/TIA showed a statistically significant (p<0.05) relationship with the male sex, alcohol consumption, low physical activity, waist hip ratio, low HDL cholesterol, raised blood sugar (FBS/PPBS) and left ventricular hypertrophy. Presence of co-morbidities such as diabetes mellitus, hypertension, ischemic heart disease, peripheral vascular disease, and pancreatic disease also proved to have a significant association with the occurrence of Stroke/TIA. There was no statistically significant relationship with regard to the presence of family history of hypertension, ischemic heart disease and stroke in siblings, parents and grandparents.

Conclusion

The prevalence of non-fatal stroke/TIA in the Sri Lankan community was found to be almost twice as high compared to a similar study done in Bombay India (0.842% prevalence in the Parsi community). However it was significantly lower than the prevalence of 19.1% observed in a study conducted in an urban slum of Karachi, Pakistan.
Although our study reveals a relatively low prevalence of non-fatal stroke/TIA in the Sri Lankan community, it is in our best interest to increase awareness regarding stroke prevention and the treatment options available. This study has also highlighted the importance of blood pressure and glycaemic control in the prevention of strokes/TIA.
Reliability of the 20 minute whole blood clotting test as an indicator of coagulopathy in patients envenomed by Sri Lankan Viperidae snakes


Faculty of Medicine, University of Colombo

Introduction

Snake bites carry a high rate of morbidity and mortality as a result of the local and multi systemic complications. There is an estimated 40,000 snake bites every year in Sri Lanka. Coagulopathy is one of the main complications caused by the venom of Viperidae. The toxic effect of the venom activates enzymatic pathways which results in crisis of homeostasis. The current practice of detection of coagulopathy is by the 20 minutes whole blood clotting time (20 WBCT). Coagulopathy also leads to the alterations of Prothrombin Time (PT), INR, Activated Partial Thromboplastin Time (APTT) and Thrombin Time (TT). A discrepancy between 20 WBCT and the coagulation profile has been observed in some instances. A recent study concluded that WBCT was not a good test to identify coagulopathy in Russell’s viper envenomation.

Objectives

This study was conducted to identify the correlation between 20 WBCT and coagulation profile.

Methods

A prospective analytical study was carried out in all medical wards of the National Hospital Sri Lanka within a period of 6 months from January 2012. The diagnosis of the viper bite was based on visual examination of the snake or the syndromic approach. Serial 20 WBCT was done at the bed side and concomitant PT/INR and APTT was done at the hematology lab, NHSL. Information regarding the socio-demographic factors and the snake bite was gathered via interviewer administered questionnaires.

Results

17 patients were included in the study. Majority (58.8%) was male and mainly from Colombo suburbs. Commonest viper bite presentation was hump nosed viper (41%) and commonest area of bite was foot (70.6%). 41% of patients presented to the hospital within the first hour after snake bite.76.5% had local complications and 53% had at least one systemic complication regardless of the type of viper. Out of them, 17.6% had neurotoxicity, 41.2% had nephrotoxicity while 29.4% had coagulopathy. There was no statistically significant correlation between the result of 20 WBCT and coagulation tests, PT (p=0.856) and APTT. (p=0.361)

Conclusions

Results of the current study suggested that there was no correlation between 20 WBCT and coagulation tests, PT and APTT in patients envenomed by Sri Lankan Vipiridae snakes. Implications of this may be far reaching. Therefore the study will be continued recruiting a larger number of patients.
FACULTY OF SCIENCE
Message from the Dean

It is with great pleasure that I send this message to be published in the Proceedings of the Annual Research Symposium 2012 of the University of Colombo. This Symposium provides a platform for academics of different disciplines to share their knowledge and experience in research.

The last century has been marked by spectacular scientific and technical advances including breakthroughs in Electronics and Information and Communication Technologies. However, it is already declared that in this century, the major focus would be on the research leading to the deeper understanding of the biology and chemistry of the human beings, and improvement of their performance including health. The necessary foundation to embark on such a task has already been laid down by the Immerging fields such as nanotechnology, biotechnology, and information and communications technology (ICT), brain research, and artificial intelligence (AI). The advancement of research in this arena will depend mostly on the ability of researchers in converging these technologies to suit the tasks. It is already an established fact that the convergence of such technologies also has had a profound effect on national economies, trade and livelihoods including food and agricultural production in many countries. In this context I believe the theme selected for this year’s Symposium “Converging Technologies and Sustainable Development” is a very appropriate one. In Sri Lanka, however, interdisciplinary research of this nature is still at its infant stage, and significant investments from the government and other funding agencies are necessary to improve this situation.

I wish to thank the Symposium Committee for organizing this event, and congratulate the Coordinator, Abstract Committee of the Faculty of Science, and Organizing committee of the Faculty for successfully organizing this event.

Professor T.R. Ariyaratne
Dean, Faculty of Science
Faculty of Science

Abstracts

1. Acetyl and butyryl-cholinesterase inhibitory activity of bran extracts of some Sri Lankan traditional red rice (Oryza sativa L.)
2. Potential of Sri Lankan black tea (Camellia sinensis L.) in dissolution of human kidney stones in vitro
3. Assessment of heavy metals in black tea produced in different agro-ecological regions of Sri Lanka
4. Genetic Diversity of the Plasmodium vivax Circumsporozoite Protein (Pvcsp) in Sri Lanka
5. Substrate effect on photocurrent enhancement of electrodeposited n-type Cu$_2$O thin films
6. Evaluation of the Strengths and Weaknesses in Teaching Physics through Competency-based Approach
7. Impact of shrimp-farming on mangrove ecosystems in Pambala, Chilaw
8. Weligama Coconut Leaf Wilt Disease (WCLWD) causing phytoplasma
9. Analysis of benzoic acid and sorbic acid in some selected food items available in Sri Lanka
10. Screening of Efficient Phosphate Solubilizing Microorganisms from Rhizosphere of Some Export Agricultural Crops
11. Fluorescent Sensor Based on 2-Cyano-1,10-phenanthroline for Fe$^{2+}$ion Analysis in Acetonitrile
12. Angiopteris evecta (Forst.) Hoffm: a potential source for antibacterial activity
13. Two-particle Quantum Walks over a Line
14. AC-SECM Metal Ion Imaging
15. A study of prognostic factors for Breast Cancer
16. Safety evaluation of Caryota urens L. (Kithul) treacle in rats
17. The Application of the Fama and French Factor Model for the Sri Lankan Stock Market 317
18. An investigation of the factors affecting the rental value of houses in Colombo district 322
19. Free amino acid profiles of Caryota urens L. (Kithul palm) sap, treacle and jiggery 324
20. Modeling Daily Rainfall using Markov Chains 327
21. Onset and Retreat of Rainy Season in the Dry Zone 330
22. Evaluation of new Mini STR markers for DNA based human identification; An in silico approach 333
23. Performance of neural network model in estimating daily maximum and minimum temperature in Jaffna 336
24. Development of Short Range Hazard prediction model for toxic air pollutants 339
25. A study of Science and Technology doctoral degree holders in Sri Lanka and their contributory patterns 343
Acetyl and butyryl-cholinesterase inhibitory activity of bran extracts of some Sri Lankan traditional red rice (*Oryza sativa* L.)

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**Introduction**

A prevalent therapeutic approach in treating neurodegenerative diseases such as Alzheimer’s disease is to enhance acetylthiocholine (ACh) levels using inhibitors of acetylcholinesterase (AChE), the selective enzyme responsible for the hydrolysis of ACh at the cholinergic synapses (Lawrence and Shakian, 1998). In addition to AChE, a substrate non-specific butyrylcholinesterase (BChE) also plays an important role in hydrolyzing ACh (Greig et al., 2002). Therefore, cholinesterase inhibitors intended for treatment of Alzheimer’s disease should have a good inhibition towards both enzymes. Role of oxidative stress in neurodegeneration is well reported and several antioxidant rich natural products are reported to have cholinesterase enzyme inhibitory activity (Pannangrong et al., 2011). Previously we reported the marked antioxidant activities of brans of selected Sri Lankan traditional red rice. The present study evaluates the acetyl and butyryl-cholinesterase inhibitory activity of brans of these selected rice varieties (RV) *in vitro*.

**Materials and Methods**

Four Sri Lankan traditional red rice varieties (Sudu Heeneti, Goda Heeneti, Masuran and Dik Wee) were obtained from Rice Research and Development Institute (RRDI), Batalagoda. Rice seeds were dehulled (Satake THU 35B), polished in a laboratory mill (Satake TM 05C) and passed through a 60-mesh sieve, resulting in a uniform fraction of rice bran. Rice brans were then extracted by shaking for overnight at room temperature with 10 times the sample weight of 70 % ethanol-water (v/v). Rice extracts were centrifuged and filtered through 0.45 µm nylon filters. Crude rice extracts obtained by filtration were evaporated to dryness with a rotary evaporator, under reduced pressure at 40 ºC and freeze dried. The freeze dried extracts were subjected to *in vitro* acetylcholinesterase/butyrylthiocholinesterase enzyme inhibition assays.

**Acetylcholinesterase/butyrylthiocholinesterase enzyme inhibition assay**

AChE and BChE inhibition assay was performed according to method of Ellman et al. (1961) with some modifications using 96 well micro plates. A reaction volume of 200 µl containing 150 µl of 0.1 M sodium phosphate buffer (pH 8.0), 0.02 mU of AChE/ BChE (10 µl) and 10 µl of different concentrations of rice bran extracts and the positive control...
were pre incubated for 15 min at 25 °C. The reaction was then initiated by the addition of 0.071 mM acetylthiocholine/butyrylthiocholine and 0.5 mM DNTB in 20 µl of 0.1 M sodium phosphate buffer. The hydrolysis of acetylthiocholine/butyrylthiocholine was monitored by the formation of yellow 5-thio-2-nitrobenzoate anion as the result of the reaction of DTNB with thiocholine for a period of 10 min at 412 nm using 96 well micro plate reader. Galanthamine was used as the positive control. Rice bran extracts were dissolved in 50 % ethanol. Control incubations were carried out in the same way while replacing rice bran extracts with same amount of 50 % ethanol. All the reactions were performed in triplicate. The kinetic parameter Vmax was used to calculate the % inhibition. The concentrations of rice bran extracts and the positive control that inhibited the hydrolysis of acetylthiocholine/butyrylthiocholine by 50 % (IC50) were calculated using the EZ-Fit Enzyme Kinetics program (Perrella Scientific Inc., Amherst, MA, U.S.A.).

Results and Discussion

Acetylcholinesterase and butyrylthiocholinesterase enzyme inhibitory activity of brans of selected Sri Lankan traditional rice is given in Table 1 and 2.

<table>
<thead>
<tr>
<th>Rice variety</th>
<th>Concentration (µg/ml)</th>
<th>Concentration (µg/ml)</th>
<th>Concentration (µg/ml)</th>
<th>Concentration (µg/ml)</th>
<th>IC50 (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudu Heeneti</td>
<td>44.36 ± 0.39</td>
<td>58.79 ± 0.45</td>
<td>66.55 ± 0.04</td>
<td>68.26 ± 0.55</td>
<td>37.00 ± 0.68</td>
</tr>
<tr>
<td>Dik Wee</td>
<td>37.28 ± 1.27</td>
<td>47.86 ± 1.33</td>
<td>56.56 ± 1.42</td>
<td>63.15 ± 0.42</td>
<td>77.03 ± 2.37</td>
</tr>
<tr>
<td>Masuran</td>
<td>27.75 ± 0.72</td>
<td>44.71 ± 3.77</td>
<td>52.16 ± 0.39</td>
<td>58.60 ± 0.18</td>
<td>88.27 ± 6.64</td>
</tr>
<tr>
<td>Goda Heeneti</td>
<td>17.51 ± 0.39</td>
<td>26.09 ± 0.72</td>
<td>33.52 ± 0.39</td>
<td>39.30 ± 1.42</td>
<td>291.00 ± 3.54</td>
</tr>
</tbody>
</table>

Data represented as mean ± SE (n=3). IC50 values superscripted by different letters are significantly different at p < 0.05; IC50: Galanthamine: 0.46 ± 0.02 µg/ml

Results revealed that bran extracts of all the selected rice varieties with both enzyme inhibitory activities. However, significant differences were observed among the varieties too for both enzymes (p<0.05). Bran extract of Sudu Heeneti demonstrated significant (p<0.05) and highest enzyme inhibition compared to other varieties for both enzymes and IC50 values for AChE and BChE were 37.00 ± 0.68 and 18.50 ± 0.60 µg/ml respectively. The order of potency of enzyme inhibition exerted by bran extracts of selected RV followed the similar pattern for both enzymes as SH>DW>M>GH. IC50 values of DW, M and GH for AChE and BChE were 77.03 ± 2.37, 88.27 ± 6.64, 291.00 ± 3.54 and 30.33 ± 0.32, 30.20 ± 1.96, 96.60 ± 0.56 µg/ml respectively. Results revealed that inhibition of BChE are more prominent compared to AChE inhibition. This is the first report of acetylcholinesterase and butyrylcholinesterase enzyme inhibitory activity by bran extracts from Sri Lankan rice varieties.
Table 2: Butyrylcholinesterase inhibitory activity of selected Sri Lankan traditional red rice

<table>
<thead>
<tr>
<th>Rice variety</th>
<th>Concentration (µg/ml)</th>
<th>IC$_{50}$ (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12.5</td>
<td>25</td>
</tr>
<tr>
<td>Sudu Heeneti</td>
<td>39.84 ± 0.66</td>
<td>64.52 ± 1.40</td>
</tr>
<tr>
<td>Dik Wee</td>
<td>30.27 ± 3.29</td>
<td>49.18 ± 0.10</td>
</tr>
<tr>
<td>Masuran</td>
<td>25.11 ± 0.27</td>
<td>50.99 ± 1.99</td>
</tr>
<tr>
<td>Goda Heeneti</td>
<td>18.11 ± 2.37</td>
<td>32.57 ± 4.59</td>
</tr>
</tbody>
</table>

Data represented as mean ± SE (n=3). IC$_{50}$ values superscripted by different letters are significantly different at p < 0.05; IC$_{50}$: Galanthamine: 3.03 ± 0.01µg/ml

Conclusion

It is concluded that, brans of these selected Sri Lankan traditional red rice may play an important role in managing neurodegenerative diseases such as Alzheimer’s disease. Results also show the possibility of isolating active compounds from these selected rice bran and those compounds may have the potential for development of novel nutraceuticals and pharmaceuticals for managing Alzheimer’s disease.

References


The authors acknowledge the financial support granted by the Sri Lankan Treasury to Industrial Technology Institute (ITI) (No.10715TG6) and Batalagoda Rice Research Institute for supplying samples for the study.
Potential of Sri Lankan black tea (*Camellia sinensis* L.) in dissolution of human kidney stones *in vitro*

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Introduction

Previous studies have disclosed that black tea contains between 1.5 - 6.5 mg of soluble oxalates/g tea and thus regular consumption of black tea will lead to a moderate intake of soluble oxalate each day (Savage et al., 2003). Therefore, consumption of black tea may increase the urinary oxalate concentration, possibly leading to an increased risk of kidney oxalate stone formation (Brinkley et al., 1990). On the contrary, it is claimed that its consumption reduces the risk of kidney stones formation and in fact leads to a reduced risk of kidney stone formation by 14% in males (Curhan et al., 1996) and 8% in females (Curhan et al., 1998). Human kidney stones are predominantly made of calcium oxalate (more than 75%) (Savage et al., 2003). Three main mechanisms have been suggested for dissolving oxalate based kidney stones (Savage et al., 2003): an increased urinary flushing leading to high oxalate excretion; an increased level of calcium consumption via food and beverages leading to reduced oxalate absorption in the digestive tract; and by dissolving of calcium oxalate present in the kidney stones by chemical constituents ingested into the body.

The aim of this study was to examine the ability of black tea infusion (BTI) to dissolve kidney stones, since BTI has been shown to reduce urinary oxalate levels (Savage et al., 2003). The study was conducted *in vitro* on human kidney stones collected following surgery using low grown BOPF grade Sri Lankan orthodox black tea infusion.

Materials and Methods

Orthodox black tea sample (1 kg) of BOPF grade was collected from a randomly selected tea factory (low grown; 382 m, average mean sea level), and medium size (1-3 g by weight) calcium oxalate based kidney stones removed from patients by surgery obtained from the Department of Urology Surgery Clinical Ward, National Hospital Sri Lanka were used in the present study.

Assessment of dissolving potential of kidney stones

Different concentrations of black tea infusions (BTI) were freshly prepared: 30, 60 and 240 mg/kg bw/day which is equivalent to 1½, 3 and 12 cups respectively (n = 6/ concentration). One gram of crushed kidney stones of particle size ≤ 1000 µm and ≤ 500 µm were placed in 100 ml glass beakers. Then, either 25 ml of different concentrations of warm (40 ± 3 °C) BTI or water (control) was added and covered with a watch glass. This was incubated at room temperature (30 °C) for 24 hrs. Oxalic acid contents in incubated
samples were determined at 6, 12 and 24 hrs using high performance liquid chromatography as described by Savage et al., (2003). Oxalate concentrations of the incubated samples were expressed as mg/ml.

Statistical analysis

Statistical comparisons were made using the Mann Whitney U test. The results (n = 6/concentrations) are expressed as mean ± SEM. The probability level, \( p \leq 0.05 \) was considered as significant.

Results

The oxalate contents in incubated BTI samples and water (control) are presented in Table 1. The results show that the BTI increases the soluble oxalate levels in the incubated samples. The highest dissolution was evident at 24 hrs in crushed kidney stones containing particle size < 500 µm, with 60 mg/kg bw/day concentration of BTI (by 72%) followed by 240 mg/kg bw/day (by 70%), whereas, 30 mg/kg bw/day concentration showed 48% dissolution at 24 hrs. The kidney stones of particle size < 1000 µm resulted in a dissolution of 12%, while the solid kidney stones did not dissolve with 60 mg/kg bw/day concentration of BTI at 24 hrs. This effect was time- and dose-dependent (\( r^2 = 0.8921, p < 0.01 \)).

Discussion

This study examined the calcium oxalate dissolving potential of BTI of Sri Lankan low grown BOPF grade orthodox black tea on human kidney stones in vitro. The results showed a dose and time dependant (maximum dissolution at 24 hrs) oxalate dissolving potential of BTI. This is a novel finding for Sri Lankan black tea. Further, the finding of the present study is in agreement with the clinical study of Curhan et al., (1996; 1998). It is concluded that, the Sri Lankan BOPF grade orthodox BTI has the potential to dissolve human kidney stones in vitro and thus the consumption of BTI may reduce the risk of kidney stone formation.

References


Table 1: Oxalate contents (as determined by oxalic acid) in different concentrations of BTI incubated with solid human kidney stones, and with crushed stones of particle size <1000 and < 500 μm, for 6, 12 and 24 h. (Mean ± SEM)

<table>
<thead>
<tr>
<th>BTI Concentration</th>
<th>Oxalic acid concentration, mg/ml, n = 6/concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid kidney stone</td>
</tr>
<tr>
<td></td>
<td>6 h</td>
</tr>
<tr>
<td>Water (Control)</td>
<td>0.00±0.00</td>
</tr>
<tr>
<td>BTI, 50 mg/kg bw/day</td>
<td>0.02±0.00</td>
</tr>
<tr>
<td>BTI, 60 mg/kg bw/day</td>
<td>0.08±0.00</td>
</tr>
<tr>
<td>BTI, 120 mg/kg bw/day</td>
<td>0.02±0.00</td>
</tr>
</tbody>
</table>

* the value is significant at p < 0.05, compared to the control value.
Assessment of heavy metals in black tea produced in different agro-ecological regions of Sri Lanka

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Introduction

In recent times, many tea importing countries have either changed or are in the process of changing their food safety laws, generally resulting in lower limits for pesticide residues and heavy metals. In addition, food items such as tea, which are generally regarded as safe (GRAS) are also included in random monitoring programmes at the points of entry to those countries. Therefore, it is important that base line levels of pesticide residues and heavy metals for different types of Sri Lankan teas are re-established and precautionary measures taken, in order to to ensure that Sri Lankan tea complies with these new regulations.

The main sources of heavy metals in plants are the soil and other agricultural inputs. Therefore, one of the main factors that influence the heavy metal content is the agro-ecological region where tea is grown. Therefore, in this study black tea obtained from nine agro-ecological regions of Sri Lanka were analyzed for copper, nickel, iron and cadmium content.

Materials and Methods

Thirty five tea factories were selected from the nine Agro-ecological regions. Black tea samples of BOP grade were collected as three batches. Using AOAC procedures (AOAC, 1984, AOAC 1995), 105 number of samples were dry-ashed and after extracting with acids, they were aspirated into air-C\textsubscript{2}H\textsubscript{2} flame and measured the absorbance using Atomic absorption spectrophotometer (GBC 932 plus).

The results were statistically analyzed using MINITAB (version 13.10) statistical software. The significant differences among regions were evaluated using one-way ANOVA at 0.05 probability level. Statistical analysis was done using paired samples t-test.

Results and Discussion

Cu, Ni, Fe, Cd content in black tea in main agro-ecological regions is shown in Table 1.

