



AIRS' 18

Proceedings of the
1st Annual International Research Symposium

4th December 2018

International College of Business and Technology
Sri Lanka

**Proceedings of
1st Annual International Research Symposium -2018**

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Published by
AIRS'18
and
International College of Business and Technology (ICBT Campus)

December, 2018.
ISSN 2659-2061

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Message from the Conference Chair
Dr. Sampath Kannangara
Executive Dean & CEO – International College of Business and Technology

It is a great privilege to Chair the Annual International Research Symposium of ICBT, ‘AIRS’18’ to be held on 4th December 2018 at 9.00AM at ICBT Auditorium. This is the first International research symposium organized by the International College of Business and Technology. This will continue to move forward in the research arena from this year onwards under the ISSN-2659-2061.



The theme for this year is ‘Embracing the Excellence of Research Impact for an Innovative Future’ which has opened up in to a multidisciplinary approach consisting of five main session themes. They are Social Sciences, Engineering and Construction, Health Sciences, Business Management and Information Technology.

The research theme is a timely choice, especially at a time where the whole world is experiencing the fourth industrial revolution centered on innovations in many fields, blurring the boundaries between physical, digital and biological spheres. Popularly termed as Industry 4.0, many industries are adopting smart innovative and autonomous systems fueled by data and machine learning resulting in the disruption of traditional business models. Technologies such as Artificial Intelligence & Machine learning, Big Data Analytics, Internet of Things, Cloud Computing and Cognitive Computing are the main drivers behind the new industrial revolution. Innovations anchored around these technologies are making a significant impact on all industries from Health sciences, Engineering to Businesses. It is estimated that almost five million jobs will be lost to these technologies by year 2020. However at the same time, millions of jobs will be created for those who are proficient in these emerging technologies.

In this exponentially changing environment, businesses need to understand their changing environment, challenge the assumptions of their operations, and relentlessly and continuously innovate to stay ahead in global competition. Organizations need to become early adopters of these emerging technologies and should take steps to upskill their workforce by providing new education and training in these technologies.

This conference will be a platform for academic and industrial researchers to publish their work in above-mentioned areas that would help Sri Lanka and the region in becoming a part of the fourth industrial revolution.

Message from the Editor-in-Chief
Dr. Kalum Kathriarachchi
Head of Department of Engineering and Construction
International College of Business and Technology

Dear Colleagues,

Welcome to the Proceedings of the 1st ICBT Annual International Research Symposium (AIRS) in ICBT Campus, Colombo, Sri Lanka. I would like to express my deepest appreciation to the authors whose technical contributions are presented in these proceedings. It is because of their excellent contributions and hard work that we have been able to prepare these proceedings.



Education without innovative research and development is meaningless for the community. This is more so when we are intertwined globally and contribution to global knowledge is the call of the day. I feel highly motivated by the positive response from contributors and like-minded educational fraternities exhibiting their deep interest in bringing this 1st ICBT Annual International Research Symposium (AIRS).

AIRS endeavors to provide a forum for academicians, researchers and practitioners who are interested in the discussion of data driven innovation and are keen to promote, share and publish relevant high-quality research in the domains of Engineering, Health Science, Information Technology, Business Management and Social Science. Thus, AIRS aims to promote the data driven innovations in various fields and provides assistance in decision making in relevant areas.

On behalf of the editorial board, I am very grateful to our track chairs for their great efforts in reviewing the papers in their tracks and organizing to assign other volunteer reviewers, the conference technical program committee members, and the designated reviewers.

I would like to hear from you as well as your valuable suggestions on improving our Symposium further. I sincerely extend my thanks to contributors, editorial board members and looking forward for continuous support.

I look forward to an exciting day of insightful presentations, discussions, and sharing of technical ideas with colleagues from around the world. I thank you for attending the conference and I hope that you enjoy your visit to AIRS.

Profound Regards,

Editor-in-Chief

Dr. Kalum Kathriarachchi

Keynote Speaker
Professor Graeme Thompson
Pro Vice-Chancellor, University of Sunderland



He joined the university as Dean of Arts, Design and Media in 2009. Previously managing director and director of programmes for the UK's commercial television station ITV Tyne Tees. After studying journalism at Darlington, Graeme's career as a journalist, producer and commissioner took him from newspapers into the BBC where he was a producer for BBC Radio York, BBC Radio 4 and the BBC World Service. He joined ITV as a producer for Yorkshire Television in 1989 and moved to Tyne Tees four years later. He is founding chair of the innovative community arts project The Cultural Spring as well as Sunderland Culture – a new company set up by the university with city partners to operate and develop cultural venues and assets. He also chairs the Royal Television Society Education Committee which delivers mentorships and bursaries for students studying media-related under graduate degree programmes. He is a council member for the UK's Creative Industries Federation and Arts Council North and a board member for organisations including the North East Culture Partnership, the North East and Yorkshire Film and Television Archive and the Customs House in South Shields. He writes for the respected monthly journal of TV and digital content production – Television.

Title of the Speech: Research and Innovation – Driving Economic Regeneration from Medical School to Culture.

Overview: Examining the breadth of Applied and Specialist Research underway at the University of Sunderland. The university's new research strategy focuses on academic centres of excellence as well as industry-linked research in medicine, cyber crime, advanced manufacturing, culture and creative industries. In the last Research Excellence Framework (REF) ten out of the 13 areas submitted were rated as world-leading. Graeme Thompson will look at some of headline developments in research at Sunderland and reflect on opportunities presented by the new medical school and the creation of a culture company to operate arts venues across the city. He will outline in particular the impacts of research on economic regeneration as well as on the careers of academic staff. He will draw on his own experience of working in television and the creative industries to look at the effect on communities of participatory arts and crafts. He will explain how areas of research at Sunderland are closely aligned to academic departments, ensuring research is relevant and informs teaching provision. The curriculum now benefits from six new research institutes in Engineering and

Advanced Manufacturing, Computer Science, Business, Law and Tourism, Education and Society, Health Sciences and Wellbeing and Arts and Creative Industries. Graeme Thompson will talk about how the strategy benefits students, staff and the wider economy.

Key Take-away:

1. Research underpins curriculum development and results in excellent teaching
2. Applied Research in which the university partners with industry can have commercial and economic impact
3. Having a research strategy linked to the curriculum helps focus departments as well as individual academics
4. Action Research in culture has brought about arts-led economic regeneration
5. The opening in summer 2019 of a new medical school in Sunderland is opening up exciting new areas of research.

Keynote Speaker
Professor Rafid Alkhaddar
Head of the Department of Civil Engineering
Professor of Water and Environmental Engineering
Hon Vice President of the Chartered Institution of Water and Environmental Management (CIWEM)
Liverpool John Moores University
Liverpool, UK

Professor Alkhaddar has extensive experience in Water and Environmental Engineering, with special expertise in Wastewater Treatment methods. He graduated from the University of Basra, Iraq as a Civil Engineer and completed his MSc and PhD in Civil Engineering Hydraulics from the University of Strathclyde, Glasgow, UK



He has maintained a very strong link with the UK Water and Environmental industry in order to stay involved with any new developments in the aforementioned fields. He also has excellent links with Professional bodies especially the Chartered Institution of Water and Environmental Management (CIWEM) where he was the President of the Institution in 2015-16. He is also a Fellow of the Institution, on its Board of Trustees and an Honorary Vice President of the Institution.

He is currently the Head of the Department of Civil Engineering at LJMU where he manages over 20 staff and 500 students, who are on various courses such as HNC, BEng, MEng, MSc and PhD. The Department run fully accredited degrees by the Institution of Civil Engineers in the UK and he lead a number of these accreditations.

He has published over 150 publications in refereed journals and international conferences.

He has a number of International links which culminated of his appointment as a Visiting Professor to a number of International Universities in Turkey, Egypt and Iraq. He has also joined an International delegation to validate Civil and Environmental Engineering Programmes in the UK and internationally in Lithuanian and Saudi Universities.

He has developed a number of collaborative programmes with International Universities. One was a 2+2 programme with the University of Babylon and another one was with the International College for Business and technology (ICBT) in Sri Lanka where a top up degree programme was developed as has been running for over 5 years.

He has managed to attract over £1.5 Million in research and consultancy funding since the year 2000.

Title of the Speech: Water the Essence of Life

Overview: Life cannot be sustained without water. The presentation will cover how much water we use around the house and also demonstrate how much water is used around the world. Some lessons to be learned will also be demonstrated. There will be a review of water research at LJMU and what lessons that can be learned.

Keynote Speaker
Professor David Proverbs
Associate Dean (International)
Faculty of Computing, Engineering and Built Environment
Birmingham City University

David Proverbs BSc (Hons), PG Cert Ed, PhD, MBA, FHEA, FCIQB, FRICS, is Professor of Construction Management and Associate Dean International in the Faculty of Computing, Engineering and Built Environment at Birmingham City University.

David worked for 10 years in the construction sector as a Project Manager before joining academia as a Research Assistant in 1994. He has led large built environment schools at two modern universities and was Chair of the Council of Heads of the Built Environment between 2012-2016. David is now responsible for establishing and growing a high quality international portfolio of provision across the various disciplines in the Faculty.



David is an internationally renowned expert in flood risk management and pioneered the development of flood recovery in the UK. He has gained research funding from organisations including the British Council, DEFRA, EPSRC, NERC, RICS and World Bank. He has published extensively on topics linked to flood damage, flood adaptation and resilience. David is a confident and adept communicator and has given many key note presentations, guest lectures and undertaken various media activities. David has excellent leadership skills, having led many teams, supervised numerous funded projects and provided mentoring to colleagues and students he has supported.

David has published well over 200 refereed conference papers and journal papers, numerous consultancy reports and several leading text books on flood risk management. He is co-editor to the International Journal of Building Pathology and Adaptation, a member of the RICS UK Education Standards Board and a Trustee to the RICS Research Trust.

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BUSINESS MANAGEMENT

**IMPACT OF THE USAGE OF GREEN PRACTICES ON THE GREEN
CORPORATE IMAGE OF APPAREL INDUSTRY, SRI LANKA**

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Abstract

Objectives of the study were to identify the green practices used by apparel factories in Sri Lanka, to identify the relationship between usage of green practices and green corporate image and to identify the significant green practices, which affect the green corporate image. The considered green practices are use of organic cotton, reusing, reducing, recycling, safe waste management, green procurement, green supply chain management, green operations, product/ material recovery and green logistics. A quantitative approach followed and data were collected through a questionnaire. The sample was 40 randomly selected brand auditors of five apparel companies in Kandy. Statistical analysis revealed that there is a strong positive correlation between the usage of green practices and the green corporate image. Green operations and product/ material recovery are the significant green practices identified. Findings of the study are useful for any apparel firm who is searching for an avenue for growth.

Key Words: Apparel industry, Green corporate image, Green practices

Introduction (Purpose/Aim & Background)

Organizations in 21st century focuses not only on profit as their bottom line but they consider on planet and people along with profit and is called as ‘triple bottom line’. Global warming, Sustainable production, green practices, carbon foot print, cleaner production are major themes of most of the international conferences and summits. In such a context, maintaining a positive green image is much important for any organization. ‘Green corporate image’ pertains to the effort a firm makes in order to create and maintain a positive green image (Bathmanathan & Hironaka, 2016). It is a gateway to a higher level of the firm’s reputation as it is reckoned to be a driving factor in current business set-ups (Weng et al., 2015).

Apparel industry of Sri Lanka plays a vital role for the growth of Sri Lankan economy. It has been the country’s largest export earner since 1986 and was responsible for more than 52% of the total exports earnings of the country (Export Development Board, 2012). The major buyers of garments are retailers such as Ralph Lauren, GAP, Victoria’s Secret, Nike, Patagonia and Polo for instance which are from the US and Europe (Board of Investment of Sri Lanka, 2016). Concerns on environment of western countries are higher than eastern countries as they suffer from many of the consequences of environmental pollution. Over the years, there has been a growing concern on the environmental impact of clothing factories (Chen, 2009).