Copper content ranged between 16.2 and 165.7 mg/kg with a mean value of 29.4 mg/kg. There were five outlying figures from Nuwara Eliya region. This may be due to spraying of copper based fungicides and plucking of tea before the recommended pre-harvest interval of seven days. After removing these outliers the new mean value for Nuwara Eliya region was found to be 25.9 ± 6.4 mg/kg for copper. There is no significant variation
among the agro-ecological regions observed by the statistical data analysis. The Sri Lanka Tea board guideline for copper is established as 100 mg/kg.

Table 1 Mean copper, nickel, iron, cadmium content of black tea in agro-ecological regions

<table>
<thead>
<tr>
<th>Agro-ecological region</th>
<th>copper (ppm) ±σ</th>
<th>nickel (ppm) ±σ</th>
<th>iron (ppm) ±σ</th>
<th>cadmium (ppb) ±σ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Up country</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuwara-Eliya</td>
<td>42.1 ± 40.4</td>
<td>7.0 ± 7.1</td>
<td>141.9 ± 24.9</td>
<td>100 ± 40</td>
</tr>
<tr>
<td>Dimbulla</td>
<td>27.2 ± 5.9</td>
<td>5.4 ± 0.9</td>
<td>100.0 ± 20.0</td>
<td>90 ± 40</td>
</tr>
<tr>
<td>Bogawanthalawa</td>
<td>23.0 ± 5.8</td>
<td>4.3 ± 0.6</td>
<td>92.9 ± 14.9</td>
<td>30 ± 30</td>
</tr>
<tr>
<td>Agarapatana</td>
<td>29.2 ± 5.2</td>
<td>4.8 ± 0.8</td>
<td>101.3 ± 21.2</td>
<td>30 ± 10</td>
</tr>
<tr>
<td>Udupussallawa</td>
<td>28.2 ± 5.2</td>
<td>5.3 ± 0.8</td>
<td>106.2 ± 22.3</td>
<td>30 ± 30</td>
</tr>
<tr>
<td><strong>Mid country</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malwatta Valley</td>
<td>27.1 ± 0.7</td>
<td>6.0 ± 1.3</td>
<td>154.2 ± 38.8</td>
<td>50 ± 70</td>
</tr>
<tr>
<td>Bandarawella</td>
<td>29.5 ± 6.8</td>
<td>5.4 ± 0.9</td>
<td>110.0 ± 16.4</td>
<td>50 ± 20</td>
</tr>
<tr>
<td><strong>Low country</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malwatta Valley</td>
<td>20.8 ± 2.6</td>
<td>3.0 ± 0.6</td>
<td>104.8 ± 35.2</td>
<td>50 ± 80</td>
</tr>
</tbody>
</table>

The nickel content of black tea was 5.4 ± 3.8 mg/kg within the range of 0.6 to 26.4 mg/kg. Only four values were greater than 10 ppm, which were observed in Nuwara Eliya region. However, it was found that there is no significant variation of the nickel content in black tea produced in different regions. There is no maximum limit established for nickel in tea from the Sri Lanka Tea Board. The results were statistically analyzed to establish a baseline value for nickel. The nickel content was less than 8 mg/kg (p < 0.05).

Analysis of the iron content in black tea samples indicated that the values ranged between 49.3 and 241.3 mg/kg. The lowest mean value was found in Bogawanthalawa region. The highest mean value was found in Uva-Malwatta Valley region. The overall mean iron content is 116.8 ± 35.4 mg/kg.

The iron content in the Nuwara Eliya region was significantly different from all other up country regions and low country. There was a significant difference in mid country with Dimbulla, Bogawanthalawa, Udupussallawa, Bandarawella and low country. Uva-Malwatta Valley was significantly different from Uva-Bandarawella.

These variations may be due to soil characters and environmental factors. A proper study of iron content in soil of all regions has not been done yet. Further analysis should be carried out to find out the characters of soil, cultivar and fertilizer application, which affect the iron content in tea leaf. The Tea board guideline for iron is established as 500 mg/kg. The mean value obtained in this study is 116.8 mg/kg. Since all samples analyzed did not exceed the level of 300 mg/kg, it can be suggested to reduce the maximum limit for iron in tea from 500 mg/kg to 300 mg/kg after further experimentation.

Mean value of cadmium content in black tea was 80 µg/kg. Only one sample was observed with greater than 0.2 mg/kg of cadmium. This may be due to contamination of fertilizers with cadmium. After removing the outlier value, the new mean value of
Cadmium for mid country region was 60 ± 40 µg/kg. The cadmium content of Sri Lankan black tea is not significantly different region wise (p < 0.05).

Conclusion

The results revealed that copper, iron, and cadmium content in black tea produced in all agro-ecological regions of Sri Lanka are well below The Sri Lanka Tea Board limits. Variation of copper, nickel, and cadmium content in black tea in agro-ecological regions is not significant. Iron content in black tea produced in different agro-ecological regions varied significantly. However, statistical analysis confirms that iron content is less than 300 mg/kg (p < 0.05). Therefore, it is suggested to explore the possibility of reducing the iron limit from 500 mg/kg to 300 mg/kg in Sri Lanka Tea Board guidelines after obtaining further data.

References


Special thanks to the Management of Sri Lanka Tea Board for allowing to do the sample preparation and Mr. Silva (Department of Chemistry, University of Colombo) for helping to get AAS measurements.
Genetic Diversity of the *Plasmodium vivax* Circumsporozoite Protein (*Pvcsp*) in Sri Lanka

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²Center for Evolutionary Medicine & Informatics, The Biodesing Institute, Arizona State University, Tempe, AZ, USA
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**Introduction**

The circumsporozoite protein (CSP), sporozoite’s major surface protein comprises a central repeat (CR) region, flanked with two conserved domains (Coppi et al., 2011). The protein is diverse across all *Plasmodium* species and consists of tandem arrays of relatively short amino acid motifs (Brito and Ferreira, 2011). *P. vivax* CSP (*PvCSP*) displays two major types of peptide repeat motifs (PRMs), each consisting of nine amino acids, GDRA[D/A]GQPA and ANGAGNQPG, defining variants VK210 and VK247, respectively (Rosenberg et al., 1989). Both variants are globally distributed, but geographic biases have been described (Leclerc et al., 2004).

We investigated the genetic diversity of *Pvcsp* in Sri Lanka, where low transmission and unstable malaria prevails. Local and global *P. vivax* isolates were analyzed for patterns of sequence variation in the *csp* gene by examining the polymorphism of the PRMs and the evolutionary relationships of the *Pvcsp* worldwide isolates were traced.

**Materials and Methods**

Single clone infections from two malaria endemic areas, Anuradhapura (N=17) and Kataragama (N=29) and from a malaria non-endemic area, Colombo (N=14) confirmed by genotyping at the polymorphic *Pvmsp-3α* locus using a combined nested polymerase chain reaction (PCR) and restriction fragment length polymorphism (RFLP) (Wickramarachchi et al., 2010), were used for this study.

The CR domain of *Pvcsp* was amplified by nested PCR as described by Imwong et al., (2005). Sequencing of the PCR products were done on both strands using VCS-NF and VCS-NR primers at Macrogen, Korea.

Measure of genetic polymorphism by nucleotide diversity (π) was calculated using DnaSP version 5.1 (Librado and Rozas, 2009). Natural selection was determined by the difference between the non-synonymous and synonymous substitutions (Dn – Ds) estimated by Nei and Gojobori’s method (MEGA 5, Tamura et al., 2011) and recombination and linkage disequilibrium (LD) were tested by DnaSP 5.1.
The evolutionary relatedness of the available global sequences including Sri Lanka (VK210) was determined by i) the construction of a phylogenetic tree using the Maximum Likelihood (ML) method by MEGA 5, and ii) calculating the genetic differentiation between geographic regions via $F_{ST}$ values using DnaSP 5.1.

**Results**

All of the 60 *P. vivax* isolates were of the VK210 variant consisting of variable repeats of 4 different PRMs, GDRA(A/D)GQPA, GNRAAGQPA and GNGAGGQAA. Three varying lengths sequences were observed where the 128 a.a. sequence (N=57; C2- C17) was significantly more common than both the 137 (N=1; C1) and the 119 (N=2; C18 & C19) a.a. sequences. Although the Sri Lankan isolates corroborated the variations in the peptide repeats motifs GDRA(A/D)GQPA of other global isolates, with different alternations of non-synonymous codons GCT or GAT, respectively, coding for Alanine (A) or Aspartic acid (D) (Leclerc et al., 2004), the PRM, GNRAAGQPA, observed in this study is unique to the island and is reported for the first time.

Four each from the eight and five RATs (different nucleotide sequences encoding the same PRM) identified by Patil et al (2010) for GDRADGQPA and GDRAAGQPA, respectively were detected from our study, where GGAGACAGAGCATGGACAGCCAGCA of the former a.a. sequence differed only by a single nucleotide polymorphism. Except for a single isolate, where the nucleotide sequence of GNGAGGQAA comprised a single nucleotide polymorphism (GGAATGTTGACGTGGACATGCAGCA), rest of the Sri Lanka isolates coincided with the nucleotide sequence observed by Patil et al., (2010).

The 19 amino acid haplotypes defined from the Sri Lankan population were exclusive to the island. Of these, 52% (N=31) was of the C4 a.a. haplotype. The 194 world wide isolates of VK210 variant obtained for this study from Azerbaijan, Brazil, China, Gabon, Iran, Korea, the Philippines, and the Solomon Islands, defined 57 a.a. haplotypes.

Elevated nucleotide diversity ($\pi$) was recorded from the Korean isolates followed by isolates from Brazil, Sri Lanka and Iran. The Sri Lankan population demonstrated a significant purifying selection at the CR region of PvCSP ($Z$ test $P<0.05$), where excess of synonymous substitutions per site ($D_s = 0.059 \pm 0.014 \text{ S.D.}$) were observed compared to non-synonymous substitutions ($D_n = 0.013 \pm 0.004 \text{ S.D.}$). A linkage disequilibrium (LD) was maintained across the *Pvcsp* for the entire local population corroborating Patil et al., (2010).

The Sri Lankan population showed the highest degree of genetic differentiation with Iran ($F_{ST} = 0.521$) followed by Brazil ($F_{ST} = 0.509$) and Korea ($F_{ST} = 0.434$).

Phylogenetic tree drawn using all available VK210 worldwide isolates, defined 19 distinct groups. Most isolates were geographically clustered into groups. Of the Sri Lankan isolates, 2 from Kataragama were exclusive to group 5 while the rest depicted no clustering indicating origin from a common ancestor.

**Conclusion**

This study for the first time demonstrated the genetic diversity of the central repeat domain of the *P. vivax* Circumsporozite protein in Sri Lanka, where the polymorphism was due to point mutations, insertions and intragenic recombination. It has been
hypothesized that the presence of repeat arrays serve as a ‘‘smoke-screen’’ that elicits a strong but ineffective immune response on the part of the host (Kemp et al., 1987). The study further adds insights to the origin of *P. vivax* isolates from a common ancestor, where the RATs in the CR region showed a similar arrangement and some of the isolates in the phylogenetic tree revealed no clustering. The scarcity of non-synonymous polymorphisms at the CR region may not indicate a recent bottleneck in the evolutionary history of the *P. vivax* VK210 variant, rather the strain may be maintained in the population for a relatively long time.

References

Substrate effect on photocurrent enhancement of electrodeposited n-type Cu$_2$O thin films

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$^2$Department of Physics and Astronomy, Upsala University, Sweden
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Introduction

Cuprous oxide (Cu$_2$O) is a metal-oxide semiconductor with a band gap of about 2 eV, which has attracted interest because of its potential applications in solar energy conversion, catalysis and gas sensors. Such applications and emerging applications of Cu$_2$O thin films in other areas make it worthwhile to study the electro-optical characteristics of Cu$_2$O thin films extensively (Olsen et al., 1982). Fabrication of Cu$_2$O thin films using electrodeposition is advantageous over the other techniques as this process includes low temperature, economy, simplicity and possibility of making large area thin films. Also, adjusting the deposition parameters during electrodeposition allows the conductivity type and the film morphology to be controlled as required (Lee et al., 2006; Rai 1988).

The currently reported photovoltaic conversion efficiencies of good Cu$_2$O based solar cells have remained in the range of 1-2 % which is far below the theoretical value. Barrier height measurements in various Schottky barrier solar cells have shown that values are always in the range 0.7-0.9 eV regardless of the substrate which forms the back contact of the cell. This is believed to be the principal cause of the low performance of the Cu$_2$O Schottky barrier solar cells (Abdu, 2009). Therefore, the selection of a better substrate (metal or conductive coating) for the junction formation is considered to be the most important factor. Metals with high work functions such as Ni and Pt, are considered to be such candidates for the n-Cu$_2$O Schottky junction solar cells. Cost-wise Ni can be considered a better material as opposed to Pt which is highly expensive.

Experimental

Electrodeposition of Cu$_2$O thin films on Ti, ITO and Ni substrates was accomplished in a three-electrode electrochemical cell containing aqueous solutions of 0.1M sodium acetate and 0.01 M cupric acetate Deposition method has been discussed in detail elsewhere (Siripala and Jayakody,1986). Prior to the deposition, Ti and ITO substrates were cleaned with detergent, diluted HNO$_3$ and finally with distilled water. Ni substrates cleaned with acetone and distilled water. The film deposition was carried out at 60 °C under potentiostatic conditions of -200 mV vs. SCE. Deposition times on different substrates of Ti, ITO glass and Ni were 40 minutes, 1 hour and 4 hours respectively. The deposition times were determined by estimating the current-time values in order to obtain films of similar thicknesses. Current-time characterization was performed using a multimeter (Mastech MS 8218)
For spectral response measurements Cu$_2$O films were investigated in a photoelectrochemical cell containing a 0.1M sodium acetate solution. The contact area of the film with the electrolyte was ~4 mm$^2$. The counter electrode was a platinum plate and the reference electrode was a saturated calomel electrode (SCE). Measurements were made using a phase sensitive detection method to monitor the photocurrent signal produced by a chopped monochromatic light beam at a chopping frequency was 63 Hz. A monochromator (Scicnetech - 9010), a potentiostat (HukotoDonko HAB-151), a lock-in amplifier (Stanford Research- SR 830 DSP), and a chopper (Stanford-SR 540) were used for the measurements. Morphological and structural characterization of the films were made using a scanning electron microscope (Philips XL40), an atomic force microscope (Burleigh, Vista-100) and a SHIMADZU (XD-D1) X-ray diffractometer.

Results and Discussion

Structural and morphological studies of the films made with SEM, AFM and XRD were consistent with small grain Cu$_2$O thin films. Figure 1 shows the deposition current vs. time curves for Cu$_2$O films deposited on three different substrates, ITO glass, Ti and Ni justifying the need of different deposition times to obtain similar thicknesses.
Figure 2 shows the spectral responses of Cu$_2$O films grown on Ti, ITO glass and Ni substrate. It can be clearly seen that there is remarkable improvement in photocurrent of the Cu$_2$O films grown on Ni substrates. This is attributed to the ohmic contact formed between Ni and the Cu$_2$O layer as opposed to the rectifying contact that is formed when ITO glass and Ti are used as substrates. This enhanced photo-current will lead to solar cells of improved performance in which the efficiencies will better the current value of 1%.

**Conclusions**

It can be seen from this study that the n-type Cu$_2$O thin films electrodeposited on Ni substrates have enhanced spectral responses compared to ITO glass and Ti substrates as a result of better film-substrate contact. Therefore, Ni/Cu$_2$O system can be used as a highly useful junction for solar cells application.
References


*HETC project is gratefully acknowledged for the financial assistance through the research grant KLN/O-Sci/N4.*
Evaluation of the Strengths and Weaknesses in Teaching Physics through Competency-based Approach

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Department of Physics, Faculty of Science

Background
Traditional teaching methods such as the lecture method have been used in the school education, up to G.C.E. (A/L) classes in Sri Lanka for a long time. In 2007, the National Institute of Education in Sri Lanka introduced the competency based approach (CBA) for the first time for grade 6 and 10 (NIE, 2009). It was extended to other grades progressively in the later years. The G.C.E. (A/L) curriculum was reformed in 2009 and CBA was introduced in teaching-learning process. In the CBA, the teacher acts as a resource person and provides the students the required reading material, equipment, other inputs and it is carried out according to the 5E model (Ginige, 2008). It involves five stages of learning phases namely, engagement, exploration, explanation, elaboration, and evaluation (Ginige, 2008).

An evaluation of the process development and implementation of curriculum has been carried out for grades 6 and 10 in 2008 (Perera, 2008) and for grades 7 and 11 in 2009 (Perera, 2009) and the strengths and weaknesses have been discussed. The present study evaluates strengths and weaknesses of CBA against the traditional lecture method, focusing on students’ understanding of selected lessons in physics and to identify the difficulties in teaching physics in the school-based environment through CBA.

Methodology
Lesson plans were prepared according to the 5E model for selected six physics lessons in the Thermal Physics unit of the G.C.E. (A/L) syllabus: namely, thermal expansion of solids and liquids, behaviour of gas, gas laws and related problem solving and transfer of heat. Three schools in Kurunegala district namely, Kuliyapitiya CC, Saranath MV, Kuliyapitiya, and Mayurapada CC, Narammala were considered. Two groups of students with same educational level were selected from each school based on their G.C.E. (O/L) results and through an examination in physics. A selected group of students were taught through CBA and the other with the lecture method. At the end of each lesson an identical question paper was given to each group to evaluate them. The students who study physics in G.C.E. (A/L) classes and physics teachers in government schools were given separate questionnaires in order to get the outcome of learning through CBA.

Data Analysis and Discussion
Comparing the success of CBA with lecture method in teaching physics
The calculated arithmetic mean $\overline{X}$ and standard deviation $\sigma$ of marks for each lesson for students in Group A and Group B are tabulated below.
### Evaluation of questionnaires given to students

Responses were received from 2,324 students in Kurunegala, Puttalam and Gampaha districts for the questionnaire given to students. 52% of students think that their knowledge in subject matter is enhanced and 86% believe that motor skills, speaking skills, working corporately are developed through CBA. However, 69% of students consider that it is not an effective method in preparing for G.C.E. (A/L) examination, and 89% assume it is not an alternative for private tuition. Furthermore, 54% of students still prefer lecture method in learning physics to CBA.

### Evaluation of questionnaires given to teachers

Responses where received from 148 physics teachers islandwide for the questionnaire relating to student progress of learning physics through CBA and preparation of school based-environment to conduct CBA.

### Evaluation of student progress of learning physics through CBA

The percentage of teachers’ view on student participation is either good or satisfactory on activity-based teaching is 67%, student discipline in class students’ is 66%, reaching the relevant competency level is 63%, and completing the students’ activities during the allocated time period is 50%. Therefore teachers’ view on students’ performance on CBA has many positive aspects.

### Implementation of CBA in school based-environment

The positive aspects are that 66% and 62% respectively believes that there are sufficient teachers available and selected lessons of the syllabus can be covered using CBA. Conversely, 96%, 72% and 54% respectively states that the whole G.C.E. (A/L) syllabus cannot be covered, the classroom environment is inadequate and labs/teacher assistants are insufficient. Furthermore, 57% of teachers and 59% of students express that standard instruments for these activities are insufficient.

### Conclusions

The results obtained for the written tests indicate that the lecture method and the CBA are the same within the standard deviation of mean values of marks. Responses of students indicate approximately equal percentages of positive and negative aspects of CBA.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Group A (Lecture Method)</th>
<th>Group B (CBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\bar{X}$</td>
<td>$\sigma$</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
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<tr>
<td>2</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>5</td>
<td>10.33</td>
<td>2.79</td>
</tr>
<tr>
<td>6</td>
<td>11.47</td>
<td>3.67</td>
</tr>
</tbody>
</table>

The calculated average of the arithmetic mean of marks is $11.3 \pm 0.7$ and $10.5 \pm 0.7$ for Group A and Group B respectively. It could be seen that the arithmetic mean of marks obtained for written tests by the students who have learned by the lecture method and through CBA are the same within the standard deviation of the mean values of marks.
Responses of teachers on the student progress indicate a higher percentage of positive to negative aspects of CBA. Responses of physics teachers on preparation of school based-environment to conduct CBA are mostly negative. From the present study, it was not possible to conclude whether the same conclusions hold for group of “average” students.

References

KKCK gratefully acknowledge Principals, Heads of Science Sections, physics teachers, laboratory assistants and student groups in the schools selected for the study.
Impact of shrimp-farming on mangrove ecosystems in Pambala, Chilaw

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Background
Mangroves are the coastal equivalent of tropical forests and hence of important ecological and environmental significance. In Sri Lanka, as in many other countries, conversion of mangrove forests to other uses has resulted in a considerable decline of these ecosystems. It is estimated that mangroves in Sri Lanka cover only 87 km², which amounts to around 0.2% of the total land area of the country (Legg and Jewell, 1995). One of the major factors that has led to their destruction in Sri Lanka is shrimp farming. Valietel et al. (2001) report that the conversion of mangroves to aquaculture ponds is responsible for about 38% of the total mangrove loss that has occurred in the country. In addition to the direct destruction of mangroves, shrimp farming has also caused the degradation of water quality in lagoons and the loss of biodiversity in the remaining patches of vegetation (de Silva and de Silva 2002; Wolanski et al. 2000). In the present study we attempt to assess the impact of shrimp farming on mangroves in Pambala, Chilaw, an area where shrimp farming is extensively conducted, by assessing changes in the composition of mangrove flora and selected invertebrate taxa as well as through changes in water quality of the lagoon.