Therefore, Sri Lankan apparel manufacturers must make a stronger attempt to keep up with their global competition from countries such as Pakistan, India and Bangladesh who seem to have a slightly better grip on the green concept thus attracting the attention of major clothing retailers (Eryuruk, 2012). There are studies about 'Green corporate image'. However, there is a gap in the empirical knowledge in respect of 'Green corporate image' in Sri Lankan apparel sector. Thus, the research question addressed in this study is as follows:

What are the green practices used by Sri Lankan apparel factories and their impact on Green corporate image?

An attempt was made to achieve the following research objectives:

To identify the green practices used by the apparel factories of Sri Lanka

To identify the relationship between the usage of green practices and green corporate image of apparel manufacturers in Sri Lanka

To identify the significant green practices which affect the green corporate image of apparel manufacturers

Methodology

A deductive approach was used for the study with quantitative data. The theoretical population of the study was selected as the 'brand auditors' of all the apparel factories in Sri Lanka. Brand auditors are the representatives of each brand that an apparel manufacturer supplies for and they stay in local apparel firms. They are appropriate respondents to answer questions regarding the usage of green practices of different factories and buyers' perception towards on green corporate image. However, a study population was selected for this study as the brand auditors of the apparel factories in Kandy due to time constraint. The population size was 45. A sample size of 40 was selected with a confidence level of 95% and confidence interval of five. A stratified sampling method was used where seven brand auditors chosen randomly from five factories.

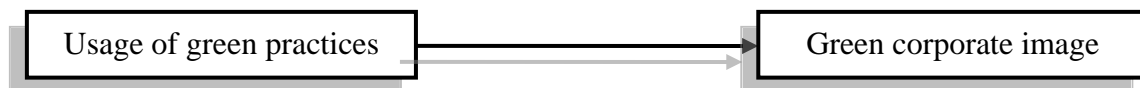


Figure 1: Conceptual framework

H0: There is no any relationship in between usage of green practices and green corporate image

H1: There is a relationship in between usage of green practices and green corporate image

Green corporate image - Green corporate image, the dependent variable of this research refer to the effort an apparel firm in Sri Lanka makes in order to create and maintain a positive green image. The dimensions of green corporate image are the credibility and stability of green products of a firm, sufficiency of abilities to meet the green needs of customers, having a fine environmental reputation, excellence of performance with respect to environmental management and green innovation (Chang & Fong, 2010). All the dimensions were measured with a 5-point Likert scale (1= strongly disagree to 5= strongly agree)

Usage of green practices – The independent variable in this research. This includes various eco-friendly garment and apparel manufacturing techniques such as; use of organic cotton, reusing, reducing, recycling, green packaging, safe waste management, green procurement, green supply chain management, as gathered by the literature review. Ten commonly used green practices in the apparel sector have been discerned with the support of literature (Eryuruk, 2012; Hasanbeigi & Price, 2015). This has been indicated with a 5-point Likert scale (1= very low usage to 5= very high usage).

A reliable and a validated questionnaire was developed and distributed. Descriptive statistics, bivariate correlation and linear regression techniques were used to analyze the data set using SPSS software.

Findings/ Results

Table 1: Univariate Analysis of Green Practices

Green Practice	Mean	Std. Deviation
Organic Cotton Usage	4.33	.838
Recycling	4.33	.662
Safe Waste Management	4.18	.721
Reducing	4.10	.718
Re-using	4.10	.718
Green Procurement	3.59	.785
Green Supply Chain Management	3.21	.833
Green Operations	3.21	1.321
Product/Material Recovery	2.15	1.089
Green Logistics	1.33	.478

In table 1, the mean values of usage of organic cotton, green supply chain management, green operations, green procurement, reducing, re-using, recycling and safe waste management are above the average level (2.5). This implies that the usage of these practices by Sri Lankan apparel firms are higher. The mean values of green logistics and product material recovery are lower than the average level. This implies that there is a lack of practicing those green practices. Further, it could be identified that firms use most of the green practices, 8 practices out of 10. And the highly used practices are organic

cotton usage and recycling.

Table 2: Master Summary of Univariate Analysis

	Usage of Green Practices	Green Corporate Image
Mean	3.454	3.929
SD	.5165	.8008

According to table 2, the mean values of usage of green practices and green corporate image are above the average level, which implies that the usage of green practices in Sri Lankan apparel firms is in a satisfactory level and green corporate image is also in a satisfactory level. But there is a room for firms to improve this level as both averages are below 4.0.

Pearson correlation coefficient in between usage of green practices and green corporate image is 0.8 with a significance level of 0.000. Thus, there is statistical evidence to claim that

there is a positive relationship in between usage of green practices and green corporate image.

Table 3: Multiple Linear Regression Analysis

Green Practice	Unstandardized Coefficients	Sig.
Organic Cotton Usage	.894	.193
Recycling	-.077	.373
Safe Waste Management	.115	.295
Reducing	.034	.747
Re-using	.239	.147
Green Procurement	-.029	.791
Green Supply Chain Management	.004	.973
Green Operations	.347	.041
Product/Material Recovery	.359	.000
Green Logistics	-.035	.681

Table 3 shows the coefficients of multiple linear regression analysis. As per the output, it could be identified that the significant level of green operations and product/material recovery is less than 0.05. Thus among the ten green practices considered those two practices become more significant for Sri Lankan apparel firms. But according

to Table 1, the usage of those two practices are very less. Mean of product/material recovery is only 2.15 and green operations is only 3.21.

Conclusions and Recommendation

Apparel sector plays a major role in developing the economy of the country. This research examined the impact of the usage of green practices on the green corporate image in apparel sector, Sri Lanka with reference to some selected leading apparel firms in Kandy. The univariate analysis shows that the apparel industry of Sri Lanka has a quite satisfactory level of usage of green practices and the green practices which are being utilized by the apparel industry of Sri Lanka are the usage of organic cotton, green supply chain management, green operations, green procurement, reducing, re-using, recycling and safe waste management whereas green logistics and product material recovery are not being utilized by the factories. Also, the usage of green practices had a positive relationship with green corporate image. Which is consistent with the findings of Miles & Russell (1997), Namkung & Jang (2013) and Hillestad et al. (2010). Green operations and product/ material recovery are the significant green practices, which impact on corporate brand image of Sri Lankan apparel firms. But unfortunately, the usage level of those two practices are low in Sri Lanka.

Hence, the apparel firms who wish to build and to raise green corporate image need to concern about the usage of green practices, which investigated. Especially about the green operations and product/ material recovery. The apparel companies who are trying to attract US, European buyers should specially pay attention on this. Management needs to pay a considerable concern on those practices in planning and designing the operations of a firm. Further studies can be done to identify the reasons for lack of usage of green operations and product material recovery by Sri Lankan firms. In addition, research opportunities are available on testing the research framework for other manufacturing industries in Sri Lanka.

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EFFECT OF SERVICE QUALITY ON CUSTOMER SATISFACTION: A STUDY ON SELF-SERVICE TECHNOLOGY PRODUCTS IN STATE BANKS

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Abstract

State banks in Sri Lanka have introduced self-service technology to improve banking experience. However they underperforms compared to non-state banks. Previous research indicates a palpable relationship with customer satisfaction and profitability of organizations and also service quality as important predictor of customer satisfaction. This research surveyed 112 state banking customers from Colombo district and found Reliability, Assurance, Tangibility, and Responsiveness dimensions of service quality to have significant relationship with customer satisfaction of self-service technology related services in state-banks. Improvement in the self-service technology must be carried out along these dimensions.

Key Words: Service Quality, Customer Satisfaction, Self-Service Technology

Introduction

Compared to previous century the consumer today has evolved to depend on information technology (IT) as a consequence of the development in the online products and services (Parasuraman, 2000; Howard and Worboys, 2003). In an early research Mattila & Hanin (2000) noted a swing in banking from traditional banking system to “online” banking. Self-service technology is IT driven banking services conducted without the assistance of a service personal (Suraweera et.al, 2011). These services such as Internet banking system, Mobile banking system, Automated Teller Machines (ATM), standardize the service delivery at a low cost to the bank (Joseph et al., 1999), and have given consumer more autonomy in banking activities (Meuter et al., 2000). However an early study done by Howcroft (1991) indicated frequent customer dissatisfaction with the ATM services due to interruptions and breakdowns of ATMs. Similarly, inadequate technology infrastructure and poor product quality could lead to setbacks in mobile banking (World Bank, 2017).

Despite the availability of array of self-service technological services the fee based income from these services of Sri Lankas’ state banks underperform compared to competitive non-state banks (see Table 1). Competition in the banking industry offers customer the opportunity to evaluate products & services and switch between banks (Buhal & Will, 1997) or, to build a lasting relationship with a bank (Sathye, 1999). Therefore to remain profitable as Roger (1996) argued, increased customer satisfaction is important. In an earlier study Cronin & Taylor (1992) argued that the service quality has a significant influence in improving customer satisfaction. Bowen & Hedges (1993) had

studied service quality in retail banking and found a link between growth of share price and level of service quality of a bank. Stephen et al, (1998) argued that an organization failing to deliver appropriate service quality could experience negative word of mouth, increase customer attrition and declining profits. Based on this premise of customer satisfaction as the way to profitability, number of research carried out in Sri Lanka have found customer satisfaction to positively correlate with service quality (Ranaweera & Prabhu, 2003; Wijethunga & Goonathilake, 2003; Gunarathne, 2014; Navaratnaseelan & Elangkumaran, 2014; Weerasiri, 2015).

In this background, it is interesting to see how do service quality factors related to self-service technology influence Sri Lanka's state-bank customer satisfaction? Hence, the objectives of the research is to analyze the significance of service quality factors influencing the customer satisfaction of self-service technology services in the state-banking sector in Colombo.

Booms and Lewis (1983), defined service quality as a key aspect which consumers use to evaluate particular service. Gronroos (1984) presented a three facets for service quality by concentrating on what customer's get, how customers get and how customers differentiate the firm and its services. One of the seminal studies Parasuraman et al. (1985; 1988) asserted that the customer's satisfaction level on a product or service can be recognized based on the anticipated quality of the particular product or service and perceived performance of the same product or service. (Parasuraman et al., 1985)

Table 1: Comparison of Net Fee and Commission Income for financial year 2014- 2016

Bank	2014	2015		2016	
In LKR Bn	Amount	Amount	% Variation	Amount	% Variation
Commercial Bank	4.85	5.40	12%	7.10	31%
Hatton National Bank	4.87	5.78	18%	7.05	22%
Sampath Bank	4.18	5.29	26%	6.58	25%
Bank of Ceylon	8.09	7.83	-3%	7.21	-8%
Peoples Bank	3.70	3.54	-4%	3.73	6%

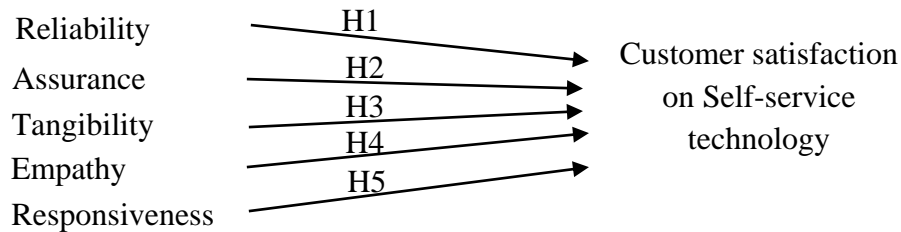
Source: Annual Reports of Sri Lankas Commercial Banks

Significance of the Study

The findings of this research study will help state banks to improve their policies and improve their services related to self-service technology leading to improved customer relationship. The research however has a limited generalizability considering its sampling method. Nevertheless it provides significant insight into the factors affecting the self-service technology. The rapid advancement of technology could impact the validity of the research findings in years to come, in which the study can be considered as one of early studies into the topic.

Methodology

Conceptual framework for this research study is developed based on the SERVQUAL model initially formed by Parasuraman et al., (1988). Accordingly the five dimensions in SERVQUAL model referred as Tangibility, Reliability, Responsiveness, Assurance and Empathy are deduced as independent variables of this study while customer satisfaction is



the dependent variable.