Methodology
The study was conducted from March to July 2011. Impacts were monitored in five mangrove areas located adjacent to shrimp farms that were currently in operation while three sites away from shrimp farms served as reference sites. No shrimp farms were located within a radius of 2 km of the reference sites. At each site, five quadrates of 5 m x 5 m were established using poles and ropes. All mangroves and associate species were identified and enumerated within these quadrates. The regeneration capacity of the species was assessed by counting the seedlings and saplings within subquadrates of 1 m x 1m inside the main quadrate. Crustaceans, polychaetes and molluscs were also identified and enumerated within the subquadrates. Separate counts were taken for benthic fauna and epifauna. Seven water quality parameters, i.e., temperature, pH, turbidity, salinity, dissolved oxygen, nitrate and phosphate, were assessed at five locations in the lagoon, at each of the eight sites, using standard protocols. The rate of sedimentation was also assessed using a simple gauge. For each parameter, the one way ANOVA and Tukey’s tests were used to examine for significant differences between shrimp farming and reference sites.

Results
A total of 14 species of mangroves and eight species of mangrove associates were recorded during the present study which is lower than the numbers recorded in this area previously. Floral species richness in non-shrimp farming areas (18 ± 0.69) was significantly greater than that in shrimp farming areas (12 ± 0.36). Trends in abundance were similar with a significantly greater abundance being recorded in reference sites (shrimp farming sites - 84±0.76; reference sites - 114±0.69). Composition was also altered with certain species being
present only in areas not affected by shrimp farms whilst others were more abundant in shrimp farming sites. In contrast, the Shannon-Weiner Diversity Index in shrimp farming sites and reference sites was not markedly different with the former and latter having values of 0.24 ± 0.005 and 0.28 ± 0.05 respectively. There was also no significant difference in the proportion of seedlings/saplings between shrimp farming and reference sites. Considering fauna, total species richness of molluscs, crustaceans and polychaetes were similar in both reference and shrimp farming sites (Fig. 1) while for abundance the composition was significantly different between the them (Fig. 2). Oysters are shown as a separate group from the molluscs because of their greater abundance. Selected species (e.g., *Thalasina*) were also more abundant in sites affected by shrimp farms than in the reference sites.

![Fig 1: Species richness (as a percentage of the total species richness) of invertebrate fauna in both reference and shrimp farming sites in the Pambala area.](image)

![Fig 2: Composition of invertebrate fauna (as a percentage of the total abundance) in the (a) reference and (b) shrimp farming sites in the Pambala area.](image)

Water quality in sites near shrimp farms was markedly different to that of reference sites (Fig. 3) and with the exception of phosphate, the differences between shrimp farming and non-shrimp farming sites were significant. The turbidity in shrimp farming sites (28.6 NTU±1.73) was double that of reference sites. Similarly, salinity levels in shrimp farming sites (16.8 mg l⁻¹±1.46) were five fold higher than that in reference sites (3.33 mg l⁻¹±0.43). Salinity was generally low because of the considerable rainfall during the sampling period. Water temperature in shrimp farming sites was 26.3 °C, whilst that in non-shrimp farming sites was 28.8 °C. Shrimp farming sites were also less acidic (7.2 - 7.8) than the reference sites (6.2 - 6.7). Dissolved oxygen values of 5.6 (±0.23) and 6.7 (± 0.05) were recorded for the shrimp farming sites and reference sites respectively. Plant nutrients were also much greater in shrimp farming sites (nitrate 0.08 - 0.28 mg l⁻¹, phosphate 0.2 - 0.36 mg l⁻¹) than in reference sites (nitrate 0.02 - 0.03 mg l⁻¹, phosphate 0.01 - 0.08 mg l⁻¹). No significant differences in sedimentation were noted over the duration of the study although there were signs of sediment accrual.
Conclusions

The present study has shown that the rapid growth of shrimp farms in the Chilaw area has serious negative impacts on the mangrove ecosystems and the lagoon. This was evident through its impacts on both biotic and abiotic components of this ecosystem. The composition and diversity of flora and selected faunal taxa were seriously altered in the vicinity of shrimp farms in comparison to that of the reference sites. Despite the constant flushing, water quality of the lagoon has deteriorated as apparent by the greater levels of nutrients and turbidity (suggesting higher sediment loads), implying risks of eutrophication and the potential toxicity to mangrove flora and fauna. If the current trends continue it may have serious implications for biodiversity conservation and ecosystem integrity as well for the aquaculture industry itself.

References


Weligama Coconut Leaf Wilt Disease (WCLWD) causing phytoplasma

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Preethi Udagama¹

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²Crop Protection Division, Coconut Research Institute, Lunuwila

Introduction
Coconut is one of the most important plantation crops in Sri Lanka, providing livelihood for nearly 0.5 million people (Ministry of plantation industries, 2008). Sri Lanka has earned about $120 million of export revenue by exporting coconut products. The Weligama Coconut Leaf Wilt Disease (WCLWD), the major threat to the crop was first reported in Weligama area in 2006. The disease has so far affected trees in the Galle, Matara, and Hambanthota districts. Although non-lethal, this disease could result in permanent injuries to the plant reducing its productivity. There would be dire consequences if this disease spreads to the coconut triangle, which includes an area of more than 70% of the total coconut cultivated land in the country.

The early symptoms of the disease are difficult to be identified and also symptom development is very slow (Sasikala et al., 2005). As no reliable therapeutic agent is yet discovered for this phytoplasmic disease, the only prevention method is to remove and dispose of all affected individual trees. Up to now, the Coconut Research Institute was compelled to cut down and destroy nearly 100,000 coconut palms in the Matara district due to this disease.

Phytoplasma disease diagnosis is difficult due to the inability of phytoplasma cultivation in pure cultures in vitro, their low concentration and uneven distribution in the host plant (Fránová et al., 2007). A sensitive, specific and rapid diagnostic test would be highly desirable for routine detection, mainly to avoid using infected planting material (Heinrich et al., 2001). A serological diagnostic technique based on monoclonal antibodies to the phytoplasma would provide an excellent diagnostic tool. Thus, this research aims to raise diagnostic monoclonal antibodies to WCLW phytoplasma, where initially polyclonal serum raised in experimental animals to purified phytoplasma was used to establish a specific ELISA for subsequent screening of specific hybridomas. Attempts to validate the in house established WCLWD phytoplasma specific indirect ELISA (Kanatiwela et al., 2012), using 110 coconut palms including 80 disease positive and 30 disease negative palms is reported.

Materials and Methods
The total number of samples to be screened was determined using the formula, n= \{4 x ds x (1-ds)/e\} where ds is the diagnosed sensitivity that is sought (95%) and e is the amount of error allowed in the estimate of diagnostic sensitivity (5%) (Crowther, 2009).
Infected coconut palms were collected from the plantations of the Matara district, and apparently healthy palms were collected from home gardens of Moratuwa and Horana areas in the Colombo district. Sugarcane plants infected with White Leaf Disease (WLD), caused by an unrelated phytoplasma, (kindly provided by the Sugarcane Research Institute) were used as disease control.

DNA extracted from all coconut palms and sugarcane plants were subjected to a nested polymerase chain reaction using phytoplasma specific universal primers (P1, P7/R16F2n, R16R2). The coconut samples yielding amplicons that produced a characteristic band of 1.2 kb on 1% agarose gels were considered disease positive (DP) samples (N=80) while the rest that lacked this band were considered to be disease negative (DN) samples (N=30). Five sugarcane samples that produced this characteristic band on the gel were used as disease controls.

The antigen extracted from the leaf samples by grinding 1 g of spear leaves in 10 ml of PBS + 2% Polyvinylpyrolidone was subjected to indirect ELISA. The cut-off value separating positive (True Positive- TP) from negative (True Negative- TN) samples was calculated as 2 standard deviations above the mean OD value of the disease negative (DN) values (DN values + 2SD) obtained from 30 healthy coconut palms.

In the validation of this ELISA, Diagnostic Sensitivity (D-SN= [TP/ (TP +FN)] x 100), Diagnostic Specificity (D-SP = [TN/ (TN+FP)] x 100), False Positivity (FP = 1- D-SP) and False Negativity (FN = 1-D-SN) were determined (Crowther, 2009).

Plotting the receiver operating characteristic (ROC) curve is a common approach of displaying the discriminatory power of a diagnostic test (Williams et al, 2011). ROC analysis was carried out using SPSS 15.0 for Windows Evaluation Version to determine the accuracy of the test in distinguishing healthy and infected palms by this established ELISA.

**Results**

It was calculated that a total of 360 coconut palms should be screened in the validation process.

The OD cut-off value separating positive (True Positive- TP) from negative (True Negative- TN) samples was calculated to be 0.27 (Fig 1).

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**Results**

It was calculated that a total of 360 coconut palms should be screened in the validation process.

The OD cut-off value separating positive (True Positive- TP) from negative (True Negative- TN) samples was calculated to be 0.27 (Fig 1).
Figure 1: Optical density (OD) responses of WCLWD phytoplasma infected and healthy coconut leaf samples and of sugarcane leaf samples infected with WLD.

Each closed circle represents the mean value of duplicate absorbance values of each antigen sample. Horizontal line indicates the cutoff value (0.27) calculated to distinguish infected and healthy coconut palms.

The following parameters were calculated using data obtained from screening 110 coconut palms (N=80 PCR positive and N=30 PCR negatives) by the established indirect ELISA for WCLWD phytoplasma, for the initial validation of this assay: diagnostic sensitivity of 88.75%, specificity of 80%, while false negativity and false positivity were 11.25% and 20%, respectively.

The area under the curve (AUC) of a ROC plot of a perfect diagnostic test with 100% accuracy, that fully discriminates between positives and negative samples equals one. When the ROC curve analysis was performed, the AUC was calculated to be 0.868 (accuracy of 87%) which indicated that this in house established Indirect ELISA for WCLWD phytoplasma performs well at distinguishing between phytoplasma infected and healthy palms (Fig 2).
Many more WCLWD phytoplasma positive and negative coconut palm samples (N=250) as well as several types of disease control samples must be screened by this ELISA in order to further validate this assay.

Conclusions

The in house established Indirect ELISA for WCLWD phytoplasma, using crude plant extract and specific polyclonal serum, seems to have satisfactory sensitivity (89%) and specificity (80%) values and the area under the curve in ROC curve analysis confirms that this assay performs with good accuracy (87%) to distinguish healthy and infected palms. These parameters may be improved by screening 250 more coconut palms as statistically required. It is encouraging that this indirect ELISA does not recognize sugarcane leaf extracts that are infected with White Leaf Disease caused by an unrelated phytoplasma.

References


*Financial assistance by the Coconut Research Institute is acknowledged.*
Analysis of benzoic acid and sorbic acid in some selected food items available in Sri Lanka

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²Government Analyst’s Department, Colombo

Background

Food preservation is the process of treating and handling food to stop or slow down spoilage and thus allows for longer storage to prevent food borne diseases (Zeuthen and Sorensen 2000). Nowadays this preservation is often made with the use of chemical preservatives, among which benzoic and sorbic acids, and their respective sodium, potassium and calcium salts, are widely used. Benzoic acid and sorbic acid are used to prevent growth of yeasts, moulds and bacteria that can grow in food items and help to extend their shelf life and safety. The salts of benzoic acid and sorbic acid are more frequently used as they are more soluble than the acid form (Mahindru 2008). To ensure the safety of consumers, international standards as well as Sri Lankan government food preservative regulations have been employed for any form of benzoic acid and sorbic acid that is to be used as a permitted preservative in food products.

There are various methods for the analysis of benzoates and sorbates in food items, such as chromatographic methods and spectroscopic methods. Nowadays, reversed phase HPLC is the most common analytical procedure for the detection and quantification of these preservatives in foods and beverages (Bui and Cooper 1987, Wood 2004).

Objectives

The principle objective of this study is to optimize and validate a simple HPLC method for routine determination of benzoic and sorbic acid in some selected jam and sauce products and to quantify benzoic and sorbic acid in those food items.

Methodology

Chromatographic separation was achieved using a C₁₈ column (ZORBAX Eclipse Plus) using acetate buffer 0.005 M (pH=4.7): methanol (70:30) as the isocratic mobile phase with flow rate of 1.2 ml/min at 30 °C. The column effluents from a 5 µl injection were monitored using a UV detector at 235 nm.

Five samples from jams and sauces declared to contain benzoic and sorbic preservatives on their labels were purchased from different supermarkets located in the city of Colombo, Sri Lanka. Benzoic and sorbic acids in jam and sauce samples were efficiently extracted with methanol after homogenization.

Quantification was based on the external standard method using calibration curves constructed over the concentration range from 5 mg/ dm³ to 100 mg/ dm³ of benzoic acid.
and sorbic acid. The linearity of the calibration curves was determined using correlation coefficient value ($r^2$) of the curve.

In order to verify the accuracy and precision of the analytical procedure, recovery studies were carried out. Recovery percentages were determined by spiking different amounts of standards of analyts to negative samples of each matrix. The accuracy was then calculated from the test results as a percentage of the analyte recovered by the assay. Limit of detection (LOD) and limit of quantification (LOQ) were estimated by successively decreasing the concentration of the prepared standards until the peak with $S/N = 3$ and $S/N = 10$ were obtained.

**Results**

Chromatographic conditions resulted in an effective separation of the preservatives for all products analysed in a run time of 15 minutes. The average retention time was 7.8 minutes for benzoic acid and 12.1 minutes for sorbic acid. Accordingly the LOD calculated for benzoic acid and sorbic acid were 0.5 mg/dm³ and 0.2 mg/dm³ respectively. The LOQ calculated for benzoic acid and sorbic acid were 2.0 mg/dm³ and 1.0 mg/dm³ respectively.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Amount spiked (mg/kg)</th>
<th>Amount recovered (mg/kg)</th>
<th>Percentage recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Benzoic</td>
<td>Sorbic</td>
<td>Benzoic</td>
</tr>
<tr>
<td>Jam 1</td>
<td>154</td>
<td>141</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>213</td>
<td>199</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>347</td>
<td>312</td>
<td>90</td>
</tr>
<tr>
<td>Jam 2</td>
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</tr>
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<td>221</td>
<td>205</td>
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</tr>
<tr>
<td></td>
<td>318</td>
<td>288</td>
<td>91</td>
</tr>
<tr>
<td>Sauce 1</td>
<td>110</td>
<td>91</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>234</td>
<td>204</td>
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<td></td>
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</tr>
</tbody>
</table>

Determination of percentage recoveries of benzoic acid and sorbic acid were carried out by spiking selected pre analysed jam and sauce samples with three different concentrations of benzoic and sorbic acid. Table 1 summarizes the percentage recoveries of benzoic acid and sorbic acid in jam and sauce from selected samples. Higher percentage recoveries, i.e. more than 80%, obtained for both benzoic acid and sorbic acid indicates that the extraction procedure is suitable for the quantification of these preservatives.

Recoveries obtained for sauce samples were lower than other samples. This may be due to the complex sample matrices and poor extraction procedure of two compounds. Higher percentage recoveries may be achieved using other extraction procedures such as solid phase extraction or solvent-solvent extraction.

The levels of benzoic acid and sorbic acid in commercial jam samples varied approximately from 160 mg/kg to 270 mg/kg while levels of benzoic acid and sorbic acid in commercial sauce samples varied approximately within the range of 100 mg/kg – 500
According to the food preservative regulations, the maximum permitted limit for benzoic and sorbic acid in sauces are 250 mg/kg and 1000 mg/kg respectively, while the maximum permitted limit for benzoic acid in jam is 500 mg/kg. Therefore, levels of benzoic acid and sorbic acid in jam and sauce samples, did not exceed the maximum permitted limits prescribed by the food preservative regulations of Sri Lanka.

Conclusion:

The described chromatographic conditions and extraction procedure seems to fulfill the criteria of selectivity, sensitivity, reproducibility and convenience for analysing the benzoic acid and sorbic acid contents in the respective samples under study. Therefore, this simplified methanol extraction procedure followed by HPLC separation can be used for the routine analysis of benzoic and sorbic acid in food samples, as the official AOAC methods for determining these preservatives in food and beverages require extensive sample preparation, lengthy clean up steps and relatively long analysis times. When the amounts of benzoic and sorbic acids present in the analysed samples were considered, major violations of the legislation cannot be seen.

References:


Screening of Efficient Phosphate Solubilizing Microorganisms from Rhizosphere of Some Export Agricultural Crops

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Department of Plant Sciences, Faculty of Science

Introduction

Nutrient deficiency, chemical fertilizer application and soil deterioration is a well-known cyclic occurrence associated with agriculture in which successive cycles lead to more and more deterioration of soil. With the advancement of technology, sustainable and environmentally friendly solutions are sought to address such problems. Development of biofertilizers to supplement soil with nutrients eases the demand on chemical fertilizers and its negative impacts on the environment. Phosphorus (P) is one of the major plant nutrients. Its deficiency limits the plant growth and development in almost all agricultural soils. Due its high reactivity, applied P readily combines with soil minerals forming insoluble phosphates, lowering its availability to plants. As such, development of an economical and environmentally friendly alternative for successful soil P management is a major concern in crop production and phosphate solubilizing microorganisms (PSM) attracted attention in this regard (Rodriguez and Fraga, 1999).

Export agricultural crops (EAC) are important contributors to the Gross National Product. Although Eppawala rock phosphate (ERP) is applied to EACs concerning the perennial nature of the plant, it has been shown that phosphate availability of ERP for EACs can be increased using PSMs (Mala et al., 2010). Hence, the main objective of this study is to develop a phosphate biofertilizer for EACs using suitable phosphate solubilizing microorganisms.

Methodology

Screening Phosphate Solubilizing Microorganisms (PSMs)

Soil samples were collected from rhizospheres of wild and cultivated species of three EACs: Pepper, Cocoa and Cinnamon and screened on Pikovskaya (PVK) medium (Pradhan and Sukla, 2005) containing tri calcium phosphate as the sole P source. PSMs were isolated based on the clear halo production on the medium. Isolated organisms were subjected to a secondary screening on a modified PVK medium containing a partially soluble phosphate to identify the persistent expression of the character. Isolates that showed a positive response were selected for further experimentation and coded for easy reference.

Evaluation of the efficiency of phosphate solubilization

All selected isolates from secondary screening were evaluated for the efficiency of P solubilization using two parameters: quantity of P solubilized at a given time and amount of organic acid secreted as denoted by a decrease in the medium pH. Isolates were assessed in PVK and a modified PVK medium containing ERP as the P source. For fungi, the respective broth media were inoculated with approximately $1 \times 10^8$ fungal spores/mL from a respective fungal isolate and incubated at room temperature for 24 and 48 h under 100 rpm constant oscillation. Three replicates were maintained. After incubation, media
were filtered to remove any suspended materials and 10 mL of the filtrate were used to measure pH values and another 20 mL was taken to measure solubilized P content using Murphy and Riley method (Murphy and Riley, 1962). Efficiencies of the bacterial isolates were measured in the same way, except that the inoculum density was adjusted to $1 \times 10^8$ cfu/mL and the incubation time was increased up to 72 hours.

**Statistical Analysis**

The experimental data were subjected to one-way ANOVA tests, correlation analysis and multiple mean comparison tests using Minitab 15 statistical software package.

**Results and Discussion**

**Isolation of PSM**

From the primary screening, 12 fungi and 41 bacteria were isolated. All the fungal isolates showed the persistence of the trait in the presence of partially soluble P while only 26 bacteria out of 41 were successful.

**Evaluation of the efficiency of phosphate solubilization**

The amount of phosphates solubilized in both PVK and ERP modified PVK liquid media by fungal and bacterial isolates showed significant variability at 5% significance level ($p=0.000$). Almost all the isolates exhibited significant increment in soluble P content compared to control, showing effective conversion of insoluble P forms in to soluble forms. The highest P solubilization values of 145.79(±9.09) mg P/L in PVK and 16.15(±9.00) mg P/L in ERP-PVK media were recorded by the fungal isolate MPsRF1. Among bacterial isolates, the highest P solubilization of 222.33(±28.39) mg P/L in PVK medium was recorded by the isolate MPlRB3 while isolate MPlRB2 gave the highest P solubility (68.23(±5.90) mg P/L) in ERP-PVK medium.

Significant pH reductions ($p=0.000$) were observed in all treatments in comparison to the control. Highest organic acid productions in PVK medium were exhibited by the fungal isolate TClRF1 and the bacterial isolate MPcRB1 with 3.6403(±0.9865) and 3.251695 (±0.152753) pH values, respectively. The highest organic acid producers in ERP-PVK medium were fungal isolates MTcRF1 and MPsRF1, recording a pH of 4.1691(±0.0577) and the bacterial isolates MCvRB1, TUbB1, TCvRB1, TCvgRB1 and TCvjBB1 (pH 3.94 (±0.058)). This indicates the production of organic acids by the microorganisms to acidulate the medium for P solubilization. Yet, the correlation analysis revealed an absence of a correlation between the decrease in pH and the amount of solubilized phosphates by fungi in both media ($r=0.320$ (p=0.311) and $r=0.534$ (p= 0.074) in PVK and ERP-PVK media, respectively) indicating the existence of other mechanisms in fungi to solubilize P other than acid production. In contrast, bacterial isolates showed a significant correlation of $r = 0.714$ (p=0.000) in PVK medium and $r=0.602$ (p=0.001) in ERP-PVK medium. This indicates that organic acid production is a major factor contributing to solubilization of phosphates. Accordingly, fungal isolate MPsRF1 and bacterial isolates MPlRB2 and MPlRB3, the best solubilizers of phosphates were selected for further studies.
Conclusion

Fungal isolate MPsRF1 and bacterial isolates MPIRB2 and MPIRB3 are effective in phosphate solubilization and hence are the best candidates for the production of a phosphate biofertilizer. A strong relationship between organic acid production and phosphate solubilization was observed in bacterial isolates whereas in fungal isolates such indication was not found.

References


The National Research Council is highly acknowledged for providing financial assistance for the project.
Fluorescent Sensor Based on 2-Cyano-1,10-phenanthroline for Fe^{2+} ion Analysis in Acetonitrile

S.I.M. Nilam and M.D.P. De Costa

Department of Chemistry, Faculty of Science

Introduction

Fluorescent sensors for the detection and measurement of Fe^{2+} will be actively investigated in this paper, as this metal ion is a significant environmental pollutant and essentials element in biological systems. For most of the reported Fe^{2+} fluorescent sensors, the binding of the metal ion cause a quenching of the fluorescent emission. Only a few sensors in which the binding of the metal ions causes an increase in the fluorescence have been reported (Zhaochao, Yi Xiao and Xuhong Qian, 2005). To increase the selectivity and sensitivity of a measurement, ratiometric measurements are utilized. Ratiometric measurements involve the observation of changes in the ratio of the intensities of the absorption or the emission at two wavelengths. However, ratiometric sensors for the detection of Fe^{2+} are very rare. We designed and synthesized the fluorescent sensors (1), 2-Cyano-1,10-phenanthroline which contain fluorophore and ionophore and show the static quenching, fluorescent enhancement and dynamic quenching for a range of concentration. The fluoroionophore (1) shows high selectivity for Fe^{2+} with detection limit 3.6\times10^{-9} M.

\[
\text{Compound (1)}
\]

Experimental

Synthesis of (1)

To a solution consisting of 5.0 g (0.026 mol) of 1,10-phenanthroline-1-oxide and 5.0 g of potassium cyanide dissolved in 40 ml of distilled water, 5.0 ml of benzoyl chloride was added dropwise, under magnetic stirring. The total addition required 1 hour, and the reaction mixture was stirred for an additional 2 hours. The resulting precipitate was collected by suction filtration, washed with distilled water, and dried as a brown solid in 87% yield. Crystallization from ethanol gives the pure compound melting point 237 °C.[Wen-Hua Sun, et al 2006, 237-238°C] IR \nu_{\text{max}} (\text{cm}^{-1}): 3058, 2228, 1502, 851.

Results and Discussion

The cations binding properties of compound (1) were investigated by UV-vis absorption and fluorescence spectroscopy. All the experiments were carried out in acetonitrile medium by adding aliquots of different metal ions. The UV-vis absorption spectrum of compound (1)
exhibits one isobestic point at 274 nm on addition of metal ions, as shown in Figure 1. The addition of Fe$^{2+}$ from 0-3.53 µM resulted in an increase in absorption at 280nm to a limiting value. Absorption studies indicated that only one complex was formed.

In the fluorescence spectrum, compound (I) exhibited emission band at 364 nm at the concentration 4.875×10$^{-6}$ M, when increasing the concentration of Fe$^{2+}$ from (0-1.08×10$^{-7}$ M) resulted in decrease fluorescence at 364 nm due to the static quenching of fluorescence of 1 by Fe$^{2+}$. Further addition of Fe$^{2+}$ (1.08×10$^{-7}$ - 3.6×10$^{-7}$ M) to the solution of compound (I), a significant decrease in the 364 nm emission and a new band due to emission of complex appeared at 404 nm, which was attributed to 1- Fe$^{2+}$ complex with an isoemissive point at 375 nm (Fig 2). The inset in Figure 2 shows the dependence of intensity ratios of emission at 404 nm to that at 364 nm (I$_{404}$/I$_{364}$) on Fe(II) which indicates the formation of complex between 1 and Fe$^{2+}$; further increasing Fe(II) concentration from 3.6×10$^{-7}$ M the emission from complex undergoes a dynamic quenching with Fe$^{2+}$ (Fig 3).

The complex formation constant was calculated using Benesi and Hildebrand method that was log(K) = 5.73. An interference study was carried out with same conditions for different metal ions such as Na$^+$, K$^+$, Cd$^{2+}$, Zn$^{2+}$, Mn$^{2+}$, Cu$^{2+}$, Co$^{2+}$, Pb$^{2+}$, Ag$^+$, Ni$^{2+}$. No significant fluorescence was observed in the presence of these metal ions. To test the practical applicability of 2-Cyano-1,10-phenanthroline as Fe$^{2+}$ selective fluorescence sensors competitive experiments were carried
out in the presence of Fe(II) at $3 \times 10^{-7}$ M mixed with Na$^+$, K$^+$, Cu$^{2+}$, Zn$^{2+}$, Mn$^{2+}$, Co$^{2+}$, Pb$^{2+}$, Ag$^+$, and Ni$^{2+}$ at $3 \times 10^{-7}$ M. There was no significant variation found in the intensity ratio ($I_{404}/I_{364}$). This confirms that compound (I) has higher selectivity for Fe$^{2+}$.

In order to determine the stoichiometry of the 1-Fe$^{2+}$ complex, the method of continuous variation (Jobs plot) was also used. The total concentration of the compound (I) was constant ($1.2 \times 10^{-6}$ M), with a continuous variable molar fraction of guest ($[\text{Fe}^{2+}] / [\text{I}] + [\text{Fe}^{2+}]$). Figure 4 shows the jobs plot of compound I with Fe$^{2+}$ at 404 nm. The 1-Fe$^{2+}$ complex concentration approaches a maximum when the molar fraction of Fe$^{2+}$ is 0.25, indicating a formation of 1:3 complex.

**Conclusion**

We developed highly selective fluorescence sensor for Fe$^{2+}$ based on 2-cyano-1,10-phenanthroline. The recognition of Fe$^{2+}$ gave rise to ratiometric change at the ratio of the fluorescent intensity of 364 and 404 nm for the complexation. For the very low concentration of Fe$^{2+}$, 2-cyano-1,10-phenanthroline undergoes static quenching and in higher concentration of Fe(II) it undergoes the dynamic quenching. The detection limit for Fe$^{2+}$ was found to be $3.6 \times 10^{-9}$ M. Thus 2-cyano-1,10-phenanthroline may be considered as a potential fluorescent chemosensor for Fe(II).

**References**


Zhaochao, Yi Xiao, Xuhong Qian. Ratiometric and selective fluorescent sensors for Cu(II) based on internal charge transfer, Organic letters 2005:7 889-892
Angiopteris evecta (Forst.) Hoffm: a potential source for antibacterial activity

S. M. L. D. Nilanthi, C.D. Wijayarathna, and G.H.C.M. Hettiarachchi

Department of Chemistry, Faculty of Science

Introduction

The continuous increase in resistance to pathogenic microbes and shortage of new antimicrobial agents are a serious problem in the treatment of infectious diseases. Several studies have been done to reveal the antimicrobial agent on higher plants. However, very little attention has been given to the lower plants, especially the pteridophytes. Being a tropical island, Sri Lankan flora also has a substantial contribution to the pteridophytes. This paper presents the investigation of the antimicrobial activity of Angiopteris evecta (Forst.) Hoffm which was selected through an ethnomedicinal survey conducted in two selected areas in Sri Lanka namely Mahiyanganaya and Bulathsinghala. A. evecta is a terrestrial fern with well developed subterranean rhizome and pinnately compound large fronds.

Methodology

Considering the richness of biodiversity of pteridophytes, a field survey was conducted from January 2011 to April 2011 to explore ethnomedicinally important pteridophyte floras used by the local healers, local people and tribal people in Mahiyanganaya and Bulathsinghala areas. Structured questionnaire survey method was conducted to collect the information. To obtain more detailed information of ethnomedicinal usage, informants were accompanied to the field to collect plant material as much as possible. The collected plants were photographed and pressed to show the interviewees to collect information. Data on plant species, families, vernacular names, parts used, traditional use and modality of use were recorded. Interviews were conducted as personal and groups with 165 people including 38 local healers, 105 local people and 22 tribal people. All the specimens were collected in duplicate forms and the samples were authenticated by the national herbarium Peradeniya in Kandy, Sri Lanka. Voucher specimens were deposited in the herbarium.

Based on the ethnomedicinal survey, A. evecta was selected for further investigation of the antibacterial activity. Freeze dried samples of fronds, roots and rhizome were used for solvent extraction. Each sample was mixed with the solvents in the ratio of 1:10 (v/w) and follows the serial exhaustive extraction method (Das, K et al., 2010). Extraction procedure was repeated for complete extraction of the bio active compounds. The filtrate was concentrated in vacuo at 35°C using rotary evaporator. In vitro antibacterial activity of crude extracts was determined by standard disk diffusion method (Bauer, A. W et al., 1959). Pre identified bacterial cultures of Escherichia coli, Staphylococcus aureus, Klebsiella pneumonia, Streptococcus fecalis were collected from the Department of plant sciences, University of Colombo and grown on nutrient broth at 37°C for 24 h. The cultures were adjusted to the concentration of $1 \times 10^8$ - $1 \times 10^9$ CFU/ml by using spectrophotometer at 600 nm.
10 µl of 100 mg/ml the stock solution of extract was aseptically introduced to sterilized filter paper disks of 5 mm in diameter. The disks were kept for few minutes to allow them to absorb the solution and were placed on the surface of the inoculated MHA plates with different bacterial strains. Standard antibiotic disks (25 µg/disks of cloxacilin) were used as the positive control. A filter paper disk impregnated with 10 µl respective pure solvent was used as a negative control. The plates were incubated at 37 °C overnight. The experiment was performed in triplicate and the antibacterial activity of the extract compound was expressed the mean of diameter of zone of inhibition (in mm).

**Results and Discussion**

A total of 35 plant species belonging to 17 families were collected through the survey. Among these plant species, 33 have been identified at the National herbarium Peradeniya in Kandy, Sri Lanka and 2 species were unable to be identified. Result of the survey demonstrates that, 27 species have ethnomedicinal usage to cure 13 diseases including wounds, constipation, hemorrhoids, diabetics, growing cartilage, dysentery, muscle pain etc. More than 10 species are used to cure wounds, fractured bones and boils. Figure 1 shows ethnomedicinal usage of 35 pteridophyte species and it indicates *A. evecta* is used to cure maximum number of diseases than the other pteridophytes species. Therefore *A. evecta* was selected to investigate the antibacterial activity.

**Table 1. Inhibitory zone diameter (mm) of fronds, roots and rhizome of *A. evecta* on different bacterial strains**

<table>
<thead>
<tr>
<th>Plant part</th>
<th>Test Organism</th>
<th>Positive control</th>
<th>Chloroform</th>
<th>Dichloro</th>
<th>Methane</th>
<th>Acetone</th>
<th>Ethanol</th>
<th>Methanol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fronds</td>
<td>S. aureus</td>
<td>10.25±0.21</td>
<td>0.00</td>
<td>10.02±0.28</td>
<td>8.09±0.35</td>
<td>12.05±0.35</td>
<td>9.91±0.46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E. coli</td>
<td>18.00±0.11</td>
<td>0.00</td>
<td>10.94±0.54</td>
<td>7.88±0.60</td>
<td>9.07±0.75</td>
<td>8.08±0.38</td>
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</tr>
<tr>
<td></td>
<td>K. pneumonia</td>
<td>11.05±0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S. fecalis</td>
<td>16.43±0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>8.62±0.72</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Root</td>
<td>S. aureus</td>
<td>10.25±0.21</td>
<td>0.00</td>
<td>0.00</td>
<td>8.47±0.32</td>
<td>0.00</td>
<td>8.16±0.85</td>
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</tr>
<tr>
<td></td>
<td>E. coli</td>
<td>18.00±0.11</td>
<td>0.00</td>
<td>10.34±0.37</td>
<td>14.11±0.54</td>
<td>14.15±0.61</td>
<td>8.88±0.91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K. pneumonia</td>
<td>11.05±0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>S. fecalis</td>
<td>16.43±0.31</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhizome</td>
<td>S. aureus</td>
<td>10.25±0.21</td>
<td>0.00</td>
<td>13.39±0.59</td>
<td>12.26±0.32</td>
<td>8.51±0.32</td>
<td>7.30±0.58</td>
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<tr>
<td></td>
<td>E. coli</td>
<td>18.00±0.11</td>
<td>9.31±0.66</td>
<td>7.82±0.34</td>
<td>10.05±0.60</td>
<td>7.82±0.13</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>K. pneumonia</td>
<td>11.05±0.17</td>
<td>0.00</td>
<td>0.00</td>
<td>7.69±0.20</td>
<td>0.00</td>
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<td>S. fecalis</td>
<td>16.43±0.31</td>
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</table>

In vitro antibacterial activity of crude extracts was determined by standard disk diffusion method. The mean diameter of zone of inhibition of fronds, roots and rhizome of *A. evecta* on different bacterial strains are listed in Table 1. The results were statistically analyzed and F test results showed there was no significant difference among plant parts in inhibiting the bacteria growth but there was a significant difference among bacteria strains and the crude extracts made with different solvents. Dichloromethane, acetone, methanol and ethanol crude extracts showed significantly higher effect on inhibiting growth of *Escherichia coli* and *Staphylococcus aureus* than the chloroform extract used for test. Also *Escherichia coli* and *Staphylococcus aureus* showed more sensitivity than *Klebsiella pneumonia* and *Streptococcus fecalis* towards all extract tested except chloroform extract. Altogether these results revealed the crude extracts to be a good source of potential antimicrobial compounds.
Figure 1: Ethnomedicinal usage vs number of diseases

References


Two-particle Quantum Walks over a Line

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Introduction

Quantum computing, the quantum analogue of classical computing makes use of qubits - quantum analogue of classical bits, as the elementary quantum registers of storing, manipulating and measuring data (Nakahara and Ohmi, 2008). Mathematically, a qubit is a unit vector of the form

\[ |\psi\rangle = \alpha |0\rangle + \beta |1\rangle \]

so that \[ |\alpha|^2 + |\beta|^2 = 1 \]

in a Hilbert space spanned by canonical basis states \[ |0\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \] and \[ |1\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \]. When a qubit is queried, obtained is a probabilistic answer, instead of a deterministic one. That will be, the state \[ |\psi\rangle \] with probability \[ |\alpha|^2 \], and \[ |\psi^\prime\rangle \] with probability \[ |\beta|^2 \]. Also quantum algorithms were designed following this quantization. Various strategies for quantum algorithms emerged, along with the one based upon the idea introduced by Aharanov [4], and it was developed under the term ‘quantum walks’. Currently, two main categories of quantum walks are being considered: discrete and continuous quantum walks; while discrete quantum walks were studied under two subcategories as Markov chain-based and coin-based walks.

Coin-based quantum walk is the explicit quantum analogue of classical random walk, in which the walker is at some position on a discretized straight line initially, where the coin flip takes place to decide either to move to left or to right. The walk is thus determined by the probability of finding the walker at some point at a given time. Mathematically, the state of the walker is thus the tensor product of coin states and the vertex states (.Berry and Wang, 2010). The most accepted mathematical model states that the walker is in the Hilbert space \[ \mathcal{H}_C \otimes \mathcal{H}_P \] where \[ \mathcal{H}_C \] is the coin state, spanned by the orthonormal basis states \[ |1\rangle_c \] and \[ |0\rangle_c \], and \[ \mathcal{H}_P \] is the position Hilbert space spanned by the basis states of vertices on the straight line the walker moves. Thus, a generic state of the walker can be expressed as

\[ |\psi(t)\rangle = \sum_{n=\infty}^{\infty} a_L(n,t)\psi(n) + a_R(n,t)\psi(n+1) \in \mathcal{H}_C \otimes \mathcal{H}_P \]

where \[ a_L(n,t) \] and \[ a_R(n,t) \] are left and right amplitudes respectively, of the walker at position \[ n \], time \[ t \].

Hadamard Walk over a Line

Outcome of the coin flip in a quantum walk depends upon the choice of the coin. Commonly used coins are Grover’s coin, Hadamard coin, balanced coin, Pauli’s coin etc. For instance, if Hadamard coin \[ \tilde{H} \] was selected, the evolution of the walk could be regarded as repeated alternative application of \[ \tilde{H} \otimes \tilde{I} \] and the shift \[ \tilde{T} \] defined as follows, with the initial state \[ |0\rangle_c |0\rangle_p \]:

The coin operation is defined as \[ \tilde{H}: \mathcal{H}_C \rightarrow \mathcal{H}_C \] so that

\[ c_1|0\rangle_c + c_2|1\rangle_c \rightarrow \frac{1}{\sqrt{2}}(c_1 + c_2)|0\rangle + \frac{1}{\sqrt{2}}(c_1 - c_2)|1\rangle \]

and the shift operation is defined as \[ \tilde{T}: \mathcal{H}_C \otimes \mathcal{H}_P \rightarrow \mathcal{H}_C \otimes \mathcal{H}_P \] so that

\[ |0\rangle_c |n\rangle_p \rightarrow |0\rangle_c |n+1\rangle_p \] , \[ |1\rangle_c |n\rangle_p \rightarrow |1\rangle_c |n-1\rangle_p \].
Analytical Solution of Hadamard Walk

An analytical solution of the Hadamard walk along the straight line was derived by Nayak and Vishwanath (2008). The methodology adopted by them was reducing the time evolution of the system into the eigenvalue problem in the Fourier space by discrete Fourier transformation. First, the state of the walker at the position \( g \sqrt{\text{866}} \) at time \( g \sqrt{\text{82}-1} \) is expressed in terms of the states at the positions \( g \sqrt{\text{866}-1} \) and \( g \sqrt{\text{866}+1} \) at time \( g \sqrt{\text{82}-} \) by

\[
|g\sqrt{\text{866}}\rangle = M_+ |\psi(n-1,t)\rangle + M_- |\psi(n+1,t)\rangle,
\]

where

\[
M_+ = \begin{bmatrix} 0 & 0 \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}
\]

and

\[
M_- = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ 0 & 0 \end{bmatrix}.
\]

Then in the Fourier space it takes the form

\[
|\tilde{\psi}(k,t+1)\rangle = \tilde{M}_k |\tilde{\psi}(k,t)\rangle
\]

for \( \tilde{M}_k = e^{ik} M_+ + e^{-ik} M_- \), and after solving with the relevant initial condition, and transformed back to the time domain, the solution was obtained (Aharanov et al., 1993).

The importance of this solution is, its extendibility for regular graphs, as quantum walk on the infinite straight line was found to be isomorphic to the quantum walk on certain regular graphs, as shown by N. Shenvi, J. Kempe and K. Whaley (2003).

Two-particle Quantum Walks

For many potential practical applications of quantum walks, multi-particle walkers are preferred instead of single particle walkers. A two-particle walker has several possibilities to interact: they might evolve their walks individually, independent of the states of each other, or they can interact when confronted (Berry and Wang, 2011). Needless to say, the walk takes place in the Hilbert space \( \mathcal{H}_c \otimes \mathcal{H}_p \) \( \otimes \) \( \mathcal{H}_c \otimes \mathcal{H}_p \). Identity interaction is one way of interacting, in which the coin operator \( \hat{C} \) collapses down to the identity operator at common vertices. For the two-particle Hadamard walk, \( \hat{C} = \hat{H} \otimes \hat{H} \) when the two particles are at different vertices, and \( \hat{C} = I \) when they are at the same vertex. In \( \pi \)-phase interaction, another possibility of interacting, rather than using the identity coin operator, the phase of all vertex states are being shifted by \( \pi \). However, the non-interacting quantum particles are also not totally independent of each other due to quantum entanglement. Regarding the identity interaction, when entanglement is neglected, the problem can be transformed to the following form which might be helpful in obtaining analytical solutions:

If the \( 4 \times 4 \) matrix \( P_i \) is defined for each \( i = 1,2,3,4 \) as \( P_i = (p_{jk}) \) so that \( p_{jk} = \begin{cases} 1, & j = k = i \\ 1, & j = k = i \\ 0, & \text{otherwise} \end{cases} \) and

\[
N_1 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1/2 & 1/2 & 1/2 & 1/2 \\ 0 & 0 & 0 & 0 \end{bmatrix}, \quad N_2 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1/2 & 1/2 & -1/2 & -1/2 \\ 0 & 0 & 0 & 0 \\ 1/2 & -1/2 & 1/2 & -1/2 \end{bmatrix}, 
\]

\[
N_3 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1/2 & -1/2 & 1/2 & -1/2 \\ 0 & 0 & 0 & 0 \end{bmatrix}, \quad N_4 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 1/2 & -1/2 & 1/2 & -1/2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}.
\]
then the state at positions \( n, m \) at time \( t + 1 \) is given by

\[
|\psi((n, t + 1), (m, t + 1))\rangle = M_1|\psi((n - 1, t), (m - 1, t))\rangle + M_2|\psi((n - 1, t), (m + 1, t))\rangle + M_3|\psi((n - 1, t), (m + 1, t))\rangle + M_4|\psi((n + 1, t), (m + 1, t))\rangle.
\]

where,

\[
M_1 = N_i \text{ for } m = n \text{ and } m = n \pm 2, \quad M_2 = N_1, \quad M_2 = P_2, \quad M_3 = N_3 \text{ and } M_4 = N_4, \text{ for } m = n + 2, \quad M_1 = N_1, \quad M_2 = N_2, \quad M_3 = P_3 \text{ and } M_4 = N_4, \text{ for } m = n - 2, \quad M_1 = P_1, \quad M_2 = N_2, \quad M_3 = N_3 \text{ and } M_4 = P_4, \text{ for } m = n,
\]

References


Detecting metal ions qualitatively and quantitatively using electrochemical techniques is well known. Ion selective electrodes (ISE) and voltammetric techniques are the predominant methods for detecting metal ions. (Pesavento et al., 2009) ISEs have many advantages such as their nondestructive nature and selectivity. However, ISEs are not available for every metal, and this limits the use of ISEs. (Batley et al., 2004, Pesavento et al., 2009) On the other hand, voltammetric techniques can disturb the existing equilibrium in the medium. Due to advantages such as sensitivity and low detection limits for most metal ions, ISEs are the top choice for the detection of metal ions. (Pesavento et al., 2009, Bakker et al., 2006)

Detection of metal ions can be helpful in understanding the chemical nature of a surface. In addition, mapping of metal ions can be used to understand the behavior of metal ions in biological systems. Maintaining the same level of accuracy throughout the detection period and producing minimum disturbance to the system are two main requirements for mapping techniques. Voltammetric and amperometric techniques can be used continuously with the same level of accuracy; however, these methods are not free of disturbance (consumption of analyte and electrolysis products). Non-amperometric methods, such as AC-SECM (alternative current scanning electrochemical microscopy) coupled with a modified electrode, can be used to detect ions without disturbing the system.