Figure 1: Conceptual Framework

Hypothesis

H1- Reliability has a significant relationship with customer satisfaction of self-service technology of state-banks in Sri Lanka

H2- Assurance has a significant relationship with customer satisfaction of self-service technology of state-banks in Sri Lanka

H3- Tangibility has a significant relationship with customer satisfaction of self-service technology of state-banks in Sri Lanka

H4- Empathy has a significant relationship with customer satisfaction of self-service technology state-of banks in Sri Lanka

H5- Responsiveness has a significant relationship with customer satisfaction of self-service technology of state-banks in Sri Lanka

Research Design

(a) This study took a deductive approach, executing a quantitative survey research and examined numerical data collected through a 1-5 Likert scale questionnaire. This method of data collection has benefits such as appropriateness for the problem in hand, flexibility in gathering the data and the option of updating the collected data. It also allows the researcher to take control on the environment of data gathering (Kent & Kent, 2007). The questionnaire was designed purposely for the research with some insights from Tripathi (2013) and Ongori (2013). A pilot study consisted of 20 respondents tested for reliability of 05 service quality variables which exceeded Cronbach's Alpha coefficient of 0.7. Data was examined using SPSS 21 version software. Subsequently the 120 respondents were surveyed randomly from Pettah branches of two state banks in which 112 considered for analysis.

(b)

(c) Table 02: Test of internal consistency

Variables	Number Items	Cronbach's Alpha
Reliability	5	0.757
Assurance	5	0.873
Tangibility	5	0.763
Empathy	5	0.718
Responsiveness	5	0.765
Customer Satisfaction	3	0.794

Results

Table 03: Correlation Analysis

		Tangibility	Reliability	Responsiveness	Assurance	Empathy	Customer Satisfaction
Customer Satisfaction	Pearson Correlation	.444**	.554**	.568**	.665**	.128	1
	Sig. (2-tailed)	.000	.000	.000	.000	.179	
	N	112	112	112	112	112	112

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Except the H4₊, all other alternative hypothesis are accepted. The significance level of customer satisfaction and empathy is above 0.01 level. Hence the null hypothesis H4₀ cannot be rejected. The correlation analysis found statistically significance relationships between customer satisfaction and 4 service quality dimensions, i.e., tangibility, responsiveness, assurance and reliability. Assurance with correlation value of 0.665 seems to have a major influence in the mindset of the customers who are using self-service technology channels within the two major state banks operating in Colombo district. According to table 04 the regression model predicts the dependent variable, customer satisfaction significantly well.

Table 04. ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	20.993	4	5.248	23.971	.000 ^b
Residual	23.427	107	.219		
Total	44.420	111			

a. Dependent Variable: Average Customer Satisfaction

b. Predictors: (Constant), Average Reliability, Average Responsiveness, Average Tangibility, Average Assurance

Discussion & Conclusion

This research found Service Quality Dimensions, Tangibility, Reliability, Responsiveness and Assurance, to significantly correlate with Customer Satisfaction of Self-Service Technology products offered by two public banks in Colombo Sri Lanka. In contrast to the current study findings, Ongori (2013), found responsiveness and tangibility as the two important service quality factors affecting customer satisfaction in the Self-service

channels in Kenyan commercial banks. In a smimilar research in Sri Lanka, Navaratnaseelan and Elangkumaran, (2014) found Tangibility and Empathy having a major correlation with customer satisfaction level. Ushantha et al. (2014), on the other hand, found all 5 service quality factors having a positive correlation with customer satisfaction. In the current study out of 5 hypothesis related to service quality dimensions only 4 were accepted. This deviation compared to previous study could be due to differences in the instruments used, subjects and services offered by different banks.

Future research in this area should include a bigger sample drawn from different cities to increase generalization. A detailed comparison with private sector banks could also be noteworthy to identify any differences.

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THE IMPACT OF INTEREST CHANGES FOR THE PROFITABILITY OF COMMERCIAL BANKS IN SRI LANKA

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Abstract

This research emphasizes about a research study, which is in relation to the finance industry. The prime objective of this research is to analyze the impact of interest rate changes for the profitability of commercial banks being operated in Sri Lanka by examining the financial statements of commercial banks during 2012 to 2016. This research is completely based on quantitative, secondary data. To examine the impact of interest rate changes on the profitability of commercial banks, Pearson correlation, model summary, Anova and correlation methods have been used in this study. As a result, it is found that there is strong and positive correlation between interest rate and commercial banks' profitability.

Key words – Commercial banks, Interest rates, Profitability.

Introduction

Commercial banks always can be categorized under the finance sector. Finance sector indicates an economy made up of firm that provides services such as providing loans, cash management, and online transaction facilities etc. to the public. Sri Lanka has a fairly well diversified banking system. Moreover, there are also different types of commercial banks in any country. According to Sri Lanka there are 25 banks have registered as commercial banks including private banks, public banks, foreign banks, subsidiary banks etc. (Central bank of Sri Lanka, 2016).

Even though there are many fluctuations have occurred in profitability of commercial banks, which does not seem to be ample, the main reason behind this can be known as the interest rate fluctuations. If commercial bank's overall profitability is stable whereas the growth is also consistent, the impact of interest rate fluctuations might not be affect vastly. According to the Central Bank annual report, the data analyses of profitability had been examined from 2012-2016. In 2012 the highest profitability has made, whereas the lowest indicates in 2013 and 2014. (Central bank of Sri Lanka, 2016).

The main research objective, which can be examine through this study is,

- To identify the impact of average deposit rate for the profitability of commercial banks.
- To identify the impact of average loan rate for the profitability of commercial banks.

In order to carry out a particular research, first or foremost contrivance is to analyze the symptoms, which will help to identify the actual problem that has been occurred. According to this study the symptoms are,

1. Current profitability and the former profitability (Net interest margin) in selected commercial banks.
2. Interest rate (Average deposit and lending rate) fluctuations of selected commercial banks.
3. Reaction of the public towards commercial banks interest rates. (Number of depositors, how many have applied for personal/business loans etc.)
4. Employees/Bankers salary schemes
5. Difference of the profitability (Net interest margin) between the private banks and the public banks

Interest rates are the rudimental building block to any monetary model. The significance of interest rates are,

- It acts as a mediator particularly when depositing and lending money between customer and the bank.
- It stimulates money supply to any economy.
- Interest rates also work as a propitious tool especially in relation to the financial institutes.

In addition, a few limitations of this study is that when, selecting a proper sampling method, due to some inner crisis of Sri Lankan banking sector such as the downfallen of the Seylan bank which was a leading commercial bank in Sri Lanka, collapsed due to the excessive speculation, poor risk management etc. led to an impossibility to choose the ideal sampling method.

As another restraint, it does not cover the entire time period from the very earlier stages of commercial banks in Sri Lanka to the current time period when interpreting the results.

Methodology

According to the figure 1, there are two independent variables as deposit interest rate which mentions about the bank creditors and loan interest rate that indicates the debtors of the bank. Figure 2 - dependent and independent variable



Results and discussion

Through this study it is supposed to examine the impact of both loan and deposit interest rates to the profitability of commercial banks in Sri Lanka. In order to construct the specific model that reveals the relationship among loan and deposit interest rate with profitability, it is used multiple linear regression. Furthermore, the model can be explained as follows.

$$\text{Bank profitability} = \beta_0 - \beta_1 D + \beta_2 L$$

Where,

$\beta_0, \beta_1, \dots, \beta_2$ – Coefficients

D = Deposit rate (Average yearly)

L = Loan rate (Average yearly)

Regression Analysis

Table 1 demonstrate that the explanatory power of this model is 98% according to the model summary. It reveals that 98% of profitability level of commercial banks explained by both deposit and loan interest rates.

Table 1. Model summary

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.994 ^a	.989	.988	.06461	.989	1161.799	2	27	.000

a. Predictors: (Constant), Deposit rate (%), Loan rate (%)

Table 2- Results of Regression Analysis

Variables	Coefficients	Std. Error	P value
Constant (β_0)	.959	.705	0.001
Loan rate	.282	.148	0.011
Deposit rate	-.211	.295	0.038

As Table 02 demonstrates, it can be concluded as both loan and deposit interest rates are significantly affect to the profitability level of commercial banks. According to the regression analysis the following model can be developed in order to explain the relationship between both loan and deposit interest rates and profitability level of commercial banks.

$$\text{Bank profitability} = 0.959 - 0.211 D + 0.282 L$$

Conclusion

Interest rates play a vital role to the commercial banks. The overall interpretation of the results can be concluded as that there is a relationship between the interest rates and the profitability. Mostly when loan interest rates become high, the profitability of commercial banks also rises and when deposit interest rates increase profitability tend to get decrease. Ultimately it can be concluded that there is a significant relationship between the deposit and the lending rate to the profitability since both independent variables' hypothesis accepted.

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FACTORS AFFECTING LAPSATION OF LIFE INSURANCE POLICIES IN

KANDY

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Abstract

In a period when life insurance sector is booming, the aim of this research is to explore the customers' experiences of life insurance lapse and to identify how the lapses of life insurance occurred in Kandy. A qualitative approach was selected and in the form of interviews, data was collected from 10 individuals from a population of lapsed customers and 5 employees from a leading insurance company in Kandy. The sample was selected conveniently. Data collected through face-to-face interviews with employees and over the phone interviews with customers. The interviews were recorded, transcribed, coded and identified common themes. Then it could be identify that the financial burden of customers as well as mis-selling of products by the agents and inability to manage a good customer relationship affects lapse of life insurance policies. Findings of the study are useful for any life insurance firm who is searching for an avenue for growth.

Keywords: Lapse of insurance, Life insurance, Qualitative study

Introduction

Life insurance industry being one of the very competitive industries in Sri Lanka faces a problem of lapse policies (Fitch Ratings, 2015). A lapse policy can be defined as a policy which is not paid the premium at the end of the grace period (Fang & Kung, 2012). In Sri Lanka the grace period is considered as 2 months consecutively. Lapsation can happen due to many reasons such as the interest of customer after a period of time, forget about the policy with time since they are matured in a very long time period, lesser agent-customer relationship, miss-selling of the product, high premium rate, financial crisis of the policyholders, delay in renewal notice, poor customer service, agent forces to cancel existing policy to purchase another new policy (Subashini & Velmurugan, 2015; Nithiyalakshmi et al, 2016).

The lapsing of insurance policies is actually profitable for an insurance company in short term. Because the payments made by the customers to the company on monthly basis till the date of lapsing is not refundable to the customer until the policy is matured and the customer does not get any of the benefits that he/she signed up for at the beginning of the contract. But in the long-run, lapse policies reduces expected income of a company, unsatisfied customers and their bad word of mouth brings losses to life insurance companies (Subashini & Velmurugan, 2015). Even though literature found in other countries a gap identified with respect to Sri Lanka. Thus the research question addressed in the study was;

Why the life insurance policy laps rate increases in Kandy?

Objectives of the study were;

1. To explore the experiences of life insurance policy lapse customers
2. To analyze how the lapses of life insurance policy occurred

Methodology

An inductive approach used with data in qualitative nature. The population was life insurance policy lapsed customers declared by a leading insurance company in Kandy and employees of it. This is an insurance company which is established in 2012 and one of the top 5 life insurance companies in Sri Lanka. There were 15 lapsed policy holders as at 20/04/2018 and 12 employees. A sample of 10 lapsed policy holders and 5 employees were selected conveniently and data was collected through semi-structured interviews. Interviews with employees were conducted at their office premises as per their convenient time and an isolated place was selected to make them relax thus to have genuine opinions. Interviews with customers were conducted with the telephone due to the limited time factor. Even though a single company was selected to collect data due to the time constraint it is evident that it made less impact on the quality of the findings as it is an experienced leading company.

All the interviews were recorded and transcribed. Then codes were given to the commonly used terms. Codes were categorized into common themes. And then the emerging themes were identified as the factors affecting the lapse of a life insurance policy.

Findings

Three main themes emerged from the analysis of interviews with policy holders and agents of insurances as financial burden, mis-selling of policies, poor customer relationship management.