As metal ions chelate with the modified layer, the double-layer capacitance will change, and this change can be detected using impedance spectroscopy (Burke et al., 2008) or other AC current based electrochemical techniques. Since chelation is a reversible process, the chelation level is dynamic and fluctuates with respect to the free metal ion concentration of the system. Chelation of transition metal ions such as Cu(II) and Fe(III) have been reported previously with aniline. (Jacques et al., 2007) SECM ultra microelectrodes (UME) modified with aniline were used to test this hypothesis. UMEs modified with nitrobenzene were reduced electrochemically to produce aniline-modified UMEs. (Allongue et al., 1997)

Different transition metal wire-embedded substrates were used as the scanning surfaces for preliminary studies. Metal ion detection was performed using a 7 μm-carbon fiber UME modified with aniline. A solution of 0.05 M H₂SO₄ was used as the electrolyte for AC-SECM experiments. Corrosion at the embedded metal wire can be controlled by an applied potential to the substrate. Line scans were performed over the embedded metal wire soon after the substrate was given a potential pulse. A decrease in the AC current response is observed in the line scans performed using aniline-modified UMEs with Cu and Ni substrates. In these scans, a short potential pulse given just before the scan produced enough metal ions to register an AC current decrease. The magnitude of the AC current decrease increased with pulse potential. No current decrease is observed for a Pb-wire embedded substrate. This confirms
the ability of aniline-modified UMEs to detect some transition metal ions. The estimated level of detection based on these results is in the limit of 10 µmol dm$^{-3}$.

To confirm this further, another set of experiments were performed using the same metal-wire embedded substrates. Metal ion production and detection were performed separately from each other. The produced metal ions diffuse across the medium to the electrode. The calculated diffusion times and the experimental times taken by the metal ions to register a signal are compared to validate the results. A metal wire-embedded substrate can produce concentration waves of metal ions after each potential pulse, and the modified electrode placed nearby can detect the metal ions. The time taken by metal ions to reach the electrode was measured, and this delay between the potential pulse and the AC current pulse must be comparable with the calculated diffusion times for each metal ion. The time observed to register an AC current decrease matched the calculated diffusion times for both Ni(II) and Cu(II) ions.

To mimic an actual biological system with a localized metal ion concentrations, a micro-capillary (150 µm) embedded substrate was used to generate localized metal ions for AC-SECM mapping. A series of different 10 µmol dm$^{-3}$ metal ion solutions were pumped with the rate of 10 µL/s. Cu$^{2+}$ and Ni$^{2+}$ ions were used as the possible chelating metal ion species to test the imaging ability of the modified electrode. A non-chelating Ca$^{2+}$ ion solution was used for the control imaging scan. All these experiments were repeated with nitrobenzene-modified UMEs to validate the chelating ability of aniline with transition metal ions. Aniline-modified UMEs successfully mapped both Ni(II) and Cu(II) ions. As observed in the line scan results, nitrobenzene failed to detect these transition metal ions. These AC-SECM scans with aniline-modified UMEs showed a chelation effect with Ni$^{2+}$ and Cu$^{2+}$ (10 µM) solutions. Unlike the transition metals, Ca$^{2+}$ failed to produce a change to the aniline-modified layer on the UME. Based on all these results, we believe that AC-SECM can be used effectively to detect some transition metal ions using a modified UME.

Improving the selectivity of chelating modifiers on the UME towards target metal ions is an important goal. Mapping and tracking of metal ion movement in biological systems are other possible paths in developing these AC-SECM metal ion mapping techniques.

References


Introduction

Background

Cancer is a group of diseases. It occurs when cells become abnormal and divided without control or order. It affects persons all over the world. Breast cancer (malignant breast neoplasm) is cancer originating from breast tissue, most commonly from the inner lining of milk ducts or the lobules that supply the ducts with milk. Cancers originating from ducts are known as ductal carcinomas; those originating from lobules are known as lobular carcinomas.

Very rarely men also get breast cancers. Men possess a small amount of nonfunctioning breast tissue (breast tissue that cannot produce milk) that is concentrated in the area directly behind the nipple on the chest wall. Like breast cancer in women, cancer of the male breast is the uncontrolled growth of the abnormal cells of this breast tissue.

The size, stage, rate of growth, and other characteristics of the tumor determine the kinds of treatment for breast cancer patients. Treatment may include surgery, drugs (hormonal therapy and chemotherapy), radiation and or immunotherapy. Some breast cancers are sensitive to hormones such as estrogen and or progesterone, which make it possible to treat them by blocking the effects of these hormones.

Rationale

Breast cancer is the most commonly prevalent type of cancer among women in Sri Lanka. Therefore it is worthwhile studying about breast cancer.

Objective

The objective of this study was to investigate multiple aspects related to breast cancer patients in Sri Lanka. The main objective was to determine the Influential prognostic factors that affect the survival time of breast cancer patients.

Details of data

Data for this study was collected from breast cancer patients registered during the year 2006 to 2008 at General Cancer Hospital Maharagama. There were 2907 patients suffering from breast cancer, among which were 2833 female patients and 74 male patients during this period.

In the hospital record room they measured patient identity number, age, sex, district, province, type of cancer by ICD code, survival status, registered date and date of last visit or date of death.
Methodology

The Kaplan-Meier survival curves and hazard plots were used to descriptively study the effects of different factor levels of each independent variable on survival. The log-rank test was used to confirm associations at a univariate level. For the advanced analysis the Cox proportional hazards model was used for modeling (Collet 1994).

Outcome and Conclusions

The log-rank test indicated that age category, gender, race, menopausal status, and ward or clinics are the most significant variables that affect the survival time. Kaplan-Meier plots show that pre-menopausal women have higher survival time than post-menopausal women. Males have lower survival time than females.

In this study significant difference cannot be seen among breast cancer patients according to districts and provinces. This may be due to the relationship between genetic affect and breast cancer. Sinhalese patients have a higher survival time than other races. Very young and middle aged patients have a higher survival time while teenagers and very old patients have very low survival time.

The hazard plots indicate that the hazard of death increased very sharply for about two and half years for very old people. During the first year very young people have a high risk. Females have a lesser hazard when compared to males. Hazard of death increased very sharply for about three years for males when comparing with females. Pre-menopausal females have a lesser hazard with respect to the post-menopausal females. For both the pre and post-menopausal patients hazard of death increased very sharply for about three years.

The Cox proportional hazard regression model is used to model failure time or follow up data. This model is based on the assumption of proportional hazards, and no particular form of probability distribution is assumed for the survival times. In this study for survival data modeling Cox-proportional hazard model indicates that ward or clinic, age category, sex, menopausal status and ethnicity affect the survival time. The selection of the variables for inclusion in the model based on the deviance step wise selection method was used.

The model obtained as follows

\[ h(t) = \exp \left\{ \text{agecategory}_p + \text{ward or clinic}_q + \text{sex}_r + \text{menopausal &nonmenopausal}_s + \text{race}_a \right\} h_0(t) \]

Table 1 gives the hazard ratios for different variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>P-value</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>agecategory</td>
<td>-0.978</td>
<td>.106</td>
<td>.376</td>
</tr>
<tr>
<td>agecategory1</td>
<td>-1.500</td>
<td>.000</td>
<td>.223</td>
</tr>
<tr>
<td>agecategory2</td>
<td>-.984</td>
<td>.000</td>
<td>.374</td>
</tr>
<tr>
<td>Sexcode</td>
<td>.038</td>
<td>.873</td>
<td>1.038</td>
</tr>
<tr>
<td>Mennon</td>
<td>.844</td>
<td>.000</td>
<td>.525</td>
</tr>
<tr>
<td>mennon0</td>
<td>-0.432</td>
<td>0.003</td>
<td>.346</td>
</tr>
<tr>
<td>Racecode</td>
<td>.404</td>
<td>.186</td>
<td>.667</td>
</tr>
<tr>
<td>Racecode1</td>
<td>.217</td>
<td>.505</td>
<td>.805</td>
</tr>
<tr>
<td>Racecode2</td>
<td>-.150</td>
<td>.639</td>
<td>.861</td>
</tr>
</tbody>
</table>
Interpretation of Coefficients and Hazard Ratios

A positive sign in regression coefficient means that the hazard is higher at any given time for the associated level of the factor compared to the baseline level of the factor. Negative sign in regression coefficient means that the hazard is lesser at any given time for the associated level of the factor compared to the baseline level of the factor.

Patients who are in ward have about 0.66 times lesser risk of death than patients who are in clinic at any given time. This is highly significant.

Very young, teenage and middle aged patients have lesser risk of death than very old patients. All these age groups are having negative parameter estimates compared to very old patients.

Postmenopausal women have about 0.525 times more risk of death than male patients while pre-menopausal women have about 0.346 times less risk of death than males at any given time.

Sinhalese, Tamils and Muslims have lesser risk compared to other race category.

Recommendations

The Government can conduct public health awareness programmes on breast cancer, because the early detection will pave the way to complete curability for breast cancer patients.

References

Safety evaluation of *Caryota urens* L. (Kithul) treacle in rats

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Introduction

Traditionally, in Sri Lanka, treacle prepared from *Caryota urens* L. (Kithul) sap has been used as a sweetener for many centuries and it has been used to prepare a variety of sweet foods, drinks and some medicinal preparations such as Arista. In folklore it is claimed to posses health benefits such as anti-ageing and anti-diabetic. Recent scientific studies carried out by us showed that *C. urens* treacle posses different bioactive properties such as antioxidant, antihyperglycemic and glucosidase inhibitory properties. However, so far no scientific data is available to verify the safety of this traditional food. Therefore, in this study, toxicological evaluation of *C. urens* treacle was done using the normal rat model.

Materials and Methods

**Sample**

Authentic treacle sample (5 kg) prepared at Kithul treacle processing center at Rojasangama, Kotmale was used for this study.

**Animals**

Adult male Wistar rats obtained from Medical Research Institute, Colombo 08, Sri Lanka were used. The animals were maintained under standard laboratory conditions (12-h light/dark cycle, 25 ± 2 °C and humidity 50 - 65%) and were fed with commercial diet (Master Feed Ltd., Colombo, Sri Lanka) for 2 weeks before start the experiment.

**Diets**

A standard diet was made having following composition (in weight %) protein, 10; oil, 2.5; fiber, 5.0; mineral, 2.5; methionine, 0.2; starch, 10; and sucrose 56. Treatment diet was prepared using 60 % (w/w) *C. urens* treacle and standard ingredients to meet same nutritional composition as in standard diet. Both standard and treacle added diets were prepared dried in oven at 50 °C until the moisture content reached to 14 - 13.5%. Then two diets were packed separately in polythene bags (40 g/bag) and stored in -20 °C until use.

**Experiment Design**

After 14 days of acclimatization, rats were randomly divided into two groups (8 rats per group) and one group was given standard diet and other group was given treacle added diet *ad libitum* for 28 consecutive days. Both groups were given free access to tap water. Daily food intake and body weight gain (weekly) were recorded during the experiment. During the experiment, food intake was measured daily and body weight gained of the animals was recorded weekly. Overt sign of toxicity (salivation, rhinorrhoea, lachrymation, ptosis, writhing,
convulsions, tremors, erection of fur and exophthalmia) was monitored daily and reordered. On day 1 post treatment, rats were fasted for 14 h and blood samples were collected into EDTA treated and non-treated vials from tail vain under ether anesthesia with aseptic precautions. The EDTA non-treated samples were allowed to clot at 25±2 °C for 15 minutes and serum was separated by centrifuging at 6,000 rpm for 5 minutes at 4 °C. Randox test kits were used to determined different serum chemistry parameters such as glucose, serum proteins, serum albumin, creatinine, total cholesterol, triglyceride, urea, serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT). The EDTA treated blood samples were used to count blood cells and other hematological parameters.

Data Analysis

Data were analyzed using GLM procedure in SAS 6.12 version and mean separation was done using Duncan’s Multiple Range Test

Results and Discussion

Daily food intake and total body weight gain did not show significant (P>0.05) difference between treatment (25.0±1.6 vs 24.0±2.4 g respectively) and control (65.6±12.7 vs 72.8±10.6 g respectively) groups. An overt sign of toxicity (salivation, rhinorrhoea, lachrymation, ptosis, writhing, convulsions, tremors, erection of fur and exophthalmia) was not observed from rats in both treatment and control groups. The results of hematology parameters and serum chemistry tests of the two groups are given in Tables 1 and 2.

Table 1. Clinical hematology values of rats supplied with treacle and control diets for 28 consecutive days.

<table>
<thead>
<tr>
<th>Hematology parameter</th>
<th>Treacle</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC (10^6/µl)</td>
<td>8.26 ± 0.15a</td>
<td>8.19 ± 0.10</td>
</tr>
<tr>
<td>WBC (10^3/µl)</td>
<td>10.04 ± 0.70a</td>
<td>11.81 ±1.25</td>
</tr>
<tr>
<td>Neutrophils (10^3/µl)</td>
<td>1.22 ± 0.10a</td>
<td>1.37 ± 0.14</td>
</tr>
<tr>
<td>Lymphocytes (10^3/µl)</td>
<td>7.10 ± 0.76a</td>
<td>9.16 ± 1.13</td>
</tr>
<tr>
<td>Monocytes (10^3/µl)</td>
<td>0.38 ± 0.08a</td>
<td>0.34 ± 0.09</td>
</tr>
<tr>
<td>Eosinophils (10^3/µl)</td>
<td>0.99 ± 0.25a</td>
<td>0.57 ± 0.04</td>
</tr>
<tr>
<td>Basophils (10^3/µl)</td>
<td>0.35 ± 0.06a</td>
<td>0.37 ± 0.05</td>
</tr>
<tr>
<td>Hb (g/dl)</td>
<td>15.09 ± 0.29a</td>
<td>15.04 ± 0.17</td>
</tr>
<tr>
<td>Hct (%)</td>
<td>67.93 ± 1.16a</td>
<td>67.55 ± 0.58</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>22.20 ± 0.16a</td>
<td>22.25 ± 0.09</td>
</tr>
<tr>
<td>PLT (10^3/µl)</td>
<td>527.25 ± 105.03a</td>
<td>640.38 ± 40.32</td>
</tr>
</tbody>
</table>

Values are presented as mean ± SEM of 8 independent replicates and values in a raw with same superscript letters are not significantly different (P>0.05). RBC, red blood cell count; WBC, white blood cell count; Hb, hemoglobin concentration; Hct, hematocrit; MCHC, mean corpuscular hemoglobin concentration, PLT, platelet count.

Kithul treacle did not show any toxicological effect on tested hematological parameters such as red blood cell count, white blood cell count, hemoglobin content and platelet count (Table 1) further according to hematological results kithul treacle did not show pathological effect. According to the results of clinical chemistry parameters, Kithul
treacle did not show toxicological effect on metabolic functions (glucose, cholesterol, triglyceride and protein levels), liver functions (SGOT and SGPT) and kidney functions (urea, albumin and creatinine) (Table 2).

Table 2. Clinical chemistry values of rats supplied with treacle and control diets for 28 consecutive days.

<table>
<thead>
<tr>
<th>Parameter tested</th>
<th>Treacle</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum glucose (mg/dl)</td>
<td>87.5 ± 1.8a</td>
<td>92.8 ± 1.5</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>96.9 ± 3.1a</td>
<td>88.0 ± 4.0</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>53.2 ± 3.5b</td>
<td>67.4 ± 5.4</td>
</tr>
<tr>
<td>Total proteins (g/dl)</td>
<td>7.4 ± 0.5c</td>
<td>7.1 ± 0.4</td>
</tr>
<tr>
<td>Serum albumin (g/dl)</td>
<td>4.31 ± 0.07a</td>
<td>4.32 ± 0.09</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.6 ± 0.2c</td>
<td>0.5 ± 0.1</td>
</tr>
<tr>
<td>Serum urea (mg/dl)</td>
<td>13.2 ± 1.5b</td>
<td>13.8 ± 1.7</td>
</tr>
<tr>
<td>Serum Glutamic Pyruvic Transaminase (SGPT) (U/l)</td>
<td>15.1 ± 0.9c</td>
<td>14.5 ± 1.5</td>
</tr>
<tr>
<td>Serum Glutamic Oxaloacetic transaminase (SGOT) (U/l)</td>
<td>32.4 ± 3.3c</td>
<td>31.6 ± 2.4</td>
</tr>
</tbody>
</table>

Values are presented as mean ± SEM of 8 independent replicates and values in a raw with same superscript letters are not significantly different (P>0.05).

**Conclusion**

*Caryota urens* treacle did not show toxicological effect on blood physiology, carbohydrate metabolism, lipid metabolism, kidney and liver functions. Therefore, these findings may indicate the safety of Kithul (*C. urens*) treacle, a traditional sweetener of Sri Lanka.
The Application of the Fama and French Factor Model for the Sri Lankan Stock Market

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2Department of Mathematics, Faculty of Science, University of Colombo

Background

The explanation of the movement of stock returns is a complex task and has been the subject of research with the objective of identifying potential investment opportunities. A single-factor model, where the stock returns are driven by one variable, is often used to identify the mispricing of stocks. One such single-factor model is the Capital Asset Pricing Model (CAPM) which uses the market beta (the sensitivity of an asset against the movement of the market) as the explanatory variable to model stock return. However a single factor alone is not sufficient to model the dynamics of the market. Often multiple factors are used for modelling purposes such as size, value each of which captures a different characteristic of the market thereby improving the fit of the model.

Fama & French (1992) identified that the CAPM model does not sufficiently explain the average stock returns in the US market. Thus the CAPM was further improved with the introduction of two additional factors. This three-factor model of Fama and French (1993) indicates that expected returns can be explained by excess market returns, a size-factor and a book-to-market equity factor. The FF model is defined as follows:

\[ r_A = r_f + \beta_A (r_M - r_f) + s_A SMB + h_A HML + \alpha + e \]  

Where,
- \( r_A \) – Expected return on the asset
- \( \beta_A \) – Beta
- \( r_f \) – Returns on Weighted Average Deposit Rate of Commercial Banks
- \( r_M \) – Returns on the All Shares Price Index
- \( s_A \) – Securities sensitivity to the size premium
- SMB – Size premium
- \( h_A \) – Securities sensitivity to the value premium
- HML – Value premium
- \( \alpha \) – Intercept
- \( e \) – Standard error

The Fama & French (FF) model has been extended to markets such as New Zealand, Hong Kong etc by researches and it has been adapted to Emerging Markets as well such as India and Thailand.
Additionally, the FF theory allows portfolio construction tilted in terms of size and value. Therefore this study identifies similar investment opportunities in the context of Sri Lankan.

**Justification and Rationale**

Stock selection in Sri Lankan is ad-hoc, mostly driven on inside information rather than a fundamental or technical basis. With the incorporation of FF-model a standardized method of identifying potential investment opportunity would be possible; however given the nature of the Sri Lankan market the success of the model is questionable. This study has three main objectives:

— To conduct a factor analysis to identify the performance of the factors to identify their predictability and relationship with the FF factor portfolios.

— Assess the suitability of the FF-model over the CAPM model, and to evaluate the performance of the former for the periods during the war, after the war and across time as well.

— Identify the most suitable FF factor portfolios to be used as a base for an Index Fund

**Methodology**

The analysis period considered was January 2000 to December 2010. As the Sri Lankan stock market is an Emerging Market, there has been a vast change in the market over the past 10 years as shown in Figure 1.