Financial burden

Financial burden was identified as a major reason for life insurance lapses in Kandy. Due to financial emergencies customers neglect the installment payment of the insurance. Most of the time businessmen in Kandy face this situation. EMP 1, an employee, a senior executive who has an average lapse rate of 2 policies per month said,

“Most of my clients are businessmen. Most of them are doing businesses which are having a seasonal income pattern. So during, off-seasons these guys’ policy laps.”

Further this statement focuses on a seasonal behavior of businesses. EMP 5, another employee a junior executive with an average lapsed rate of 3 policies per month said,

“...most of my policy laps customers having financial issues...but I think they don’t like to tell it to us. They tell different other stories”

Even above statement reveals that from the lapsed customers’ point of view, it was harder to identify the theme; financial burden. This might be due to ego feelings. However, indirectly they mentioned it. CUS – 8, a customer who is a businessperson and was a customer with the insurance firm for 16 months identifies that financial burden was an issue.

“Actually, we had a small problem in last few months and forgot about the insurance actually... we had a shop in Thalathuoya, and that got robbed...”

Mis-selling of policies

The other emerging theme of the analysis is mis-selling of policies. The statement of EMP 1, mentioned above reveals that the agent has a several experiences and a good understanding of dealing with business clients in Kandy. EMP – 2 a Junior Executive who is new to the company and has one policy which is on the verge of lapsing states the following comment

“...we get targets, and we go out and pressure the customer to come and start a policy with us.”

All their benefits/ commissions depend on the target. So even if these agents have a good understanding of the profile of the customer and the possibility of laps they grant the insurance in order to show short term targets. They sell the products even to the wrong customer. An opinion of a customer, CUS – 5,

“...we did an investment policy and he told I only have to pay for 3years, after I got the policy it says I have to pay for 5 years but in 3 years I can get some money or something it was not clear to me still. So I stopped paying”

This shows that when customers are not clear about the policy, conditions of the policy they lose the trust and leads to a lapsed policy. Several customers had this type of confusion situations. This derives the attention on factors, which affect lapsed policies as mis-selling.

Poor customer relationship management

Poor customer relationship management is also a significant reason for lapsation of life insurance in Kandy. The statement of employee (EMP 5) reflects the mutual trust in between the agent and the customer is poor other than the financial burden that this customer was facing. Further, the situation of CUS – 8 indicates that due to the busy life style of customers they tend to forget the monthly payment of the policy. The company agent is accountable for this as well. If they maintain a good relationship this would have not been happened. An opinion of a customer, CUS – 5, as mentioned above shows that when customers are not having a trustworthy relationship in between the agent and the customer the policy leads to a lapse. This distrustful situation could be again found with a customer, CUS – 7 said,

“...I was out of country...I expected a Promissory note like they give in banks after I deposited money via the bank to the company account here, so I felt insecure about the company”

Another customer, CUS – 2 said that;

“Before 3 months I had to back to the ship I was working for the agent got a standing order for my payments, and I still made my payments on time every month, but I got a big injury in my left foot and was sent to the Colombo hospital... then I got to know my policy was lapsed when I claimed it... the standing order details that man has entered was wrong so they said the payments weren’t done for 3 months”

Due to the misinterpretation and carelessness while handling sensitive data as bank details by the employee caused the customer to face a horrible situation at a critical point in life.

Discussion

One of the emerging themes of the interviews was financial burden issues of the customers. This is called financial burden and this complies with the study of Subashini & Velmurugan (2015). Financial burden was a major common reason of businessmen's in the city. Kandy is a tourism based city. Hotel, travel agents, arts and crafts, gems and spices are the major business in Kandy and which target tourists and the peak period is the Perekhara season (UNESCO, 1994). So during off seasons these businessmen face financial crisis which is a major reason for life insurance lapses in Kandy.

The second reason, which identified is mis-selling of insurance policies. Due to the target pressure, most of the agents tend to sell policies, which are not based on the needs and requirements of the customer and not as per the financial position of them. This is called mis-selling of policies and this complies with the study of Nithiyalakshmi et al, (2016). The life insurance sector in Kandy has become very competitive. There are many players mainly Ceylinco, AIA, SLIC, Union, Janashakthi, Asian, HNB and other players (The Insurance Regulatory Commission of Sri Lanka, 2018). Due to this competition, insurance agents are put on much pressure in achieving targets. Roy and Shome (2018) also found that when the target pressure increases agents tend to have mis-selling.

Thirdly, poor customer relationship management was identified as a major reason, which cause for lapse policies. Agents are not following customers and reminding the due dates to them. Sometimes they are unable to build a trustworthy relationship with clients. Carelessness of agents in dealing with clients was also evident. The results are complied with the findings Velmurugan and Subashini (2015), Crosby and Stephens (2010).

Conclusion and Recommendation

This research was conducted in order to identify the factors that affect the lapsation in life insurance policies in Kandy. The study population for the research was agents and customers whose life insurance policies were lapsed in a leading insurance company in Kandy. Since the research had a qualitative approach, the data was collected via face-to-face interviews with agents and over the phone interviews done with customers. The collected data was analyzed by giving the codes and identified common themes. The identified common themes were mis-selling of product, financial burden and poor customer relationship management. The findings were compatible with the existing literature as well.

Out of these three factors, the factor financial burden cannot be controlled by an insurance company. But the other two factors are totally controllable by any insurance firm. So the management must take actions to prevent mis-selling activities of insurance agents as well as to improve customer agent relationship management. Even the lapsation caused due to financial burden can be avoided as a factor affecting life insurance lapses if the agents conduct an effective risk analysis method before issuing the policy to each customer as well as by determining their policy and premium based on the income earning potential of the client (Subashini & Velmurugan, 2015). This can be again considered as a part of mis-selling of product as well. A strong customer audit procedure, motivating agents to bring people

through references are very essential to avoid the causes of financial burden and wrong selling as well. Further, trainings to agents on the guidelines and to increase professionalism is needed.

Further, research opportunities available on validating the identified variables by following a quantitative approach.

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EFFECTIVENESS OF GREEN ACCOUNTING SYSTEMS: CASES IN SRI LANKA

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Abstract

Green accounting is a sustainable development tool in decision-making process of a country, which provides a systematic way to incorporate value of environmental contribution. The main objective of this is to investigate the present state of green accounting systems in selected manufacturing and non-manufacturing companies in Sri Lanka. Therefore two manufacturing and non-manufacturing companies have used for this research to identify their environmental reporting practices, to analyze how far their employees do aware of this green accounting system and to recognize the volume of environmental costing information reported in annual reports. According to the disclosure of environmental reporting practices, mostly manufacturing and non-manufacturing companies both have disclosed about their waste management system. Environmental policy has concerned about the establishment of environmental management system due to the lack of standards in this particular criteria.

Key words - Green Accounting, System of National Accounting, Global Reporting Initiatives, Central Environmental Authority, Strategic Environmental Assessment

Introduction

This study illustrates how far employees do aware of the green accounting system, what are the main environmental reporting practices in each company, and how do each company disclose environmental costing information in their final financial reports. Sri Lanka too had commenced work on green accounting in 2012 under the aegis of Ministry of Mahaweli Development and Environment. (Wijewardena, 2018) It is apparent that green accounting is still only halfway through and not final.

Hence, this study attempted to analyze green accounting practices, which are used by companies (manufacturing and non-manufacturing) in Sri Lanka.

Objective and Significance of the Study

Green accounting would enable to evaluate choices between without a bias against future generations, or a bias in favor of manmade assets as against natural assets. It would help in improving environmental performance, controlling cost and promote sustainability. The main objective of this study is to identify assessing, testing and reporting performance of environmental activities. Furthermore to invest in cleaner and efficient technologies, to adjust traditional measures of growth, and to recast them as measures of sustainable growth.

Methodology

This section contains the research methodologies that have used cross sectional survey due to the nature of the research study and the targeted population. This includes sample of

the study (study population), selection of period, and data collection methods. Out of many companies that use the green accounting system, the study population is made up of 5 manufacturing companies and 5 non-manufacturing (services) companies in Sri Lanka that have been using green accounting practices for the disclosure of the final financial statements. The research sample is narrowed down to two manufacturing companies and two non-manufacturing companies from the target population. Four companies were selected based on convenient sampling basis for this research. They are Brandix Lanka (PVT) Ltd and CIC Holdings PLC as manufacturing companies, Sampath Bank, and Sri Lanka Telecom as non-manufacturing companies. The research was conducted based on primary data, which was collected from the Branch Managers of the selected companies, and secondary data.

Results of Analysis

The main purpose of collecting primary data is to fulfil the objective of analyzing how far the employees of their companies do aware about the green accounting system.

Impact of green accounting system- fifteen percent of employees said that it is not very essential because some sort of reasons. Majority considered it is essential tool for the company's growth. Thirty percent of employees considered it as extremely essential and twenty percent of employees voted it as moderately essential. Therefore, the impact of green accounting and reporting system can be considered as very essential tool for a company. Cost of Environmental & Reporting System - The cost of environmental and reporting system is very high (thirty five percent). Least of the employees mentioned the cost is very low (five percent). Equal percentage of employees mentioned the cost is high and low. Therefore, the cost of green accounting system can be considered as very high. Nature of Disclosure – thirty percent of employees mentioned it should be quantitative as well as qualitative report. When the company measuring about the cost incurred to the environmental impacts it has to be measured or calculated by using amounts. Least percentage of employees mentioned it has to be qualitative report (twenty five percent). According to that, most of the employee's opinion is to be it as quantitative report. Periodicity of Reporting - Most number of employees mentioned it has to be period of yearly reporting because the reporting amounts should calculate annual basis and it is convenient for the company as well. Therefore, periodicity of green accounting and reporting system of most of the companies is annual basis. Environmental Sectors - Most of the employees do concern about the waste sector (thirty five percent). Equal percentage of employees do concern about air, land and minerals. Water sector is lesser than waste sector. It does mean that manufacturing and non-manufacturing all four companies mostly concerning about their wastage. Formal Green Accounting and Reporting System- sample companies do have or do not have about formal green accounting and reporting system. According to that, most of the companies (sixty percent) do not have formal green accounting and reporting system.

When the company discloses their environmental policy in the annual reports, they do mainly consider about the actual statement of policy. According to the results, it is

seventy percent and cumulative percentage is as well as the seventy percent. Least percentage is for the establishment of environmental management systems. The frequency is one and cumulative percent is hundred. Therefore, they do highly consider about the actual statement of policy. In the environmental pollution sector, manufacturing companies mostly did mention about the recycling plant of waste products and its cumulative percent is ninety percent. Least amount of percentage (ten percent) did consider amount the land reclamation and forestation programs. Waste management element was disclosed in thirty percent. Secondary data was collected by using their corporate annual reports. As accordance this analysis also done by using six main categories like previous one. The researcher considered about the data, which was collected by using their corporate annual reports for the past three years same as the previous one and results were taken, by considering overall data analysis in non-manufacturing companies. (Telecom, 2009/17) (Sampath, 2010/17). Thirty percent of actual statements of policies and twenty percent of general statements of 'the company will, the company does' nature policies Least percent comes the element namely, establishment of environmental management systems. Under the environmental pollution sector they mostly have being disclosed about the element of recycling plant of waste products and its percentage is fifty. Equal amount of least percentages were disclosed in eco efficiency and water discharge information. Mostly non-manufacturing companies do consider about their waste management as well and it was the second highest element, which was disclosed in annual reports

According to the results, mostly they source indirect energy and it is the element that disclosed mostly in their annual reports. Thirty percent was disclosed by the energy saving and conservation. Least percentage is disclosed about the usage of direct energy. Under the environmental audit sector, they mostly considered about the environmental risk assessment and estimations as well as the obtaining certification for Environmental Management Systems/ISO14001. Twenty percent were disclosed about the execution of environmental policies and compliance with environmental standards & regulations. According to that highest percentage of equal amounts were disclosed about the discussion of environmental and economic interactions and past & current expenditures for pollution control. Under that environmental financial sector, ten percent was disclosed about the references to financial/economic impact and contingencies provisions.

In non-manufacturing companies most of the disclosure of environmental awards and the programs that they have conducted to protect and enhance the wellbeing of future generations. Twenty percent was disclosed about the environmental education, which was used to make awareness of green accounting system.