![ASPI and 60 month moving average for April 2001 to December 2010](image)

_Figure 1 : ASPI and 60 month moving average for April 2001 to December 2010_

For the purpose of calculating the FF factors the universe was partitioned into 6 portfolios. For the size effect, into big (B) and small (S) stocks, using the median market capitalization for each month. For the value factor, the segments are 30% of securities
having the highest book-to-market (H), the second is the 40% of securities having the middle book-to-market (M) and the balance 30% as the last segment (L). The FF-factors are calculated as follows:

\[
\text{SMB} = \frac{1}{3}(\text{SH} + \text{SM} + \text{SL}) - \frac{1}{3}(\text{BH} + \text{BM} + \text{BL})
\]

\[
\text{HML} = \frac{1}{2}(\text{SH} + \text{BH}) - \frac{1}{2}(\text{SL} + \text{BL})
\]

The calculated factors were in turn analysed using the information coefficient and descriptive statistics. The FF-model and CAPM-model were fitted using multivariate regression analysis and the residuals were analysed to test the fit of the model. The analysis was conducted in two time phases, namely the period during the civil war in Sri Lanka (before May 2009) and the period after the conclusion of the war. The results were backtested using 60 month rolling windows to identify the consistency of the fit across time.

**Outcome**

As shown in Figure 2 the FF factor model explains the excess returns on the 6 portfolios better than the CAPM, both in the periods before and after the war. The same conclusion was drawn by the results of the backtest.

![Figure 2](image)

**Figure 2**: Fitted models measured by R-squared from April 2001 to November 2010

On observing the size factors, it was identified that small stocks outperform large stocks during the post war stage but not during the war. However the value factor is in-line with the FF model, where high value stocks outperform growth stocks during both phases.
Thus this trend shows a change in early 2009 as shown in Figure 3, where investment strategies have changed and the FF-model captures this transitioning.

Table 1 provides the monthly geometric return on the portfolios. Clearly smaller stocks with high value provide better returns. Additionally the Sharpe Ratio on the portfolios, also indicate that the ‘small-cap-high-value’ portfolio and ‘large-cap-high-value’ portfolio performs better over time given the volatility of their return. Thus an Index Fund for these two portfolios was constructed, and the FF model would be used as a forecasting model.

<table>
<thead>
<tr>
<th>Company Size (Market Cap)</th>
<th>Monthly Geometric Return</th>
<th>Sharpe Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High (Value)</td>
<td>Medium</td>
</tr>
<tr>
<td>Overall (April 2001 to 2010)</td>
<td>Large</td>
<td>0.0320</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td><strong>0.0379</strong></td>
</tr>
<tr>
<td>Pre – May 2009 (2004 to 2009)</td>
<td>Large</td>
<td>0.0100</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td><strong>0.0187</strong></td>
</tr>
<tr>
<td>Post – War (2006 to 2010)</td>
<td>Large</td>
<td>0.0268</td>
</tr>
<tr>
<td></td>
<td>Small</td>
<td><strong>0.0378</strong></td>
</tr>
</tbody>
</table>
Conclusion and Recommendations

This research concludes that the cross sectional returns on the Sri Lankan stock market are explained by the FF-factors and it has a better fit when compared to the CAPM-model. The study also shows that the FF theory of ‘small-cap- high-value’ stocks tend to outperform the market is true in the Sri Lankan context, and using this theory is possible to construct an Index Fund and trade it based on expectations by using the FF forecast.

The FF has approximately 36% R-square on average, hence the addition of other factors would be a better fitting and more suitable model.

References


An investigation of the factors affecting the rental value of houses in Colombo district

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Background

Colombo is the capital and the commercial district of Sri Lanka where most of the offices, popular local and international schools, and factories are located. Therefore it has the highest population density and a significant percentage of people are living in rented houses. There are many reasons for living in rented houses. The demand for rented houses is increasing rapidly and therefore the prices of rented houses too are increasing. The house owners and those who are seeking houses for rent can use these results to decide the value of their rented house.

The main objective of this study was to find out the factors that affect the monthly rental value of a house in Colombo district. Data were collected during the period of November 2010 to March 2011. Weekend Sri Lankan newspapers, telephone interviews and local web advertisements were referred to collect data. Simple random sample of size 890 was used in the study. Only the houses with rental values between Rs. 5,000 and Rs. 40,000 were considered because houses with rental values below Rs. 5,000 may not have had many facilities while luxurious houses with more facilities exceeded rental value Rs. 40,000.

Dieter (2007) investigated the housing rental rate elasticity of aggregate consumption in the Organization for Economic Co-operation and Development (OECD) countries. They investigated the impact of changing housing rental rates upon aggregates consumption based on yearly data for 18 OECD countries observed between 1970 and 2004.

Methodology

SPSS software was mainly used to analysis the data. Graphical and tabular methods were used to identify the main features of the data. The distribution of the rental value was found to be positively skewed. Therefore, a gamma model was initially fitted for the data. A multiple regression model was fitted for the log value of rental value, which is approximately normally distributed. Multicollinearity among the predictor variables was checked using Variation Inflation Factor (VIF) values. After considering the main effects, effects of the interaction terms were tested using general linear model. A residual analysis and a normal P-P plot were used to identify the distribution of residuals. The adequacy of the selected model was checked using the residual plots and the coefficient of determination ($R^2$) of the model.
Results and Findings

Rental value of 31% houses lies between Rs. 10,000 and Rs. 15,000 and percentages of houses with rental value between Rs. 15,000-19,999 and higher than Rs.20,000 are 24% and 26% respectively. 88% of houses are single storey houses while only 2% houses are three storeys. Average rental value of a single storey house is Rs. 14,500 whereas for two and three storey houses, Rs. 27,000 and Rs. 32,000 respectively. 28% houses have two bedrooms while 35% of houses have three bedrooms. Average rental values of house with one, two or three bathrooms are about Rs. 9,500, Rs. 12,900 and Rs. 22,000 respectively. Average distance from the house to the nearest town is 1.5km (45%). The minimum and the maximum distances to the town are 40 m and 7 km. Average land size of a house available for rent in the Colombo district is about 15P. When there is parking facilities available with house, land is not an important factor. Large land areas are very rare in the selected area. Average floor area of a rented house in Colombo district is 1268 sqft. Advance payment is found to be not affecting to the rental value. For the majority of houses, a six month advance payment is expected but only for a smaller percentage, an advance payment for a maximum of two years is expected.

According to the multiple regression model number of storeys, number of bed rooms, number of bath rooms, distance to nearest town, distance to main road, floor area and the interaction term of Area* Bed room were affected the rental value. R² value of the final model is about 71%. The final model is as follows.

\[
\text{Rental}_\text{Value} = \exp \left[ 8.61 + 0.15\text{Storey} + 0.21\text{BedRm} + 0.16\text{BathRm} - 0.1\text{DisTown} \\
-0.18\text{DisMainRd} + 0.0003\text{FloorArea} - 0.00064\text{BedRm} \times \text{FloorArea} \right]
\]

From the model it is clear that rental value increases with the number of storeys, number of bedrooms, number of bathrooms, and area, while it decreases with distance to town and distance to main road.

Conclusion

Advance payment months and land size do not affect the rental value. Number of storeys, number of bedrooms, number of bathrooms, distance to town, and distance to main road and floor area affect to the monthly rental value. A person can find a rented house for an average of Rs. 16,000 in the Colombo district. A renter or a house owner can use the above factors when finding or renting houses.

References


Free amino acid profiles of *Caryota urens* L. (Kithul palm) sap, treacle and jaggery

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\(^2\)Department of Chemistry, Faculty of Science, University of Colombo

**Introduction**

The sap of *Caryota urens* commonly referred to as Kithul palm is very rich in simple sugars and therefore used to manufacture treacle and jaggery that are used as substitutes for sugar and sweeteners (Thevendirarajah *et al* 1977). All these products have a very high demand due to their natural origin, and as an almost organic food product. However, these products are highly priced due to the scarcity in production and are of high demand due to the uniqueness in taste and aroma, as well as due to traditional claims on health benefits.

It is traditionally considered that the products of *C. urens* have anti-diabetic, anti-ageing and anti-rheumatic properties. Recent scientific investigation has shown that sap and treacle of *C. urens* have α-glucosidase inhibition activity and thus proves that traditional claims on anti-diabetic properties are correct indeed (Ranasinghe *et al* 2010). However, scientific validation of the folkloric claims or the identification of the chemical constituent responsible for these properties has not been attempted so far. Some of the amino acids from *C. urens* products may be the responsible chemical components for biological activities as amino acids have a variety of roles in metabolism, as building blocks of proteins, growth factors, metabolic regulators, secondary messengers and nutrients. Thus, analysis of amino acids is essential for metabolic studies.

The main objective of this study was the determination and comparison of the free amino acid profiles of *C. urens* sap, treacle and jaggery and to find out the relationship of amino acid profiles and the traditional claims on health benefits of these products.

**Materials and Methods**

Sap samples collected from three different sites were stored at 4 °C during transportation and they were divided in to 1.0 ml aliquots and stored at -40 °C until analysis. Original sap was evaporated at the site for the production of Kithul treacle and jaggery using a domestic gas burner and a stainless steel pan.

5.0 g of treacle and jaggery samples were weighed into a 50.0 mL volumetric flask and dissolved in deionized water, and made up to the mark, filtered through 0.45 µm nylon syringe filter before HPLC analysis. An Agilent 1100 HPLC system was used for individual free amino acid analysis. Each individual amino acid was determined with an external calibration.

**Results and Discussion**

Representative HPLC chromatograms of *C. urens*, treacle is given in Figure 1
Quantitative results of each amino acid in sap, treacle and jaggery are summarized in Table 1. Results are expressed as the mean and the respective standard error of mean (SEM).

Results showed that *C. urens* sap, treacle and jaggery contain glutamate, serine, asparagine arginine, and aspartate as the major amino acids in mg/100g and valine was absent.

Relatively high amount of glutamate in the *C. urens* sap, treacle and jaggery, which is a known flavor enhancer, could be the main contributor for the unique flavour of the Kithul products (Belitz and Grosch, 1999). None of the other treacle types has glutamate levels

<table>
<thead>
<tr>
<th>Amino acid</th>
<th>Sap (n=20)</th>
<th>Treacle (n=17)</th>
<th>Jaggery (n=6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspartate</td>
<td>8 ± 1.5</td>
<td>38 ± 6</td>
<td>43 ± 6</td>
</tr>
<tr>
<td>Glutamate</td>
<td>16 ± 3.2</td>
<td>73 ± 12</td>
<td>93 ± 12</td>
</tr>
<tr>
<td>Asparagine</td>
<td>11 ± 2.3</td>
<td>54 ± 5</td>
<td>59 ± 6</td>
</tr>
<tr>
<td>Serine</td>
<td>14 ± 2.8</td>
<td>71 ± 8</td>
<td>84 ± 8</td>
</tr>
<tr>
<td>Histidine</td>
<td>6 ± 1.3</td>
<td>28 ± 3</td>
<td>32 ± 3</td>
</tr>
<tr>
<td>Glycine</td>
<td>2 ± 0.3</td>
<td>8 ± 1</td>
<td>10 ± 1</td>
</tr>
<tr>
<td>Threonine</td>
<td>1.5 ± 0.3</td>
<td>4 ± 0.5</td>
<td>6 ± 0.5</td>
</tr>
<tr>
<td>Arginine</td>
<td>10 ± 1.5</td>
<td>50 ± 7</td>
<td>54 ± 6</td>
</tr>
<tr>
<td>Alanine</td>
<td>4 ± 1.3</td>
<td>18 ± 3</td>
<td>23 ± 3</td>
</tr>
<tr>
<td>Tyrrosine</td>
<td>2 ± 0.4</td>
<td>8 ± 1</td>
<td>10 ± 1</td>
</tr>
<tr>
<td>Cystine</td>
<td>4 ± 1.2</td>
<td>17 ± 2</td>
<td>19 ± 2</td>
</tr>
<tr>
<td>Valine</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Methionine</td>
<td>2 ± 0.3</td>
<td>7 ± 1</td>
<td>9 ± 1</td>
</tr>
<tr>
<td>Phenylalanine</td>
<td>2 ± 0.2</td>
<td>5 ± 1</td>
<td>8 ± 1</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>4 ± 0.4</td>
<td>15 ± 2</td>
<td>20 ± 2</td>
</tr>
<tr>
<td>Leucine</td>
<td>1 ± 0.3</td>
<td>3 ± 0.5</td>
<td>5 ± 0.7</td>
</tr>
<tr>
<td>Lysine</td>
<td>1 ± 0.2</td>
<td>3 ± 0.2</td>
<td>3 ± 0.2</td>
</tr>
<tr>
<td>Proline</td>
<td>3 ± 0.7</td>
<td>12 ± 1.5</td>
<td>15 ± 2.4</td>
</tr>
</tbody>
</table>

ND = Not Detected

Table 1. Free Amino Acid Content (mg/100g) of Kithul sap, treacle, and jaggery

Figure 1: Amino acid chromatogram of Kithul treacle
similar to Kithul treacle (Somasiri et al 2011). Folkloric claim of Kithul products having the potential of sexual arousal on consumption may be due to arginine which is considered as "The Natural Viagra" that increases the libido and potency confirms the chemical responsible for the effect. The effect may be further enhanced by the presence of histidine, and tyrosine which are known for contribute in reproduction (Balch 2005). The presence of methionine and cystine suggest very high antioxidant activity. Cystine has also been identified as a treatment for rheumatoid arthritis and hardening of the arteries. The traditional claim that Kithul sap is good for arthritis is supported due to the presence of considerable amount of histidine. Furthermore, the presence of proline improves skin texture by aiding the production of collagen and reducing the loss of collagen in the aging process.

**Conclusion**

This report is the first study on the amino acid profile of *C. urens* sap and jaggery. Free amino acid profiles of Kithul sap, treacle and jaggery can be used to explain some of the traditional claims on the health benefits of these products and is also useful for nutrition labeling of these products.

**References**


*Financial support from Treasury Grant No. 10719 / TG 10 is acknowledged.*
Modeling Daily Rainfall using Markov Chains

D.U.J. Sonnadara

Department of Physics, Faculty of Science

Background

A number of authors have used Markov chains to model the daily occurrence of rainfall. After the work of Gabriel and Neumann (Gabriel and Neumann, 1962) who applied the Markov chain model successfully to describe Tel Aviv daily rainfall data, a number of researchers have applied a similar technique to study rainfall in widely different geographical regions. However, except for a few early studies (Weerasinghe, 1989, Punyawardena and Kulasiri 1998), not much work has been carried out to model the wet and dry spell sequence of daily rainfall observed in Sri Lanka. The main objective of this work is to use Markov chains to study the wet and dry spells of observed at the Colombo meteorological station (1941-2000) based on daily precipitation.

In the first order Markov chain probability model, the probability of rain occurring on a given day (wet day) depends solely on the condition of the previous day. The two transitional probabilities can be defined as 

\[
p_0 \quad \text{and} \quad (1 - p_0)
\]

where 

\[
p_0 \quad \text{is the probability of a wet day given the previous day is dry, and} \quad (1 - p_0) \quad \text{is the probability of a dry day, given the previous day is wet.}
\]

The probability of a dry spell of length \(n\) can be defined as \(n\) successive dry days followed by a wet day. Similarly, the probability of a wet spell of length \(n\) can be defined as \(n\) successive wet days followed by a dry day. These can be shown as;

\[
p_0 (1 - p_0)^{n-1} \quad \text{and} \quad (1 - p_0)p_1^{n-1}
\]

The mean lengths of dry and wet spells are;

\[
L_d = 1/p_0 \quad \text{and} \quad L_w = 1/(1 - p_0)
\]

Although the first order model can be extended to develop higher order models, several past studies (Punyawardena and Kulasiri 1998) have shown that the first order model is sufficient for this region and that there is no advantage in using higher models. Thus, the analysis and comparisons were carried out with the results derived from the first order Markov model.
Analysis of wet and dry spells

Variation of transition probabilities

Transition probabilities show considerable variation throughout the year. The probability of observing a wet day followed by a wet day shows a bimodal pattern of rainfall occurrence with two distinct peaks with the first peak in May coinciding with the start of the southwest monsoon rains and the second peak in October coinciding with the start of the second inter-monsoon season. The probability of observing a dry day followed by a dry day is high during the northeast monsoon period and during the latter part of the southwest monsoon period. Thus, one can expect longer durations of wet spells during the months of May and October and longer durations of dry spells during the months of January and August.

Modeling sequences of wet and dry days

The accuracy of the Markov model in estimating sequences of wet and dry days is shown in Figure 1 for the Colombo weather station. The data and the model estimates agree reasonably well. For the southwest monsoon season (May to September) and the 2nd inter-monsoon season (October to November), a slight reduction in accuracies is seen in the estimate of the number of isolated one day wet spells (not shown here). The number of dry spells of one day duration is under estimated by the model for all seasons. The data and the model estimates agree reasonably well for dry spells of duration greater than 1 day. Perhaps higher order models may be able to fit the data better than 1st order model when 1 day spells are considered.

Mean length of wet and dry spells

The mean lengths of wet and dry spells for each month predicted by the model were compared with the estimated values from the data set (see Figure 2). The mean annual duration of wet spells is 2.6 days while the mean annual duration of dry spells is 3.8 days.
As expected, the months receiving higher rainfall show longer durations of wet spells. In general, the agreement between the model prediction and estimates was quite reasonable. The data shows greater disagreement for the months having longer dry spells.

Figure 2: Simulated (+) and observed (o) average lengths of spells (a) Wet (b) Dry

Conclusions
This study focused on comparing the predictions of a model based on Markov chains and actual data on sequences of wet and dry spells and the mean lengths of wet and dry spells per month. Except for isolated single wet or dry events, the model is shown to describe the observed sequences of wet and dry spells which vary depending on the season. The mean length of wet spells calculated by the model and estimated by the data are accurate to within ±0.01 days.

References
Gabriel, K.R. and Neumann, J. (1962) A Markov model for daily rainfall occurrence at Tel Aviv, Quart. J. Royal Meteorological Society, 88 (375) 90-95

Financial assistance given by the National Research Council, Sri Lanka for the research grant number NRC 06-18 is greatly acknowledged.
Onset and Retreat of Rainy Season in the Dry Zone

D.U.J. Sonnadara

Department of Physics, Faculty of Science

Background
Sri Lanka is an island in the Indian Ocean, located off the southern coast of India. The climate of Sri Lanka is considered to be warm and tropical. The mean daily temperature ranges from about 16 °C in the central highlands, to a maximum of 33 °C in low-altitude coastal areas. There are predominantly two climatic zones in Sri Lanka, the central and the south-western part of the country, known as the wet zone and the southeast, east, and northern parts of the country, known as the dry zone. When considering the wind pattern, the year can be divided into four climate seasons, namely the two monsoons (South-West from May to September and North-East from December to February) and the two inter monsoons. There is high variability of rainfall in different parts of the country during these four seasons. Since Sri Lanka’s economy depends on agriculture production, understanding temporal variation in climate in different parts of the country, especially the variations in the start and end of the rainy seasons is important to enhance agricultural productivity.

A number of methods have been adopted to determine the onset and retreat of rainy seasons (Odekunle, 2006). Studies carried out in Africa show that the percentage cumulative mean rainfall is one of the frequently used methods. Since rainfall is a readily available measurement, there are advantages in using it rather than using an associated variable. Since patterns of dry spells and wet spells at the start and end of rainy seasons are critical for crop growth, there is an advantage of developing an index to determine the start and end of rainy seasons based on the temporal patterns of rainfall events (Cook, G.D., Heerdegen R.G. 2001). The main objective of this study is to look into the feasibility of determining the onset and the retreat dates of the rainy season in the dry zone.

Data Sample
The data sample used in this study are daily rainfall measurements recorded during the period from 1961-2000 in three meteorology stations (Jaffna, Trincomalee and Baticaloa) maintained by the meteorology department of Sri Lanka. These stations were selected since they receive rainfall predominantly during northeast monsoons.

Results
Variation of cumulative rainfall
First the calendar year was shifted by 6 months so that the peak of rainy season comes in the middle of the 365 day year. In order to calculate the onset and retreat dates from rainfall amounts, 5 day totals of rainfall were calculated followed by a percentage of rainfall in the 5-day period. Then, the cumulative rainfall was calculated from the percentages (see Figure 1a). The onset and retreat of the rainy season is defined as the
maximum positive curvature point to the maximum negative curvature point (Odekunle, 2006). Figure 1b shows the curvature determined from the cumulative 5 day percentage of rainfall values. It is seen that this point roughly corresponds to 10% and 80% of the annual rainfall. The onset and retreat dates values extracted from this study are shown in Table 1.

Table 1: The timing of rainy season determined from cumulative rainfall

<table>
<thead>
<tr>
<th>Station</th>
<th>Onset</th>
<th>Retreat</th>
<th>Length (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaffna</td>
<td>87 (Sep 25)</td>
<td>183 (Dec 30)</td>
<td>97</td>
</tr>
<tr>
<td>Trincomalee</td>
<td>88 (Sep 26)</td>
<td>194 (Jan 10)</td>
<td>107</td>
</tr>
<tr>
<td>Baticaloa</td>
<td>108 (Oct 16)</td>
<td>197 (Jan 13)</td>
<td>90</td>
</tr>
</tbody>
</table>

Variation of 5-day dry spells

In this analysis, a rainy day was defined as a day having greater than 3 mm of rainfall. Figure 2a shows the distribution of wet and dry spells for the Jaffna station. It can be seen that wet and dry spells follow different scaling properties. With 5-day running mean, the dry season was defined as the time of the year when the 5-day dry spells (5 consecutive days where daily rainfall is below 3 mm) were greater than 0.5 (Cook, G.D., Heerdegen R.G. 2001). Thus, during the northeast monsoon season, 5-day dry spells are expected to fall below the 0.5 threshold. Figure 2b shows the probability of observing 5-day dry spells. The onset and retreat dates extracted from 5-day dry spell probabilities are given in Table 2.