Conclusion

This research was designed to find the awareness of GA system, GA practices and environmental disclosure volume in the sample companies. According to the research analysis, the first objective was fulfilled by distributing questionnaires. Thus, the environmental reporting practices are varying company to company. According to the disclosure of environmental reporting practices, mostly manufacturing and non-

manufacturing companies both have been mostly disclosed about their waste management system. In their environmental policy, mostly they have concerned about the establishment of environmental management system due to the lack of standards in this particular criteria. All companies disclosed about their energy savings and conservation methods through their annual reports in each year. Considering all the results and analysis part green accounting system should be more standardized. Because this system will tend to decrease the harmful effects for the environment and can be used to utilize the natural resources in an effective way.

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DETERMINATES OF STOCK MARKET PERFORMANCE OF SRI LANKA

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Abstract

Stock market performance plays a major role in an economy. Even though most of the developing economies are gifted with growing stock markets, due to the economy-political condition in Sri Lanka, Colombo Stock Exchange (CSE) continued to be underdeveloped during the pre-war period. However, with the peaceful political environment and economic growth, CSE reported a healthy growth in the post-war period. Regardless of the remarkable economic environment emerged, since 2012; the stock market growth was not sustained. Therefore, the factors for the stock market's underdevelopment remain unclear. This study investigates the factors associated with Stock Market performance related to the Sri Lankan Economy using descriptive statistics and multiple regression analysis over the period between 1997 and 2017. Market Liquidity and Size of Market were significant factors while Domestic Product (GDP) at Current market Prices, Average Weighted Deposit Rate and Inflation Rate were insignificant factors associated with All Share Price Index (ASPI).

Key words – Economical factors, All share price index, Colombo stock exchange, Sri Lankan economy

Introduction

An appropriate financial system provides suitable financial intermediaries through institutions suited to the economy, mobilizes resources and saving, and helps managing other factors of production by supplying funds and services. Proper development of a financial system enhances production as well as market activities and creates employment opportunities to the nation.

Stock market is seen as a very significant component of the financial sector of any Economy. It is also seen as playing a vital role in the mobilization of capital in many of the emerging economies. Stock market is an arguably the best place for an investor to invest in the shares of listed companies, and attractive avenue of investment which will offer a hedge against possible loss from inflation (North & Charles J. Caes, 2011). Stock market indicators show to considerable extent the economic stability of the country. The economic changes of the country directly cause fluctuations in the stock market indexes. Comparatively people in developed nation are much more eager to trade in the stock market than those in developing country like Sri Lanka. Further the greater number of companies are found to be listed with the stock market in developed countries but then in developing markets only less than half of country's total companies get registered in the stock market. According to Agénor (2000), it was found that high inflation, large fiscal deficits and real exchange rate over-valuation are often key symptoms of macroeconomic instability which constraints private sector investment and savings and thereby results in inefficient allocation of resources on the exchange, thus affecting its performance. It was investigated the relationship between

economic growth and stock market development. A strong positive correlation was determined between the stock market development and long-run economic growth after controlling the initial level of per capita GDP and initial level of investment in human capital, and other factors (Levine & Sara Zervos, 1996). Further, a research conducted by Wongbangpo & Sharma (2002), by using five Asian countries it was found that there is an effect of long-term interest rates (LTR) on stock prices.

In relation to Sri Lankan context, a research was conducted by Kulathunga (2015) it was studied the Macro economic factors with respect to the Colombo stock market by using Inflation Volatility (INV), Lending, Deposit Rate (DR), Exchange Rate Volatility (ERV) and Gross Domestic Production (GDP). It was found that there is a significant relationship between the stock market and the GDP.

Share trading in Sri Lanka goes back to the year 1896 when the Colombo Brokers Association commenced the share trading in limited liability companies, which were involved in opening plantations in Sri Lanka. The establishment of a formal stock exchange took place in 1985 with the incorporation of the Colombo Stock Exchange (CSE), which took over the Stock Market from the Colombo Share Brokers Association.

Hence, it is important to evaluate the Stock market in a developing country like Sri Lanka hence it is a vital factor of the economy as a whole.

Objective and Significance of the Study

The main objective of this study is to identify the factors affecting the performance of stock market performance in the Sri Lankan economy and to find out the impact of factors affecting the performance of stock market performance in the Sri Lankan economy.

The study is important in academic purposes as well as investing purposes. The stock market is always a dominant factor among the financial sector and among investment opportunities. In this research, various environment factors (economic factors, political factors, social factors, and natural factors) are considered as factors affecting the efficiency & effectiveness of stock market operations. Hence, it is important to evaluate and determine the relevance and the importance of such factors. In addition, this research is significant as: There are very few studies, research or any other studies with the same relevance. It is important to identify the research gap. Finding of study provide a guide on the economic factors affecting the stock market. This provides full information for existing and potential investors in the stock market.

Methodology

The secondary data were collected from Central bank annual reports, Securities & Exchange Commission's (SEC) publications, Brokers Company's publications regarding All Share Price Index, Gross Domestic Products at Current market Prices, Market Liquidity, Size of market, Market Size, Commercial banks' Average Weighted Deposit Rate, and Inflation Rate of Sri Lanka from year 1997 to 2017. Even though there is a wide range of factors affecting the stock market performance this research selected the factors based on historical literature. Descriptive analysis was conducted to identify the patterns of movements of above mentioned factors over years and simple linear regression analysis was used to identify the impact of the above mentioned macroeconomics variables on stock market performance and

All Share Price Index (ASPI) was used as the response variable. Therefore, the hypothesis of this study were,

H₀- There is no significant impact of GPD at current market price, Market Liquidity, Size of Market, AWDR and Inflation Rate on All share price index.

H₁- There is a significant impact of GPD at current market price, Market Liquidity, Size of Market, AWDR and Inflation Rate on All share price index.

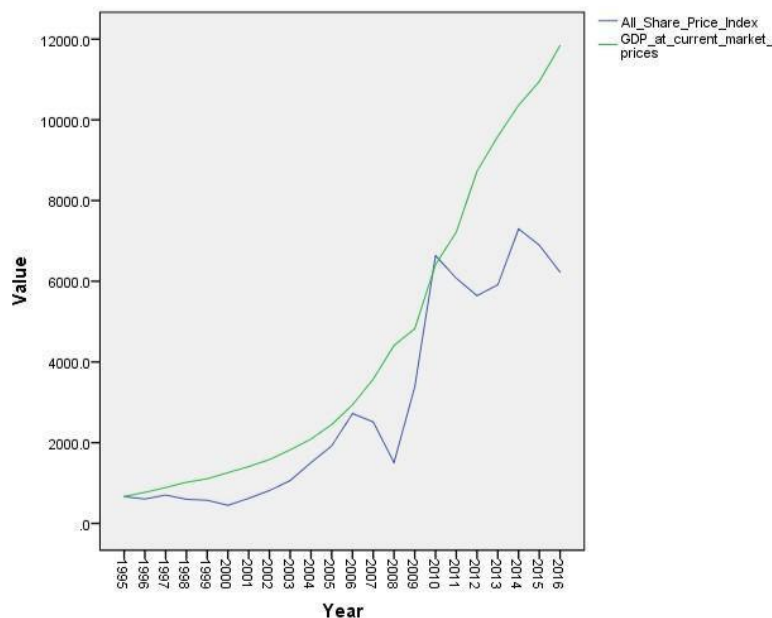
Results of Analysis

The survey data is analyzed by using quantitative methods. The results of the descriptive analysis show the patterns and the behavior of selected macroeconomics variables over the years.

Descriptive Analysis

ASPI and GDP at Current Market Price

Figure 3 ASPI and GDP at current market prices



When analyzing GDP at current market price along with the ASPI through the above Multiple line graph it shows that GDP at Market price has been rising , whereas the ASPI has major deviations which implies that GDP at market price doesn't have a positive or negative impact on ASPI.

Average Weighted Deposit Rate, Inflation Rate and ASPI

Figure 2 ASPI and Average Weighed Deposit Rate

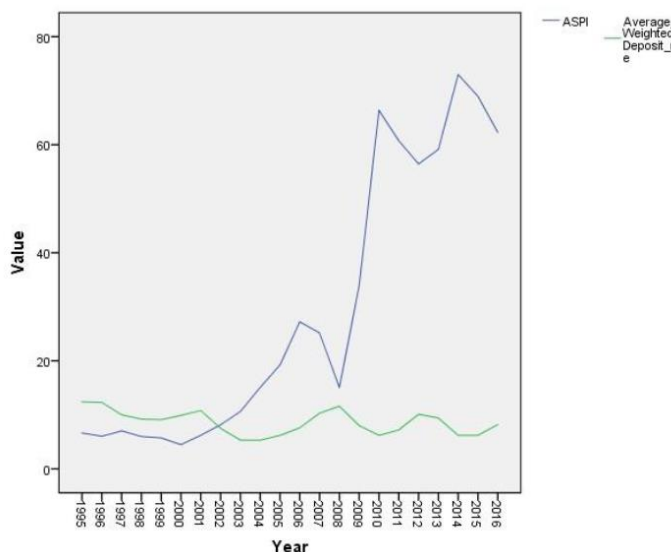
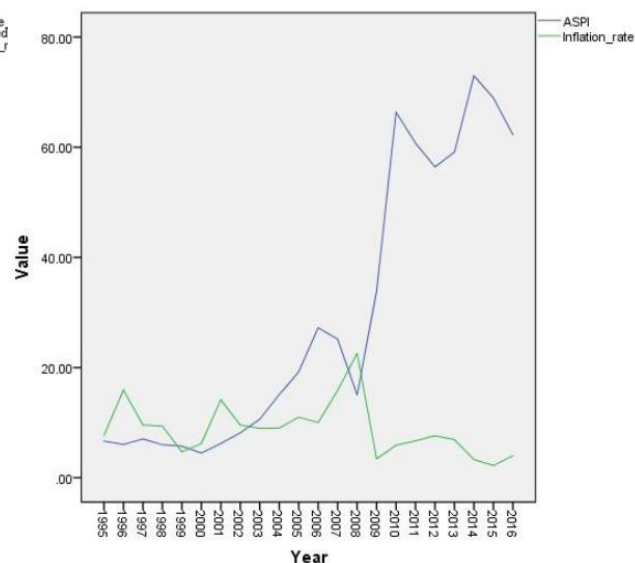


Figure 3 ASPI and Inflation Rate



The analyzed graph shows that the deviations of Average Weighted Deposit Rate (AWDR) & Inflation Rate (IR) over the time period and the ASPI index movements have a negative effect, while ASPI inclined over the period of time the AWDR & IR has declined, hence we could imply that there is a negative effect on the ASPI from AWDR.

Market Liquidity, Size of Market and All Share Price Index (ASPI)

Figure 4 ASPI and Market Liquidity

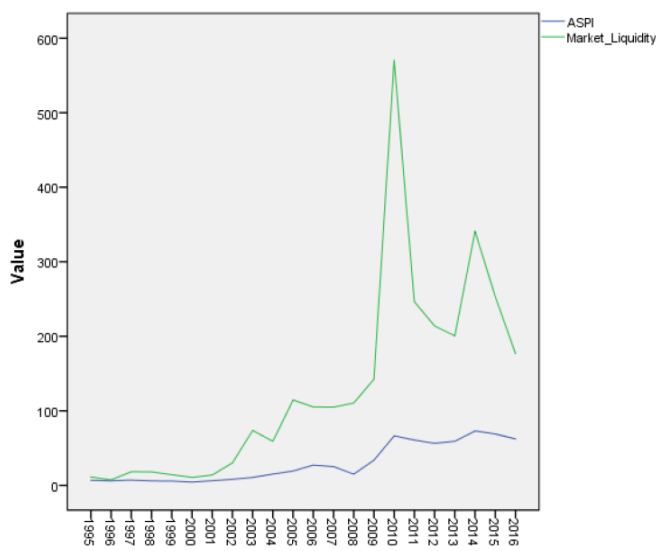
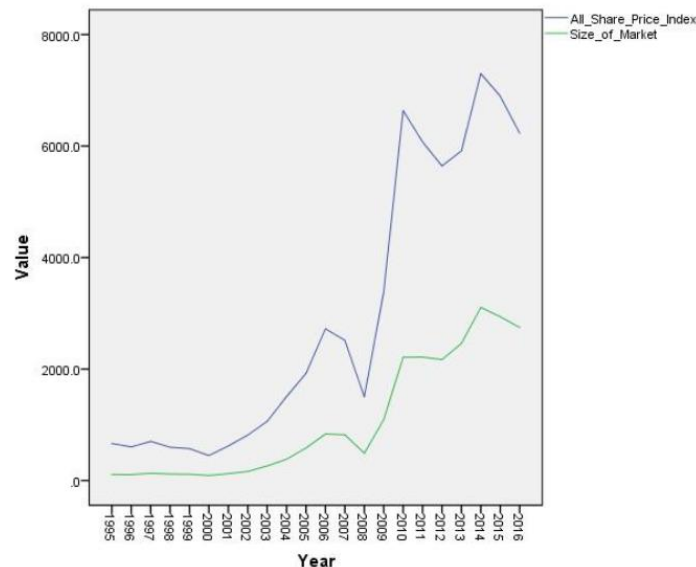


Figure 5 ASPI and Size of Market



The above multiple line graph indicates that the deviations of the Market Liquidity and Size of Market throughout the years has almost the same upward and downward movements throughout the years in line with ASPI. Therefore, it can be implied that Market Liquidity and Size of Market has an impact on the ASPI.

Regression Analysis

Table 1 Regression Model Summary

Model Summary				
Model	R	R Square	Adjusted Square	Std. Error of the Estimate
1	.997 ^a	.994	.992	223.6584
a. Predictors: (Constant), Inflation rate, Market Liquidity, Average Weighted Deposit rate, GDP at current market prices, Size of Market				

The regression model is explained 99.2 % of variation out of total variabilities since the adjusted R Square value is 0.992.

Table 2 ANOVA

ANOVA^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	136231440.700	5	27246288.140	544.674	.000 ^b
	Residual	800369.161	16	50023.073		
	Total	137031809.900	21			
a. Dependent Variable: All Share Price Index						
b. Predictors: (Constant), Inflation rate, Market Liquidity, Average Weighted Deposit rate, GDP at current market prices, Size of Market						

According to Table 2, it can be clearly identified that the overall model is significant at 5% level of significance as the p-value is less than 0.05.

Table 3 Coefficients

Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	495.981	251.837		1.969	.066
	GDP at current market prices	-.092	.080	-.136	-1.160	.263
	Market Liquidity	2.845	.815	.153	3.489	.003
	Size of Market	2.336	.341	1.003	6.851	.000
	Average Weighted Deposit rate	-5.361	28.071	-.005	-.191	.851
	Inflation rate	4.593	14.518	.009	.316	.756
a. Dependent Variable: All Share Price Index						

Table 3 shows the impact of independent variables on all share price index; considering the following hypothesis:

Results reveal that there is a significant impact of Market Liquidity and Size of Market on All share Price Index at 5% level of significance while GDP at current market price, Average Weighted Deposit Rate and Inflation Rate were insignificant factors.

Conclusions and Recommendations

Through this study, the stock market indicators and key macro-economic variables have been evaluated in order to identify the impact or the relationship of the economy in Sri Lanka on the stock market operation using variables of stock market indicators and key macroeconomic variables of the past 20 years.

According to the descriptive analysis done regarding the movement of the ASPI (ASPI) and GDP at current market price using a multiple line graph it was shown that there was no positive or negative impact, Market Liquidity & Size of Market has a positive impact while Commercial Banks Average Weighted Deposit Rate and Inflation Rate has a negative impact. According to Apergis & Eleftheriou (2002), it was identified that despite the close relationship between inflation and interest rates, stock prices are influenced by inflation but not by interest Rates. It strengthens the above result. According to the Coefficient test results GDP at Market price, Commercial Banks AWDR, Inflation Rate has no significant impact on the ASPI, Market Liquidity and Size of Market had a significant impact.

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**FACTORS AFFECTING EMPLOYEE MOTIVATION IN PLASTIC INDUSTRY IN
SRI LANKA: AN EMPIRICAL STUDY IN KURUNEGALA DISTRICT**

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Abstract

The plastic-based manufacturing industry is a significantly large industry in Sri Lanka that provides direct and indirect employment for thousands of skilled and non-skilled labour. This study investigated factors affecting employee motivation in plastic industry in Sri Lanka. The population under this study included operative employees working at plastic manufacturing companies in Kurunegala district, of whom 100 operative employees were included randomly in the research sample. A questionnaire was used to collect primary data through face-to-face interviews. Collected data were analyzed by descriptive and inferential statistics including linear regression. Results mainly highlighted that incentives, working conditions and gender are the significant factors contributing to employee motivation. Findings of this research will be helpful for the Sri Lankan manufacturers in plastic industry in implementing strategies to motivate their employees to reach performance standards.

Keywords: Employee motivation, Plastic industry, Incentives, Working conditions

Introduction

Successful manufacturing industry is the key for a sustainable development of a country (Rajala, Westerlund and Lampikoski, 2016). The Sri Lanka Export Development Board (2017) states that plastic processing is a flourishing industry in Sri Lanka for over 45 years. A total sum of Rs.15 billion has been invested in plastics processing in Sri Lanka. The capacity of local plastic processing industry at present is nearly 140,000 MT per annum with an annual average growth rate of around 10%. – 12%. Some of the major export markets for Sri Lanka include the United States, United Kingdom, Japan, Bangladesh and India. The country is still at a preliminary production stage, and it is only beginning to seek out new opportunities and explore new markets (Sri Lanka Export Development Board, 2017).

Within the organizational context, human resource is the most valuable and indispensable factor essential to carry out the organizational functions smoothly, effectively and efficiently (Serasinghe, Anjalee and Athauda, 2016). Employee motivation is one of the important dimensions that managers need to increase effective job management amongst the employees within the organization (Ali and Ahamed, 2009). Motivation as stated by Ran (2009) is the “process that accounts for an individual’s intensity, direction, and persistence of effort toward attaining a goal”. For the better survival within the market while attaining competitive advantage, each manufacturer in this industry should have highly motivated employees who strive to attain high quality production (Patrick, 2012).

Plastic industry provides direct and indirect employment for thousands of skilled and non-skilled labour (Kahangamage and Mangala, 2005). According to the statistics of Annual

Surveys of Industries carried out by the Department of Census and Statistics in Sri Lanka in 2013 and 2016, total number of operative employees in plastic manufacturing sector (establishments with 25 or more people engaged) have been reduced from 9891 to 5146, resulting a high rate of labour turnover. Pradifa and Welly (2014) has stated that there is an influence of motivation against employee turnover. Therefore, this empirical study carried out with the aim of investigating the factors affecting employee motivation in plastic industry. It also evaluated the relationship between identified factors and employee motivation through a regression model. The findings of this research will be helpful for the Sri Lankan manufacturers in plastic industry in implementing strategies to motivate their employees to reach performance standards.

Methodology

Conceptual framework

Perry and Poirter (1982) and Hosseini (2014) in their studies have identified four factors, which may have an impact on employee motivation namely; working environment (WE), incentives (I), gender (G) and marital status (MS). It hypothesized that these four factors have a significant effect on employee motivation in plastic industry in Sri Lanka. Therefore, this study employed working environment, incentives, gender and marital status as independent variables and employee motivation as dependent variable.

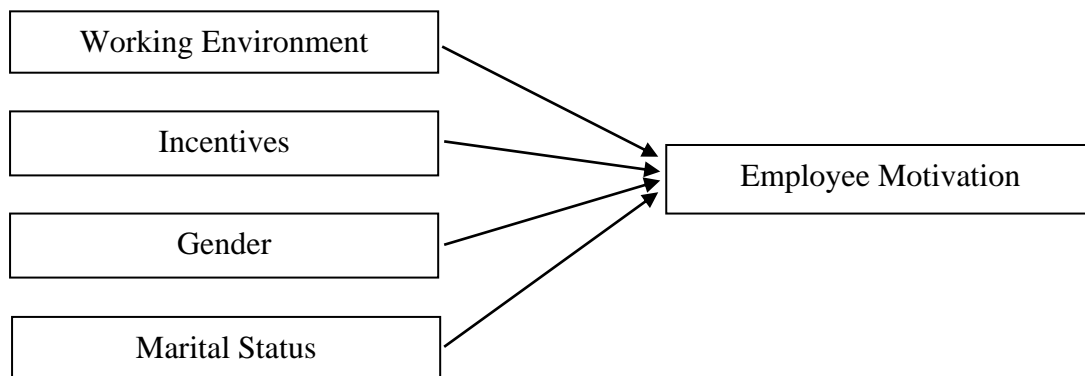


Figure 4: Conceptual framework

Study Area and Data

Due to convenience and limited time and resource availability, Kurunegala district was selected as the study area for this research. The study based on the primary data collected from operational level employees working at plastic manufacturing companies located in Kurunegala district. Out of five companies (with 25 or more people engaged), data were collected from 100 operative employees (20 employees from each company) selected by simple random sampling technique. A structured questionnaire was used to collect data via face-to-face interviews carried out from April to May 2018. Prior to the real survey, pilot survey was carried out in order to validate the questionnaire (n=10).

Data Analysis

Collected data were analyzed using both descriptive and inferential measures. Descriptive analysis was performed to summarize and to understand the demographic and other baseline information of the respondents. Multiple linear regression analysis was carried out using SPSS version 21, to develop a model, which represents the relationship between selected dependent and independent variables as denoted in equation 1. Moreover, since gender and marital status were categorical variables, dummy variables were created.

$$\text{Employee Motivation} = \beta_0 + \beta_1 WE + \beta_2 I + \beta_3 G + \beta_4 MS \quad (1)$$

Where,

$\beta_0, \beta_1, \dots, \beta_4$ – Coefficients

WE – Working Environment

I –Incentives

G – Gender

MS – Marital Status

Results and Discussion

Descriptive Statistics

Out of the total number of respondents, most of them were males (61%) and 57% of the employees were married (Table 1).

Table 1. Descriptive statistics

Variables	Category	Percentage
Age	<20	20
	21- 25	25
	26-30	1
	31-35	33
	36-40	16
	>40	5
Marital status	Married	57
	Single	43
Gender	Male	61
	Female	39
Experience	<2 years	68
	2-5 years	24
	>5 years	8

Majority were under the age group of 31 - 35 years (33%). Only eight percent of the respondents had more than five years of experience while, the majority had less than two years of experience (68%).

Regression Analysis

The model summary of the multiple regression in table 2 shows that 57% of the employee motivation is explained by the selected variables (Adjusted R square = 0.57).

Table 2. Model Summary

Model	R	R Square	Adjusted R Square
1	.232 ^a	0.71	0.57

The results of the regression analysis are displayed in table 3, including estimated regression weights (coefficients), standard errors and p-values for all the selected factors.

Table 3. Results of Regression Analysis

Variables	Coefficients	Std. Error	P value
Constant (β_0)	2.895	0.847	0.001
Working Environment	0.106	0.160	0.011
Incentives	0.288	0.137	0.038
Marital Status (Married)	-0.172	0.130	0.189
Gender (Male)	0.280	0.233	0.023

*Dependent Variable: Employee motivation,
Significance Level = 0.05*

According to Table 03, working environment, incentives and gender were significant factors for employee motivation while marital status was not a significant factor. All the significant variables had positive relationships with employee motivation. Based on the results, the following model was developed to express the relationship between selected variables and employee motivation (equation 2).

$$\text{Employee Motivation} = 2.895 + 0.106 \text{ WE} + 0.288 \text{ I} + 0.280 \text{ G (Male)} \quad (2)$$

Interpretations

At 95% confident level, keeping all the other variables as constant, if quality of working environment increase by one unit, employee motivation would be increased by 0.106 units and if incentives increase by one unit, employee motivation would be increased by 0.288 units. In addition, male employee's motivation is 0.28 units higher than that of females.