Table 2: The timing of rainy season determined from 5-day dry spells

<table>
<thead>
<tr>
<th>Station</th>
<th>Onset</th>
<th>Retreat</th>
<th>Length (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaffna</td>
<td>91 (Sep 29)</td>
<td>183 (Dec 30)</td>
<td>93</td>
</tr>
<tr>
<td>Trincomalee</td>
<td>69 (Sep 07)</td>
<td>204 (Jan 20)</td>
<td>136</td>
</tr>
<tr>
<td>Baticaloa</td>
<td>74 (Sep 12)</td>
<td>227 (Feb 12)</td>
<td>154</td>
</tr>
</tbody>
</table>

Conclusions

This paper presents results of two methods used to determine the onset and retreat of rainy season in the dry zone based on daily rainfall data recorded in Jaffna, Trincomalee and Baticaloa weather stations during the period 1961-2000. Of the two methods are used, one depend on the cumulative rainfall and the other on the temporal patterns of rainfall. In determination of length of rainy season, Jaffna showed the smallest discrepancy while Baticaloa showed the largest discrepancy. Based on the preliminary results, cumulative rainfall is recommended to determine the onset and retreat dates for individual years.
References


Financial assistance given by the National Research Council, Sri Lanka for the research grant number NRC 06-18 is greatly acknowledged.

Figure 1: Jaffna (a) Cumulative rainfall (b) Variation of curvature

Figure 2: Jaffna (a) Distribution of wet and dry spells (b) Probability of observing 5-day dry spells
Evaluation of new Mini STR markers for DNA based human identification: An in silico approach

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²Department of Zoology, Faculty of Science, University of Colombo

Introduction

Analysis of Short Tandem Repeat (STR) markers on the human genome is an important tool in the identification of individuals based on their genetic makeup. DNA extracted from materials of biological evidence is subjected to Polymerase Chain Reaction (PCR) to generate DNA profiles, unique to an individual. However, forensic analysts are challenged to obtain a complete DNA profile by the failure in PCR amplification of such biological evidence due to several factors: for example, high humidity and temperature in the tropics (as in Sri Lanka), promote the degradation of such biological materials and rapidly reduce the possibility of typing such nuclear DNA. Conventional PCR technology used in Sri Lanka analyses amplicons generated in the size range of 150 to 450 nucleotide bases. Hence, DNA in a biological sample fragmented into smaller sizes cannot be amplified by PCR. Therefore, we have evaluated the application of three new miniaturized –Short Tandem Repeat markers (mini-STRs) screened for possible application in degraded DNA evidence analysis. These novel STR markers are capable of generating smaller sized PCR amplicons (less than 150 bp) by PCR. No previous studies have been recorded in the application of these three STR loci.

Materials and Methods

Selection of STR loci

The three Mini-STR markers were selected by screening the STR marker sets published in Marshfield Clinic Center for Medical Genetics (http://research.marshfieldclinic.org/genetics/). The selected STRs, namely D4S2632, D6S2436, and D19S589 have not been adapted to human identity testing up to date. The sequences of the STR loci screened were obtained from a BLAST –nucleotide search on www.ncbi.com. The chromosomonal positions were determined by BLAT (http://genome.ucsc.edu/cgi-bin/hgBlat) and assembly of the human genome version of Feb2009.

Primer designing

The manual primer designing tool of the standalone “Primer premier 3” software was used to effectively locate primers adjacent to the repeat region of each STR locus. The G and C content of the primer were maintained within the range of 40 % to 60 % and the melting temperatures from 53 °C -55 °C. Successfully designing primer sets were evaluated for probable inter-primer interactions using the options in “Primer premier 3” software.
Evaluation of nucleosome forming potentials (NFPs)

Nucleosomes are the basic repeating structural and functional unit of chromatin consisting of nine histone proteins and about 166 bp of DNA (Kogan et al, 2006; Holde, 1988). The algorithm of Nucleosome eXclusion Sensor (NXSensor version 1.3.1) (http://www.sfu.ca/_ibajic/NXSensor/) was used to determine the nucleosome-free regions of the selected STR marker sequences. The algorithm detects an input sequence for three known nucleosome-free sequences: 10bases of poly-A, 10 bases of poly-T, and a combination of Gs and Cs (A_10, T_10, or [(G/C) 3N2] _3) (Thanakiatkrai et al, 2011). If any of these sequences are detected in the given sequence, the program outputs the sequence in FASTA format and highlights the nucleosome-free region.

The FASTA sequences (~ 100bp up and downstream to the repeat motif) of novel STR markers D4S2632, D6S2436, and D19S589 were entered into the web based NXSensor version 1.3.1 and the accessible scores for each STR marker were calculated according to the following formula (Luykx et al, 2006):

\[
\text{Accessibility(OSmin)} = \frac{\text{Total length of open contiguous segments} \geq \text{OSmin}}{(\text{length of input sequence}) - (\text{total length of ambiguous segments})}
\]

Results and Discussion

<table>
<thead>
<tr>
<th>STR Locus</th>
<th>Chromosomal location</th>
<th>Chromosomal position</th>
<th>Repeat Motif</th>
<th>GenBank accession</th>
<th>GenBank allele</th>
<th>Mini-STR amplicon length (bp)</th>
<th>Accessibility (OSmin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4S2632</td>
<td>4p15-p14</td>
<td>35704165</td>
<td>(GATA)n</td>
<td>G08391.1</td>
<td>13</td>
<td>105</td>
<td>0</td>
</tr>
<tr>
<td>D6S2436</td>
<td>6q24.1</td>
<td>154136091</td>
<td>(GATA)n</td>
<td>G27284.1</td>
<td>9</td>
<td>91</td>
<td>0</td>
</tr>
<tr>
<td>D19S589</td>
<td>19q13.42</td>
<td>58498394</td>
<td>(GATA)n</td>
<td>G08026.1</td>
<td>13</td>
<td>98</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1—Information on three novel STRs evaluated in this study. Chromosomal location and base pair (bp) position of each marker was determined by using BLAT (http://genome.ucsc.edu/cgi-bin/hgBlat) and the Feb.2009 assembly of the human genome. The miniSTR amplicon length is based on the GenBank allele observed. The accessibility(OSmin) values for the three STR loci D4S2632, D6S2436 and D19S589

The potential mini STR markers were screened from previously well characterized STR loci (Ghebranious et al, 2003) including the whole genome screening sets of STRs reported extensively in genetic linkage studies across the entire nuclear genome to determine specific genes that cause or has a linked to human diseases. A subset of the screening markers were also used to characterize the genetic diversity in global populations (Rosenberg et al, 2002 & 2003; Ayub et al, 2003)

When screening the probable STR loci to be used as mini STR markers, we considered several characteristics of each STR locus in order to obtain the best possible loci. Firstly, the STR loci consisting of tetrameric repeat motif were selected, as is strongly recommended in forensic DNA analysis, since these markers are highly polymorphic, with heterozygosity >0.90 and results reduced stutter effect in the PCR reaction (Kimpton et al, 1993). Secondly, the STR loci containing tetrameric repeat motifs were evaluated for “clean flanking regions” upstream and downstream to the repeat motif (approximately
75bp). This approach is very important when the PCR primers are located closer to the repetitive region since a clear flanking region can give rise to good primer hybridization in the PCR reaction. Thirdly, the STR loci that can produce PCR fragments less than 150 bp were selected. Finally, the selected three novel STR loci D4S2632, D6S2436 and D19S589 were evaluated for the nucleosome forming potential (NFPs) by calculating the accessibility ($O_{S_{min}}$) for each STR marker with the formula (Butler et al, 2003); 1). The accessibility ($O_{S_{min}}$) values for the STR markers D4S2632, D6S2436 and D19S589 were found to be zero which demonstrates the likelihood of a DNA sequence to be bound by nucleosomes.

**Conclusion**

This approach outlines the initial efforts to develop mini STR markers that can be used to supplement the loci included in CODIS (Combined DNA Index System) core loci to increase the power of discrimination in analyzing highly degraded DNA evidence in forensic casework. Apart from using these markers for forensic purposes, they can be successfully incorporated in cases where additional markers are needed to conclude the analysis such as human parentage testing or the analysis between closely related individuals.

**References:**


Performance of neural network model in estimating daily maximum and minimum temperature in Jaffna

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Background

Serially complete climate data are required as input for climate dependent models such as crop and insect development, soil erosion and evapotranspiration (DeGaetano et al. 1995). One of the main problems of using series climate data is missing records. Often daily maximum and minimum temperature are used by climate scientists as proxies for climate change studies. Therefore, the development of methods to estimate missing maximum and minimum temperature observations is important. Sri Lanka has a reasonable infrastructure to measure climate observations with 22 main meteorological stations covering many parts of the island and having climate observations dating back to the 1870’s. However, the weather stations in the northern and eastern parts of the country experienced problems in maintaining continuous weather records during the period from 1984 to 2000 due to the hostilities in the region. Although the recording weather observations were resumed in 2001, no attempts on the reconstruction of missing observations have been reported.

The methods of estimating the monthly, seasonal or yearly mean meteorological observations are derived by averaging, interpolation, multiple linear regressions etc (Huth and Nemesova 1995). However the estimation of daily measurements is often difficult due to high variability influenced by spatial and temporal changes. The main objective of this work is to develop a technique to reconstruct the missing daily maximum and minimum temperature in Jaffna using artificial neural networks.

Methodology

In this work, a feed forward back propagation algorithm was used to develop the neural network model to estimate the daily maximum and minimum temperature data. The Levenberg-Marquardt learning rules were used due to its rapid convergence advantage (Ustaoglu et al. 2008). A nonlinear transfer function tan-sigmoid was used in the hidden layer and a linear transfer function purelin was used in the output layers. The sum of the weighted inputs and the bias forms the input to the transfer function of the hidden layer of the neural network.

Daily standard departures of temperature in the Mannar, Anuradhapura, Puttalam, and Trincomalee stations were used to derive the inputs for the network and standard departures of temperature in Jaffna were taken as the target output of the network. Ten years of data were used to train and validate the network while five years of data were used to test the network. The predicted values were compared with the actual values (by converting the standard departures to actual temperature) to estimate the accuracy of the network output.
Results

The comparison between the observed and estimated daily maximum temperature in Jaffna (1976-1980) is shown in Figure 1. The gradient of the fitted line is 0.84 with a linear correlation coefficient of 0.88. The standard deviation of the difference between the actual and predicted values is 0.7°C. Similarly, the comparison between the observed and estimated daily minimum temperature in Jaffna is shown in Figure 2. The gradient of the fitted line is 0.78 with a linear correlation coefficient of 0.86. The standard deviation of the difference between the actual and predicted values is 1.0°C.

Since in both these cases the gradient is not equal to unity, the extreme values of maximum and minimum temperature will show higher deviations.

It can be seen that the accuracy of the network for daily minimum temperature is slightly lower than for the maximum temperature. A closer inspection shows that the accuracy of the estimation varies by month due to changes in the seasonal temperature cycle. Thus, one can improve the accuracy of the estimation by training the network for each month separately.

Conclusions

The preliminary results of a neural network model in estimating the missing daily maximum and minimum temperature of Jaffna were discussed. Standard departures of serially complete daily maximum and minimum temperature records of 10 years (1966-1975) in 4 neighboring stations, Mannar, Anuradhapura, Puttalam and Trincomalee were used as the inputs to train the neural network model. The performance of the model was tested by using an unused 5 years data set (1976-1980). The accuracies of the maximum and minimum temperature estimations were ±0.7°C and ±1.0°C respectively. The accuracy of estimation is higher for the maximum temperature compared to the minimum temperature. The results can be improved by training the network to estimate each month separately.

References


Financial support by Higher Education for the Twenty First Century (HETC) Project assisted by World Bank (IDA Credit 49190-LK) is acknowledged.
Figure 1: Comparison between the actual and estimated values for daily maximum temperature at Jaffna (a) Correlation (b) Difference

Figure 2: Comparison between the actual and estimated values for daily minimum temperature at Jaffna (b) Correlation (b) Difference
Development of Short Range Hazard prediction model for toxic air pollutants

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Introduction

Computer simulations of passive gas dispersion can be used to predict the dispersal of a toxic air pollutant in to the atmosphere. These predictions play a significant role in the disaster management and in rescue activities. Most of the chemical warfare agents are considered as dense gasses or liquids due to their physical properties and storage conditions. However, the dispersal of released gas or vapor clouds is often modeled by passive gas simulations (Kingdon, 2007). Such a model is capable of graphically representing the dispersion which allows calculating the concentration of the toxic gas in any location at a given time. Moreover, it can predict the number of human lives at stake.

The dispersal of a passive gas in the atmosphere mainly depends on the type of release, meteorological conditions, geographical parameters and chemical and physical processes. In considering the toxicity of an air pollutant in the atmosphere, it is important to focus on chemical reactions. Particularly, it is straightforward to introduce first order chemical reactions into dispersion models as a reduction or an increment of the effective mass of the toxic pollutant.

\[ A \xrightarrow{k} \text{Product} \]

For a first order reaction, if A is the toxic pollutant of interest, the concentration at a given time can be calculated as,

\[ [A]_t = [A]_0 e^{-kt} \quad (1) \]

Although, many advanced passive gas dispersion models have been developed, most of them do not account for chemical processes and are very costly. Moreover, certain models that are used by the military sector are not even commercially available. Therefore, our proposed computer simulation software to predict dispersion of a passive toxic gas release fulfills a mandatory requirement in the field of disaster management.

In this project, a computer model for the short range dispersion of toxic gas/vapor clouds resulting from an instantaneous release is developed and evaluated. This includes a diagnostic meteorological preprocessor and a Lagrangian puff/particle dispersion model based on Langevin equation (Andronopoulos, 2009). The program is capable of predicting the dispersal in the planetary boundary layer, calculating concentrations of the toxic pollutant in hazard areas considering first order chemical reactions and graphically representing them on a satellite map.

Computational Procedures

A 3D computational grid system with a constant domain height was chosen in this study. In the horizontal direction, the grid is uniform with adjustable number of cells and dimensions. The vertical coordinate system is terrain following and non-uniform, which
squeezes or expands between the varying topography and constant domain top. Terrain heights at each grid point were calculated by processing Digital Elevation Maps in ArcGis (ESRI, 2009) and were stored in a SQL Server database. Appropriate mathematical models to calculate meteorological parameters from user input and methods to interpolate them at each grid point were selected from literature and the necessary programs were written using Visual C# 2010. These meteorological parameters include wind vectors, temperature, pressure, humidity and some other micrometeorological parameters. Interpolated wind field should take topographic features into account and obey the principle of conservation of mass. Therefore, a divergence minimization algorithm was developed to perform minimum possible correction to interpolated wind field considering terrain slopes. Complete mathematical derivation will be presented elsewhere (Kumara, 2012).

To simulate the dispersion of air pollutants, the center of a pollutant cloud was treated as a particle where the concentration is distributed in a Gaussian manner in lateral, horizontal and vertical directions. The trajectory of the particle was calculated according to the following equation (Andronopoulos, 2009):

\[ x_{i}^{n+1} = x_{i}^{n} + (u_{i} + u'_{i})\Delta t \]  

(2)

in which \( \Delta t \) is the time step, \( n \) is the time step index, \( i \) is the direction index, \( \bar{u}_{i} \) is the mean wind velocity in direction \( i \), and \( u'_{i} \) represents turbulent velocity fluctuations. \( \bar{u}_{i} \) was obtained from mass consistent wind field and \( u'_{i} \) was estimated from one dimensional Langevin equation assuming that the velocity and particle position evolve as a Markov process and there exists a mutual independence between three velocity components. The instantaneous concentration of the air pollutant at a point \((x, y, z)\) was calculated using following equation.

\[ c(x_{c}, y_{c}, z_{c}) = \frac{Q}{(2\pi)^{3/2}\sigma_{x}\sigma_{y}\sigma_{z}} e^{-0.5\left(\frac{(x-x_{c})^{2}}{\sigma_{x}^{2}} + \frac{(y-y_{c})^{2}}{\sigma_{y}^{2}} + \frac{(z-z_{c})^{2}}{\sigma_{z}^{2}}\right)} \]

\[ + e^{-0.5\left(\frac{(x-x_{c}+z_{c})^{2}}{\sigma_{x}^{2}} + \frac{(y-y_{c}+z_{c})^{2}}{\sigma_{y}^{2}} + \frac{(z-z_{c}+z_{c})^{2}}{\sigma_{z}^{2}}\right)} \]

(3)

Where, \( x_{c}, y_{c}, z_{c} \) are the coordinates of the center of the cloud, \( Q \) is the mass of pollutant released, \( z_{c} \) is the ground height. \( \sigma_{i} \) \( (i = x, y, z) \) is the standard deviation of the concentration distribution and was calculated by numerical integration.

Equations (1), (2), and the Langevin equation were solved at each time step of the integration to obtain particle position and the variances of the concentration distribution. The dose of a toxic pollutant at a particular point was calculated by integrating equation (3).

**Results and Discussion**

The model evaluation included checking the accuracy of the meteorology algorithm, divergence minimization algorithm and the dispersion model. In order to evaluate the accuracy of meteorology algorithm, three important micrometeorological parameters known as surface friction velocity, Monin-Obukhov length, and sensible heat flux were compared with a calculated series of data available in well known Indianapolis tracer gas.
experiment (Olesen, 2005). Analysis of variances showed that the difference between model predictions and the reported data are insignificant, $F(1,308) = 0.0688, 0.793$ for friction velocity, $F(1,292) = 0.0605, 0.806$ for Monin-Obukhov length and $F(1,322) = 1.8986, 0.169$ for sensible heat flux.

![Figure 1: Numerical simulation of a potential flow around a hemispherical hill. (in each cell two arrows are representing analytical results and our results).](image)

Evaluation of the divergence minimization algorithm was performed by numerically simulating a potential flow around a hemispherical hill and comparing obtained results with an analytical solution. Visual observation (Figure 1) and analysis of variance showed that the numerical and analytical results were in good agreement, $F(1,2448) = 0.4626, 0.496$ for horizontal wind profile and $F(1,910) = 0.1145, 0.735$ for vertical wind profile. Evaluation of the dispersion model involved a comparison of model predictions with seven instantaneous SF$_6$ gas releases under various meteorological conditions as reported in Dipole Pride 26 field experiment (Biltoft, 1998). Analysis of the variance showed that the model predictions and reported results for 22.5 minutes after the release were in good agreement.

**Conclusion**

The model can be extended to predict near field dispersion from industrial sources of passive air pollutants.

**References**


A study of Science and Technology doctoral degree holders in Sri Lanka and their contributory patterns

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¹Science and Technology Policy Research Division, National Science Foundation, Colombo
²Department of Statistics, Faculty of Science, University of Colombo

Background
With the global trend in moving towards a knowledge-based society, the educational qualifications and trained skills of personnel become important since there is a strong link among postgraduate education, research and development (R&D) and economic growth of a particular country. The doctoral degree holders in Science & Technology (S&T) are highly qualified in specialized education with extensive training in research and development. They are capable of conducting independent research. The generated knowledge and technology contribute to innovation, which promotes economic development and social welfare of the people. Therefore, a close study of this knowledge stock and identifying the gaps and constraints for their contributory patterns is important.

Recently there has been increasing focus on identifying the value of postgraduate researchers and their contribution to wider economic, social and cultural impacts. Skills of highly competent individuals can lead to better policy making, enhanced economic growth, and improvements in the health and welfare of the people. Casey (2009) takes an economic perspective to explore the impact of doctorates: in particular, what is a doctorate worth and what is the justification for society to support the production of doctorates.

A project on doctoral studies and qualifications in Europe and the United States was carried out by Sadlak (2004) and it identified eleven main problems with doctoral education in Europe and USA.

Methodology
Recently, a Tracer Study on S&T Doctoral Degree Holders was carried out by the S&T Policy Research Division of National Science Foundation of Sri Lanka. Designed and pre-tested questionnaires were sent to all S&T doctoral degree holders in the R&D sectors in the country during the period 2008/2009. From a total of 1085 doctoral degree holders, 529 (48%) responded. The available data were summarized and analyzed. In addition, an index to represent research output for each respondent was created. Chi-square tests were performed to test for any relationships between a) Major constraints (research) and the field of expertise, and b) Major constraints (administrative) and sector of work. A multinomial logistic regression model to represent influential factors failed to fit the data adequately.
Outcome
S&T sector had a lower percentage of female doctoral degree holders than in the other sectors. Majority of doctoral degree holders were from the age category of 41-50 and it was nearly half (46.9%) of the total PhD holders. Also, life sciences had highest number of PhD holders and there was wide variation in the gender balance across various programs. Only medical sciences had higher female percentage (50.8%) than their male counterparts. Engineering sciences had the lowest female percentage among all study areas.