Conclusions and Recommendations

Employee motivation is highly important for every company due to the benefits that it brings including increased employee commitment, improved employee satisfaction, improved employee efficiency and competency development.

This study investigated the factors affecting employee motivation in plastic industry in Sri Lanka. Overall findings of the study contribute to the fact that, employee motivation significantly and positively related to incentives, quality of working environment and gender,

which is compatible with the previous studies carried out by many scholars such as; Perry and Poirter (1982); Hosseini (2014) etc. The sharing of a company's profits gives incentive to employees to produce a quality product, perform a quality service, or improve the quality of a process within the company. Money is effective when it directly tied to an employee's ideas or accomplishments. Nevertheless, if it is not coupled with other, non-monetary motivators, its motivating effects are short-lived. Further, monetary incentives can prove counterproductive if it is not made available to all members of the organization. Therefore, manufactures in plastic industry can follow a performance based pay structure. Moreover, they can provide overtime payments for the employees who work at extended working hours. The employees who successfully complete extra tasks and who hold higher level of responsibility can be paid with bonuses at festival seasons. Non-monetary positive motivators foster team spirit and include recognition, responsibility, and advancement (Onanda, 2015). Job enlargement and job enrichment can be practiced among employees, giving more duties and responsibilities for them respectively.

Promoting participatory environments and treating employees with fairness and respect will find their employees to be highly motivated. In order to set up a friendly working environment, collective activities can be conducted within the work place, such as staff get-togethers, annual trips, celebrating cultural and religious activities, parties etc. Through these activities employees will create positive peer groups and will feel relaxed and make their working environment a friendly one. Companies that have instituted flexible employee arrangements have gained motivated employees whose productivity has increased (Patrick, 2012). Programs incorporating flextime, condensed workweeks and job sharing can be implemented successfully for the motivation of overwhelmed employees. Moreover, safety should be prioritized at workplace, as most of the individuals who work in the plastic manufacturing industry have to operate dangerous machines and equipment.

Further studies can be carried out to analyze the impact of different types of incentives on employee motivation. In addition, research opportunities are available for young researches on testing the research framework for other manufacturing industries in Sri Lanka.

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FACTORS AFFECTING CUSTOMER SATISFACTION AT PINNALANDA HOTEL

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Abstract

The hotel industry is a huge industry which generates a massive amount of income to the country, provides employment for hundreds of people and satisfies locals and migrants. This study investigated the factors affecting customer satisfaction at Pinnalanda Hotel situated in Kegalle. The population of this study was 70, which considered average amount of lodged customers at the Pinnalanda Hotel per week. A structured questionnaire was distributed to collect data and collected data were analyzed by descriptive and inferential statistics including correlation analysis. Results mainly emphasized that price and payment and location are the significant factors contributing to customer satisfaction. Findings of this research will be helpful for the management in Pinnalanda hotel in implementing strategies to boost the customer satisfaction.

Keywords: Customer satisfaction, Pinnalanda hotel, Price and payments, Location

Introduction

Customer Satisfaction is defined as a psychological concept that involves the feeling of well-being and pleasure that results from obtaining what one hopes for and expects from appealing products and services (Caruana, 2002). Berkman (1986) highlighted that the customer satisfaction is important for all business entities for establishments and some it influence the repeat visit or purchases, positive word of mouth, publicity and recommendations. Customer satisfaction with the hotels involves many elements, such as the ambience of the hotel and hospitality of the service provided to the customer (Choi and Chu, 2001). High quality service and enhancing customer satisfaction are widely recognized as important factors leading to the success of companies in the hotel, catering and tourism industries. According to Gnanapala (2014), location, price and payments, hospitality, food and beverages, accommodation, security and safety and design and maintenance are some of the factors that has been affecting customer satisfaction in hotel industry.

Thangadurai (2017) states that price fairness is the best predictor of customer satisfaction and it positively influences service value. Chen, et al. (2015) in his research found that there is a non-linear correlation between the hotel price and guest satisfaction. Kumar and Bhanthnagar (2017) investigated that food quality has a strong relation with customer satisfaction. The findings of Guptha (2015) indicate that food is a favorable factor that affect directly to customer satisfaction in hotels. The research of Qu and Ozturk (2008) indicated that all of the images of locations had a significant impact on tourists' perceived value and tourists' expectations. A study aimed to examine the factors affecting customers' satisfaction with three star hotels of Dubai revealed that location as one of the main factor that affect the reviewers' satisfaction (Darini and Khozaei, 2016). Poon and Low (2005) indicate that

customers perceive hospitality as an influential factor in determining the overall satisfaction level.

This study focus on the customer satisfaction at Pinnalanda Hotel situated in Kegalle. The hotel has a need to increase the amount of positive reviews on their website and social media platforms and it believes that it can be done only through enhancing customer satisfaction. Therefore, this study aims at identifying most affecting factors for customer satisfaction at Pinnalanda Hotel and the findings of this research will be helpful for the hotel in implementing strategies to enhance customer satisfaction.

Methodology

Conceptual framework

Four factors were identified which may have influence on customer satisfaction, namely; Price and payment, food and beverages, location and hospitality.

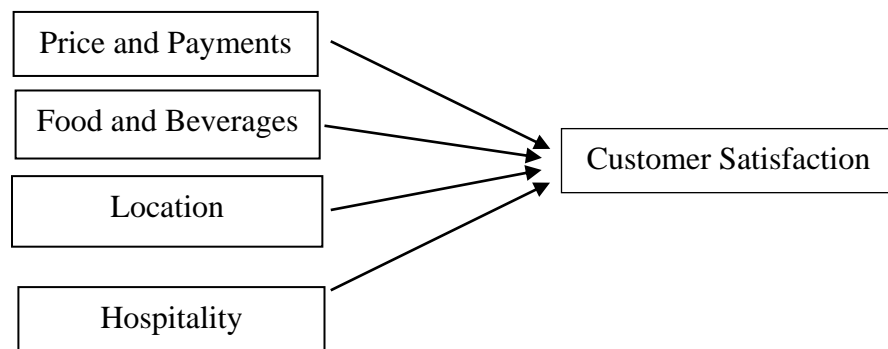


Figure 5. Conceptual Framework

Hypothesis

Price and Payments

H0; There is no any significant relationship between the ‘Price and Payments’ and customer satisfaction

H1; There is a significant relationship between the ‘Price and Payments’ and customer satisfaction

Food and Beverages

H0; There is no any significant relationship between the ‘Food and Beverages’ and customer satisfaction

H1; There is a significant relationship between the ‘Food and Beverages’ and customer satisfaction

Location

H0; There is no any significant relationship between the location and customer satisfaction

H1; There is a significant relationship between the location and customer satisfaction

Hospitality

H0; There is no any significant relationship between the hospitality and customer satisfaction

H1; There is a significant relationship between the hospitality and customer satisfaction

Study Area and Data

The study based on the data collected from the customers lodged at Pinnalanda Hotel. Due to limited time and resource availability, the average number of lodged (rooms) customers per week at Pinnalanda hotel was taken as the study population, which is 70. Sample size was 59, which was calculated using the sample size calculator. A structured questionnaire was used to collect data via face-to-face interviews carried out from July to August 2018. The questionnaires were distributed by visiting the Hotel 6 times within a week. Therefore, the 6 days of the week are fairly chosen using simple random sample, a raffle draw. Prior to the real survey, pilot survey was carried out in order to validate the questionnaire (n=10).

Data Analysis

Collected data were analyzed using both descriptive and inferential measures. Descriptive analysis was performed to summarize and to understand the demographic and other baseline information of the respondents. A correlation analysis was carried out to emphasis the relationship between the customer satisfaction and selected independent variables. Both descriptive and inferential analysis were carried out using the SPSS version 21.

Results and Discussion

Descriptive Statistics

Out of the total number of respondents, majority were male respondents (53%) and 68% were salaried respondents. Most of the respondent were people from other countries (83) and the rest are from Sri Lanka (17).

Table 4. Descriptive Statistics

Variables	Category	Percentage
Gender	Male	53
	Female	47
Occupation	Salaried	68
	Self-employed	17
	Students	8
	Other	7
Country	Sri Lanka	17
	Other	83

Correlation Analysis

Table 2 to 5 represent the results of the correlation analysis.

Table 5. Price and Payments

Variables		Customer Satisfaction	Price and Payments
Customer Satisfaction	Pearson Correlation	1	-.260*
	Sig. (2-tailed)		.047

	N	59	59
	Pearson Correlation	-.260*	1
Price and Payments	Sig. (2-tailed)	.047	
	N	59	59

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6. Food and Beverages

	Variables	Customer Satisfaction	Food and Beverages
	Pearson Correlation	1	.151
	Sig. (2-tailed)		.254
	N	59	59
	Pearson Correlation	.151	1
Food and Beverages	Sig. (2-tailed)	.254	
	N	59	59

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4. Location

	Variables	Customer Satisfaction	Location
	Pearson Correlation	1	.292*
	Sig. (2-tailed)		.025
	N	59	59
	Pearson Correlation	.292*	1
Location	Sig. (2-tailed)	.025	
	N	59	59

*. Correlation is significant at the 0.05 level (2-tailed).

Table 5. Hospitality

	Variables	Customer Satisfaction	Hospitality
	Pearson Correlation	1	.110
	Sig. (2-tailed)		.409
	N	59	59
	Pearson Correlation	.110	1
Hospitality	Sig. (2-tailed)	.409	
	N	59	59

*. Correlation is significant at the 0.05 level (2-tailed).

Significance of the factors were checked at 95% confident level, where all the factors with p values less than 0.05 had a significant correlation to customer satisfaction. Out of the four selected factors, price and payments ($p = 0.047$) and location ($p = 0.025$) were significant factors for customer satisfaction. Therefore, price and payments and location of the hotel has significant relationships with customer satisfaction in Pinnalanda Hotel.

Conclusion and Recommendations

This survey was conducted to find out the main factors that affect customer satisfaction at Pinnalanda Hotel. Customer satisfaction is a term frequently used in marketing and customer satisfaction is further defined with past literature as the result of the first objective as it is a

measure of how products and services supplied by a company meet or surpass customer expectation. Overall findings of the study contribute to the fact that, there are two factors which affects Customer Satisfaction of Pinnalanda hotel namely; price and payments and location. Moreover, all the objectives were fulfilled by conducting the research and as recommendations, the hotel can take steps to control the price of food and beverages and accommodation in a favorable manner to the customers and to enhance the scenic view of hotel premises in order to provide more customer satisfaction. Further research can be conducted on price of goods and services and payment structure of the hotel, and also on the location of the Pinnalanda hotel, so that the findings will be more precise than what was found by the current research.

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THE ROLE OF GREEN MARKETING AND HOW IT EFFECTS ON CONSUMERS IN FMCG SECTOR

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Abstract

The research study is on green marketing but exactly on customer's preference & the factors that effect on purchasing an eco-friendly product. It has been the universal apprehension for the purpose of the protection of the poisoning and degradation of environment. This research has been undertaken to explore the importance of green marketing and relationship to the attitude and purchasing behaviour of the consumers of eco- friendly products.

The objective of this research was looked into and travelled the persuading of the four old-style marketing-mix elements, satisfaction and purchasing intentions of consumers on environmental products precisely fast moving consumer goods (FMCG) or non-durable ones. The determination of the study was to obtain data from consumers' point of view. A qualitative questionnaire was divided among sub groups cover 10-15 respondents who live in Dehiwala Mt Lavinia. Furthermore, convenient sample was used as the sampling method. Our results showed that how customers are satisfied or their preference of green marketing and the factors that influence a customer to purchase a green brand such as; benefits, point of purchase (POP) & certification

However, those positive insolences towards green products do not always lead to action buying of these products.