Most had obtained their doctoral degrees from overseas, with United Kingdom being the country with the highest attraction (26.5%). There was a very low percentage of Asian countries, except Japan which attracted second highest Sri Lankan doctoral students. On average doctoral degree holders took nearly 3 to 4 years to complete, though engineering graduates were the quickest to complete their PhD (2 out of 3 were under 4 years) and in medical sciences and physical sciences, average completion time was 4 to 5 years.

There was a significant association between doctoral degree holder’s sector of work and the administrative constraints for conducting research (chi-square with 4 df = 13.038 which was significant at 5% level). But a significant relationship was not evident between doctoral degree holder expertise area and the constraints for conducting research activities. (chi-square with 15 df = 20.355, p = 0.159)

Since there are different types of research outputs, measuring and comparing individual outputs is difficult. Therefore, an index that represents research output was created for each respondent as follows,

<table>
<thead>
<tr>
<th>Weights</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Refereed publications</td>
<td>3</td>
</tr>
<tr>
<td>Non-refereed publications</td>
<td>1</td>
</tr>
<tr>
<td>Books/ book chapters</td>
<td>5</td>
</tr>
<tr>
<td>Magazines/ Newsletter articles</td>
<td>0.5</td>
</tr>
<tr>
<td>Patents</td>
<td>3</td>
</tr>
</tbody>
</table>

The weights used in this study were based on University Grants Commission circular (UGC circular No. 916), which is about the schemes of recruitment/promotion for Associate Professor/Professor in the university sector.

Table 1 shows frequency and cumulative frequency distributions of the output index scores.
Table 1: Distribution of the Output index scores

<table>
<thead>
<tr>
<th>Index category</th>
<th>Freq.</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>below 25</td>
<td>121</td>
<td>26.9</td>
<td>26.9</td>
</tr>
<tr>
<td>25 &lt;= to 50</td>
<td>114</td>
<td>25.4</td>
<td>52.3</td>
</tr>
<tr>
<td>50 &lt;= to 75</td>
<td>80</td>
<td>17.8</td>
<td>70.2</td>
</tr>
<tr>
<td>75&lt;= to 100</td>
<td>45</td>
<td>10.0</td>
<td>80.2</td>
</tr>
<tr>
<td>100 &lt;= to 125</td>
<td>24</td>
<td>5.3</td>
<td>85.5</td>
</tr>
<tr>
<td>125 &lt;= to 150</td>
<td>21</td>
<td>4.7</td>
<td>90.2</td>
</tr>
<tr>
<td>150 &lt;= to 175</td>
<td>8</td>
<td>1.8</td>
<td>92.0</td>
</tr>
<tr>
<td>175 &lt;= to 200</td>
<td>7</td>
<td>1.6</td>
<td>93.5</td>
</tr>
<tr>
<td>200 &lt;= to 225</td>
<td>9</td>
<td>2.0</td>
<td>95.5</td>
</tr>
<tr>
<td>225 &lt;= to 250</td>
<td>2</td>
<td>0.4</td>
<td>96.0</td>
</tr>
<tr>
<td>250 &lt;= to 275</td>
<td>5</td>
<td>1.1</td>
<td>97.1</td>
</tr>
<tr>
<td>275 &lt;= to 300</td>
<td>7</td>
<td>1.6</td>
<td>98.7</td>
</tr>
<tr>
<td>300 &lt;= to 325</td>
<td>1</td>
<td>0.2</td>
<td>98.9</td>
</tr>
<tr>
<td>350 &lt;= to 375</td>
<td>2</td>
<td>0.4</td>
<td>99.3</td>
</tr>
<tr>
<td>425 &lt;= to 450</td>
<td>1</td>
<td>0.2</td>
<td>99.6</td>
</tr>
<tr>
<td>450 &lt;= to 475</td>
<td>1</td>
<td>0.2</td>
<td>99.8</td>
</tr>
<tr>
<td>over 500</td>
<td>1</td>
<td>0.2</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>449</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

According to Table 1, most of the doctorates (26.9%) were from below 25 category. Overall, 80.2% had output index of below 100, and the histogram (Figure 1) showed an exponentially decaying pattern.

To find out what factors influenced the decision that doctoral degree holders think they contributed to development in the country, a multinomial logistic regression model was fitted using available factors, and the final model showed that the decision was influenced by Sector, Gender, Research constraints, and the interaction Gender * Research constraints. However, the fitted model not adequate enough to represent the contribution, suggesting further input into this aspect.

![Figure 1: Histogram of research output index](image-url)
Conclusions
The study revealed that gender wise university sector had a balance in age distribution whereas other two sectors had higher female percentages in younger age categories and younger PhD holders were attracted to university sector than other two sectors. As per the field of study, life sciences had the most number of PhD holders, whereas gender wise, engineering sciences had the lowest female ratio which is as low as 8 to 1. Most of the students seeking PhD education had a good opportunity to do their studies abroad. Funding problems and more time spent on administrative work were identified as most influential constraints. Further research is necessary to find out reasons for relatively low output scores by the majority.

References
SRI PALEE CAMPUS
Message from the Rector

It is a great pleasure for me to be sending this message to all symposium speakers and delegates at the Colombo University. This symposium represents the strength, capacity and unity of the university members as they get together to present what they have discovered in their respective fields.

Man started his journey of development 3 million years ago and the evolution of these primitive men is laid over three historic periods. We now live in an age of global change. Population increases everyday with no expansion of the world’s resources. Many global issues and challenges have arisen with the increased demands and necessities of the population. All intellectuals have recognized the importance of discovering the methods to meet the new challenges lying in front of them. It is a duty as well as an obligation of contemporary intellectuals to conduct experiments, carry out research and discover new knowledge to succeed in life.

It is our earnest hope that these aspirations will be fulfilled in the forthcoming symposium to be participated by you. This symposium will undoubtedly keep you moving forward by highlighting new ideas, building new alliances and affirming your support for one another.

I wish all participants a productive and enjoyable symposium.

Dr. Tudor Werasinghe
Rector, Sri Palee Campus
Sri Palee Campus

Abstracts

1. Influence of Satellite Culture on the Social and Cultural Conditions in South Asian Region 350
2. A Study on the Impact of Demographic Factors on Emotional Intelligence 353
3. A Semiological Study on the Connotative Meaning Depicted by the Colonial Documentary Film “A Ramble through Ceylon” 357
Influence of Satellite Culture on the Social and Cultural Conditions in the South Asian Region

Dr. DharmaKeerthi Sri Ranjan
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Introduction
Satellite media culture has excessively transformed the whole media landscape and it has made an amazing and unequal impact on the communal consciousness, material conditions and social context of the audience in South Asia. The satellite telecasting system has offered multi faceted media implications to the national broadcasters of the South Asian countries and generalizes it in a variety of fields of the life of the masses. These new kinds of telemedia, multimedia, and latterly, hypermedia have transmitted and presented a large amount of modern type of information in a non-linear way. Though this communication system has always implied relationships between center and periphery or sender and recipient, the mutual understanding between them has not always been reached or even aimed at. The new media consumers of the South Asian countries are facing a new world of socio-cultural symbols, processes and effects that can shape and reshape the perception of the masses. This digital identity at the periphery countries has extended their potential challenge and has created problems in the traditional, social and moral integration of the people. But the traditional media and sources were invariably bound to socio-cultural roots and not based on the atomistic competition and profit coverage orientation (DharmaKeerti, 2010).

Research Problem
How far has satellite culture influenced the social and cultural conditions of the South Asian masses?

Objective of the Study
To investigate the influence of satellite culture on the social and cultural conditions in South Asian region

Results and Discussion
The satellite era could engender a popular culture which would be more fascinating, increasingly independent and could create controversial autonomy in the socio-cultural basis of the South Asian countries. The Northern Pedestal Satellite TV of India has loaded their programs, drawing attention on the middle range audience from their basis of provincial and national TV. This would formulate a greater terrestrial competition for the nationalized broadcasting systems. Indian TV has been accelerating its own impact on the audience since 1990s with the latest technology in the global context. Doordarshan and its virtually regulated regime was eroded by the satellite channels which broadcasted from outside into the Indian territory in 1990s. By 2005, the TV industry in India extended up to more than 200 channels and operated them with digital technology, exercising their influence beyond the South Asian territory.
STAR TV has dramatically changed the mass consciousness of the Indians and was strong enough to capture more than 31 million homes by 2005. They captured the Indian market by offering audiences with socio-cultural and linguistic taste with the different elements. In all probability Star Plus TV utilized subtitles in English in their programs, employing a hybrid language termed Hinglish. The Star World channel has grown rapidly and achieved 17 million viewers in 29 countries across Asia.

The monopoly of the BTV (Bangladesh) started as state television network in Bengali Language but ended up after twenty eight years (1964 - 1992) with the dissemination of STV (Satellite Television) into Bangladesh in 1992. Bangladeshi audiences were familiar with the name “Sputnik” a satellite of the former Soviet Union (Fsisal, 1993). The trans-border flow of television programs from neighboring countries was not a new phenomenon for the Bangladeshi audiences because 32% of all programs from abroad were transmitted over the BTV channel to the audience. They were ardent fans of Bengali and Hindi films coming from similar social and cultural contexts in the late 1970s (Narunnabai, 1994).

The government of Khaleda Zia removed the barricades against the satellite antenna in1992 due to the Asiasat (STAR TV), Arabsat (CNN) programs, available for the audience in the country (Moslem, 1993). Accordingly, Bangladesh has been invaded by the satellite culture and Western cultural habits, behavioral patterns, language, linguistic styles and the neo technologies etc. Some sociological evidence reveals that the impact of the transnational media on the Nepali masses is greater than before. The westernized middle class in Sri Lanka and in Pakistan watch some English language programs via the CNN, BBC, Star News and Cartoon Networks. Pakistanis watch programs mostly made for India in the Hindi language, while Tamils in Sri Lanka are likely to access satellite channels in their language that are aimed at South India.

The following figures display the heavy media influence on the consumption behavior of rural masses and demeanor of the audience and their dimensions on consumerism.

### Impact of Satellite Media Culture of the Social Settings of Rural Masses in Sri Lanka

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age</th>
<th>Education</th>
<th>Occupation</th>
<th>Monthly Income</th>
<th>Gender</th>
<th>Civil Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Familiarize to Market Culture</td>
<td>.004**</td>
<td>.208</td>
<td>.000**</td>
<td>.000**</td>
<td>.002**</td>
<td>.002**</td>
</tr>
<tr>
<td>Alteration of Consumption Routine</td>
<td>.000**</td>
<td>.290</td>
<td>.000**</td>
<td>.000**</td>
<td>.298</td>
<td>.000**</td>
</tr>
<tr>
<td>Shift into Fashion Culture</td>
<td>.000**</td>
<td>.187</td>
<td>.000**</td>
<td>.000**</td>
<td>.533</td>
<td>.000**</td>
</tr>
</tbody>
</table>

**Sig. level 0.01**, 0.05*  
*Kruskal-Wallis Test & Mann-Whitney Test*

Towards the closing stages of the twentieth century, due to the collapse of the economic barricades, the liberalization of the market began and the results climaxed on world trade
on market terms, accelerating the process of economic globalization. By 1980s, with the development of the independent capital market system, the global multi-national companies began to earn and strengthen their economy and power that later influenced the social structures and social organizations of the nation states of the periphery countries. As a result of the collaborations of media, market and technology, it appeared to have the potentiality of strengthening the growing globalization.

**Conclusion**

This technological advancement revolutionized customers’ “traditions, coalescing of place-shifting” and “time-shifting” marvelously. At present, inter-governmental satellites as well as commercial platforms have become dominant forms of moving information and shaping quite distinctive cultures in South Asian countries and the world.

**Keywords:** satellite culture, hybrid culture, transnational media

**References:**


A Study on the Impact of Demographic Factor on Emotional Intelligence

Dr. Ranjan C. K. Hettiarachchi

Faculty of Mass Media

D. L. Nayana P. Amarawicrama

Introduction

Emotional Intelligence (EI) is a requisite skill or a set of abilities which help to identify emotions, to use emotions, understand emotions and manage emotions of oneself and of others. Consequently, there has been a growing interest on the area of emotional intelligence and its relevance in professional success. Examining human interactions is a much more difficult task than measuring the cognitive abilities of an individual and many researchers argue that it is the most important aspect of skills development that results in producing better performing leaders.

The term "Emotional Intelligence"(EI) also known as Emotional Quotient (EQ) has been promoted as a measurable construct quite apart from cognitive intelligence, since it was first used in scientific literature by Salovey and Mayer in 1990. (Gosling, 2006). It is believed that emotional intelligence may explain differences in the quality of intrapersonal and interpersonal relationships and contribute to effective professional development. Having realized the importance of EQ in professional skill development, many scholars attempted to carry out research on this particular area. A new research tradition on emotional intelligence was born and new dimensions of particular subjects were investigated. This research attempts to investigate the impact of demographic factors on Emotional Intelligence level.

Research Problem

To what extent do demographic factors have an impact on the level of emotional intelligence of professionals in Sri Lanka?

Objective of the Study

The study attempts to achieve the following objectives.

• To investigate the level of Emotional Intelligence (EQ) in Sri Lankan Professionals.

• To identify the relationship between demographic factors and the level of emotional intelligence of professionals in Sri Lanka.
Method

Conceptual Frame Work

Independent variables

- Age
- Gender
- Level of education
- Marital status

Dependent variables

- The level of Emotional Intelligence

Figure 1 – Conceptual Model

List of Hypotheses

The following hypotheses were developed and tested with the Sri Lankan Professionals.

H1: there is a relationship between age and the level of EI of the Sri Lankan Professionals.

H2: There is a relationship between gender and the level of Emotional Intelligence.

H3: There is a relationship between marital status and the level of emotional intelligence.

H4: There is a relationship between the level of education and the level of Emotional Intelligence.

Population

The target population of this study consisted of professionals from manufacturing and service companies in private sector in Sri Lanka. A simple random sampling method was used to define sample size and 10 companies were taken to represent the population. A total of 75 managerial level professionals were selected to join the study.

Method of Data Collection

Questionnaires

This study relies on quantitative data gathered using questionnaires. The questionnaire is designed to collect the information regarding demographic factors and to measure the level of EQ of the executives in manufacturing and service organizations in Sri Lanka. The EQ test which was developed by Chadha and Singh (2006) has been used to measure the level of EQ of the Sri Lankan professionals. Quantitative data was analyzed using descriptive statistics.
Data Analysis

One Way Analysis of Variance (ANOVA) and Chi-Square analysis were employed to see the relationship between demographic factors and the level of emotional intelligence of professionals in Sri Lanka.

Results and Discussion

Hypothesis 1: The data of table 01 for age group 50 above shows the highest mean score as 370.63 and Std. Deviation as 16.995, while age group 21-35 revealed lowest mean score (346.07) and Std. Deviation (25.216). The descriptive data shows that age difference has a positive effect on the level of EQ of Sri Lankan professionals. The data analysis shows that there is a tendency of growing EQ level when they become mature. The mean score of different age groups showed a gradual growth of Emotional Intelligence when they go up on the ladder of age.

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>EQ score mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-35</td>
<td>28</td>
<td>346.07</td>
<td>25.216</td>
</tr>
<tr>
<td>36-50</td>
<td>38</td>
<td>347.18</td>
<td>58.634</td>
</tr>
<tr>
<td>50 above</td>
<td>8</td>
<td>370.63</td>
<td>16.995</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>349.27</td>
<td>45.609</td>
</tr>
</tbody>
</table>

Hypothesis 2: The chi-Square test statistic, as shown in the Table 3, is 12.627(a) with an associated with p<0.05. The relationship between gender and the level of Emotional Intelligence is proved since p<0.05 and a conclusion is made that Emotional Intelligence level is associated with gender. Examining the patterns of gender, it is noted that male professionals have achieved higher EQ level than the female professionals.

<table>
<thead>
<tr>
<th>Pearson Chi-Square</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>3</td>
<td>.006</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>3</td>
<td>.009</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>1</td>
<td>.030</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>74</td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 3: The chi-Square test statistic as shown in Table 3, is 9.220(a) with an associated with p<0.05. The hypotheses that ‘a relationship between marital status and the level of Emotional Intelligence’, is proved since p<0.05 and a conclusion is made that Emotional Intelligence level is associated with marital status.
Table 3: Marital status and EQ level

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>9.220(a)</td>
<td>3</td>
<td>.027</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>13.312</td>
<td>3</td>
<td>.004</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>7.035</td>
<td>1</td>
<td>.008</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hypothesis 4: As the table 4 shows, there is a constant growth of EQ level when there is a growth of education level. With respect to the table 4 there is a sharp growth between the lowest level of A/L qualified Lankan professionals and Masters qualified professionals. Mean score of Masters qualified professionals seemed comparatively higher to any other group of education level. The result seemed to reveal that there was a sharp distinction between Masters qualified professionals and the other professionals.

Table 4: Mean of EQ score of education level

<table>
<thead>
<tr>
<th>Education level</th>
<th>N</th>
<th>EQ score Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/L qualified</td>
<td>7</td>
<td>327.14</td>
<td>65.692</td>
</tr>
<tr>
<td>Diploma, Degree</td>
<td>63</td>
<td>353.73</td>
<td>27.968</td>
</tr>
<tr>
<td>Masters qualified</td>
<td>4</td>
<td>383.75</td>
<td>9.465</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>352.84</td>
<td>33.751</td>
</tr>
</tbody>
</table>

Findings

It was found in this research that marital status has a high impact on the increase of the level of emotional intelligence.

Gender and Education levels also seemed to have a significant effect on the EQ level.

It can be generally concluded that demographic factors have an impact on emotional intelligence level.

Conclusion

The main purpose of this study was to investigate to what extent demographic factors have an impact on the level of Emotional Intelligence (EI) of executives in Sri Lanka. The study confirmed that demographic factors: gender, age, marital status and education level have an impact on the EQ level.

References:


A Semiological Study on the Connotative Meanings Depicted by the Colonial Documentary Film: A Ramble through Ceylon

Nalaka Wijewardhane
Faculty of Mass Media

Background
It is obvious that the genre of documentary (visual ethnography) is used in contemporary studies as a key source in understanding social, political, cultural and anthropological phenomena of colonial Sri Lankan society. But in analyzing the texts of those colonial era documentaries, it seems that the denotations are branched into different social, political, religious and anthropological phenomena. In analyzing the connotative forms, it may also expose many ideological attitudes that overrun the denotations of colonial documentaries.

The study of ethnographic denotative forms shows that during the early 20th century, which was a euro-centric era, westerners used the film media mainly to fulfill functions such as entertaining the middle class, encouraging travelers, providing facts about the colonies for colonial rulers and providing a tool for researchers on geography, sociology and anthropology (Gunasekara 2005). The few available colonial documentaries demonstrate that all of them were more or less attempts at fulfilling those objectives. Therefore one may argue that the colonial documentary could be used as a key media for studying the society of colonial times. However, since it is possible that through the study of connotative forms of those documentaries, implicit ideologies which overrun the denotative meanings may emerge, the possibility of applying the colonial documentaries as a key source of the study of colonial Sri Lankan society could become controversial.

The main aim of this study is to investigate whether it is possible to use the colonial documentaries as a source for analyzing the colonial Sri Lankan society.

Theoretical Background
The theoretical framework of this study is based on Neo-Marxist media theory. It applies the Neo-Marxist media theory for explaining the ideological problematic of media texts. In ideological analyses of media contents it is very important to build an ideological closure (Weerasinghe 2011). Its basic aim is to restrict the imagination and thought so that the re-creation of social reality occurs within the limits of the form, style, thematically forces, and conceptual norms of dominant ideology. Since a sign could be interpreted differently, it is necessary to determine the limits of the field to it make possible to read the sign for archiving the effect of ideological closure.

Research Problem
In which point of view are the local peasants described in the inter-text of colonial documentaries based on colonial Sri Lankan society?

The objectives of the study
1. To examine whether connotations defers form denotations in colonial documentaries
2. To study whether the colonial documentaries attribute local peasants the properties of stereotypical characters

3. To recognize the ethnocentricism of imperialists through the colonial documentaries.

**Methodology**

This study is conducted through qualitative research methodology. There are several documentaries available for study: Charles Urban’s *A Ramble through Ceylon* (1910), and *Curious Scenes in India* (1912), James Fits Patrick’s *Travelogues charming Ceylon* (1931), and *Tropical Ceylon* (1923) and Basil Writ’s *Song of Ceylon* (1934). Here I have chosen for the study the documentary film *A Ramble through Ceylon* produced by the Charles Urban Company in 1910, which could be recognized as the first Documentary (visual ethnography) on colonial Sri Lankan society. I have used the semiological analysis method to analyze and understand the ways of generating the content meanings in colonial documentary films since the semiological analysis method is the most appropriate method for explaining the ideological problematic of media texts.

**Findings**

The study of the description of the documentary *A Ramble through Ceylon* with regard to its icons, indexes and symbols show the application of a manipulator based narrative style rather than a communicator based narrative style in expressing the content of the documentary by the dominant use of long shots, complex mise-en-scenes, and location shootings of the documentary.

It is obvious from the study of connotative forms of the documentary film that the Europeans who documented the local (oriental) society were ethnocentric. The documentary depicts the local peasant as uncivilized, non-authoritative, and simple-minded, and they are attributed properties of stereotypical characters.

**Keywords:** colonial documentary, visual ethnography, connotative forms, ethnocentricism, ideological problematic
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