Key words; Green consumers, Green pricing, Green product, Green promotion and Green marketing

Introduction

As an entire society focuses more on the environment and recognizes itself as a green consumer group, companies try to organize their work more greenly. However, it seems to be not easy: many problems are a challenge for them. Here, without being exhaustive, this research is looking to some of these problems, which should be handled by marketing managers. Green marketing has rose attention due to the environmental deterioration and it becomes global problem. According to American Marketing Association Green Marketing interprets three definitions; "Product development and marketing is the product of the sales of products that are susceptible to environmental degradation", "product development and marketing are designed to reduce negative impacts or improve the quality of the product", and "environmental problems Organization that manufacture, promote, pack and refinish products that are sensitive or responsive attempts " (Bui, 2011)

Background of the study

The Fast Moving Consumer Goods industry covers the everyday stuffs that you purchase when shopping in the supermarket or a pharmacy. 'Fast moving' indicates that the items are quick to

leave the abandons and also tend to be high in volume but low in cost stuffs. The products are ones that are important stuffs that we use daytime in and daytime out. This multi-million-dollar sector holds some of the most well-known brand tags that we come through every single day. FMCG companies are identified by their capability to give the consumer the products that are highly demanded, while also emerging a relationship with them that contains trust and loyalty. FMCG is the majority of household appliances used in cleaning and washing machines, most of the recyclable pharmaceutical, food and personal care services. However, fast-moving consumer goods, such as plastics, stationary, pharmaceuticals and consumer electronics, have been placed.

Green marketing has rose attention due to the environmental deterioration and it becomes global problem. At present, Green Marketing interprets three of the American Marketing Association (AMA) (marketingpower.com). "Product development and marketing is the product of the sales of products that are susceptible to environmental degradation", "product development and marketing are designed to reduce negative impacts or improve the quality of the product (definition of social marketing) and, finally," environmental problems Organization that manufacture, promote, pack and refinish products that are sensitive or responsive Attempts " (H. Bui, 2011)

Companies have using green marketing for many reasons such as green policies are profit-making; the business world is more and more implicated in the social responsibilities. Furthermore, consumers have been changing of attitudes and due to the government and the competitive pressures it is essential for firms to consider the “green” adjective to marketing strategies.

Research Problem and Questions

- How customers’ preference associated with the role of green marketing?
- What are factors that influence the consumer to purchase green brands?

Research Objectives

- To identify the consumer preference towards green marketing.
- To identify the factors that influences consumer to purchase the green brand

Methodology

The target population of this research are the people including male and female between the age group of 15-65 in Dehiwala Mount Lavinia includes 7 areas such as Dehiwala, Mount Lavinia, Attidiya, Kalubowila, Kohuwala, Nedimala and Ratmalana. The sample size of the target population 10 - 15 people by taking 3 groups each 5 people.

Dividing the whole population into different strata or sub- groups helps to gather relevant information for this research. For this research Convenience Sampling method can be used. Primary data and secondary data which is gaining from the sample of the population will be used in order to analyse the research problem mostly.

Through a questionnaire which consist of open ended question will be used to do the survey as the research goes as a qualitative approach. To distribute questionnaire interviews, face to face discussions with FMCG consumer's manual methods have been used. The research is modified through descriptive and casual methodology.

Result

The identify the consumer preference towards green marketing

This study tries to investigate the number sources of consumer's concern or the level of preference towards green products and its impact on purchasing decision. People feel satisfied when they contribute towards eco/green products, because many people aware of the plastic problems and disposing problems in many countries. But in Sri Lanka, still green concept is a new concept. However, this research has found that there is a growing preference on green products and out of the sample; the youth, age between 15-24 ,60% of respondents have given their preference, thinking the potential aspects of usage such as; recycling, health consciousness & low energy usage. Due to above said potential options, there is a growing preference specially from youth category. Meanwhile promotion plays a vital role in terms of generating customer preference towards green Most of customers would purchase eco-product with the trend of being friendly to the environment. But while revelling other facts that was contradictory where customer would purchase the product in order to showcase their social status or because of its' real benefits. Organisations have e used different kinds of method where the product can be promoted via paperless system; such as e-marketing, digital marketing, social media marketing, word of mouth etc. Through the research it has revealed many of customers have exposed for more e-massages than physical massages

Factors that influence customer to purchase a green brand

This research reveals; benefits, point of purchase & certifications are the main factors that influence customers to purchase a green brand. Thus benefits will be one of the main factor which customers will look whether the product has been made using natural ingredient. Point of purchase (POP); such as eco-friendly materials, physical arrangements of shelves, colour combinations are some of the examples revealed from customers. Physical layout needs to be more attractive when stimulating customer's attention towards green concept. Certifications give a glamour to the green product as when a third party has been recognized the product as a green product, it can be used as one free advertising tool to attract customers. In hear, customers do not only think about the product itself but also the quality of the production process, quality of raw materials, overall total quality management and the distribution are some of factors which can be taken to certify.

Conclusion

As an environmental issue continue to affect human activities, society is now regards them with much concern. Most companies have started using supportable growth framework which is known as green marketing and most of the organizations have recognised green products which are ecologically friendly. Advertising supervisors can use green marketing to

receive incomes. In count, green marketing is clever to reservation the atmosphere while nourishing customers' needs. Consequently, green marketing is a device now used by many companies to increase their modest advantage as people is presently very anxious about environmental issues. In the time spread over green marketing, the companies have to obey with the consumers' needs and wants. Consumers want to identify themselves with corporations that are green compliant and are willing to pay more for a greener life style. For this reason, green marketing is not only an eco-friendly shield tool but also a marketing strategy. Other than that, marketers can offer training to their workers, especially sales representative. This is to give them knowledge on how to endorse the green product efficiently by evidently hand over the main message to the consumers.

Recommendation

Green awareness is on the rise, and the demand for eco- friendly products is developing. At the same time, buyer prospects are also receiving bigger. All consumers remain primarily worried with finding products that are the right balance of quality and price. Through better marketing of environmental and green benefits and by violent pricing, producers and marketers will be best able to position their products and gain market share in this important new segment. The study recommends that pro-environmental nervousness is a likely judge of green buying behaviour. Also, consumers wish for eco- friendly products and therefore the right mix of eco-friendly products and facility, promotion, PR and organization know-how is needed to target and fascinate the consumers who may be ready to buy eco- friendly products

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IMPACT OF JOB STRESS ON WORK PRODUCTIVITY: A STUDY ON TRAVEL EXECUTIVES OF SRI LANKA

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Abstract

Job stress has become a huge challenge in the present business world. The majority of the employees have become the victims of job stress due to many reasons. The main aim of this study is to identify the impact of job stress on work productivity and the main causes of stress in a workplace. This study is based on the Travel Executives of Sri Lanka with reference to four travel agencies and the researcher has selected 80 participants to conduct the research. The results of this study indicate the selected work-life stressors (over workload, supervisor assistance, unrealistic goals, short deadlines, excessive responsibilities and constant changing policies) has no significant impact on the job stress level of the employees. The findings of the study exhibits that there is low negative relationship between the selected work-related stressors and the job stress level. The employee productivity is not completely affected by work-related stress.

Keywords: Job stress, Stressors, Work productivity

Introduction

Background of the study

Travel and Tourism is a significant economic activity in Sri Lanka. The direct contribution of this industry to the GDP of Sri Lanka in 2016 was, LKR 631.8bn and total contribution was, LKR 1,405.4bn. The investments of this industry in 2016 was, LKR 129.4bn, 4.0% of total investment. And 10.7% of total employments are supported by the travel and tourism industry. (Turner, 2017) The travel and tourism industry of Sri Lanka consist of approximately 900 travel agencies. From that the majority of travel agencies are located in the Colombo district, which is the commercial capital of Sri Lanka. Hence, the researcher has chosen 4 reputed travel agencies in Colombo to conduct the research.

The job role of a Travel Executive

Further to the work experience of the researcher, a travel executive's job is not a nine to five job. The employee should always stay alert and must be capable to work even after work hours. Some of the main job functions of a travel executive are, arranging and booking travel and accommodation options for customers according to their interest, preparing and collecting required documents for visa purposes, find alternative travelling/ accommodation options in case of a flight or hotel cancellation, settling payments and etc. All the air ticket and hotel reservations should be made through the GDS system. In these systems there are rules that the travel executives should not breach. If these rules are violated the relevant airline sends an Agency Debit Memo informing the particular employee to make a cash payment accordingly. Which is commonly known as a "mistake" of the travel agent. This cash payment is usually omitted from the employee's salary. The above mentioned job

functions should be done for many walk-in clients and corporate clients, hence there is enough space for an error to take place due to the work pressure.

A travel executive should always maintain a good work relationship with service providers and their clients. By maintaining a good relationship with the service providers they can get priority in seat booking, solving reservation issues and complicating date changes and re-routings. Which will assist the travel agent to provide better travelling options to their clients. However, creating a good work relationship with these two parties are not easy. Because, both parties expect the travel agent to give them more priority than others. This is not an easy task for a travel agent because, he must prioritize his work with the time schedule. According to the research of Ekienabor Ehijele E (2016), using 40 respondents from the academic staff clarifies that job stress has an impact on employee productivity and commitment. A case study of Ghana Ports and Harbours Authority, Takoradi handled by Dwamena (2012) in relevant to stress and employee productivity confirms that stress has an effect on employee productivity.

Though there were many research done on this topic for different industries there is a research gap for the selected sector.

Research Questions

The following research questions will be answered in this study:

- I. Does job stress have an impact on work productivity?
- II. What are the main factors that cause stress?
- III. What are the recommendations to overcome the job stress from HR perspective?

Research Objectives

The aim of this research is to achieve the below objectives:

- I. To investigate the impact of job stress on work productivity.
- II. To identify the main factors that cause job stress.
- III. To recommend new strategies to overcome the job stress from HR perspective.

Research Methodology

Based on this study, all the travel executives who are currently employed in travel agencies of Sri Lanka can be identified as the population. In 2016 the travel trade directly supported 406,000 jobs which was expected to increase from another 3.6% in 2017. (Turner, 2017)

The researcher has chosen four top travel agencies to conduct the research out of all travel agencies in Sri Lanka. They are, NR Travels and Tours, H Travels, FM Travels and C Travels. A total of 450 employees are presently working as travel executives in the above mentioned travel agencies. The sample size of this research is 80 employees from all four travel agencies. The groups are divided as follows.

Table 1: Sample size

Company Name	Number of selected employees
NR Travels	15 employees (80/450 * 80)
H Travels	18 employees (100/450 * 80)
C Travels	21 employees (120/450 * 80)
FM Travels	26 employees (150/450 * 80)

The researcher has chosen the stratified sampling method to obtain data from the sample size and it is divided into four subgroups. The primary data has been collected through the distribution of a questionnaire. In order to collect the required data the researcher decided to use a questionnaire which was emailed and handed over to the travel executives. Also, the researcher decided to conduct interviews of employees through telephone conversations and face-to-face meetings.

The questionnaire includes 17 main questions and the researcher has mainly used close ended, dichotomous and Likert scale types of questions. The close ended questions were used to identify the demographic factors of the sample. Such as age, gender, organization and etc. The dichotomous questions are used to avoid the middle or the neutral perspective on some important factors such as work pressure, organization's preference, conflicts and etc. By using the Likert scale questions the researcher intends to understand the relationship between job stress level and six independent variables work load (WL), comprising work not matching skills (WNMS), achievable targets (AT), short deadlines (SD), supervisor assistance (SA), and constant changing policies(CCP).

Data Analysis and Presentation

These areas of the research article consist of the results identified by conducting the research. According to results of the descriptive analysis, there are 42 male participants and 38 female participants in the study. Moreover, there were four age groups mentioned to identify the age level of the employees. The majority of the employees belong to the age group of 19-29 years and the rest of the employees belong to the age group of 30-39 years. Also, as per the data collected there are no travel executives at the age of 40 years or above.

As per the results of the data sheet, 29 employees have rated their job stress level as 4 out of 5. Which is also the highest stress level. The second highest stress level is 3. 28 employees have rated 3 as their job stress level. From the 80 participant's majority have rated the job stress level as very high. The mean value is 3.71 which is above average. This clarifies the job stress level of travel executives are also above the average level.

From the 80 participants, 59 employees have mentioned that they constantly work under pressure and only 21 employees disagree. Also, the majority of all four travel agencies have confirmed on the same.

According to the results of correlation analysis, it can be seen that there were negative relationships between job stress and reasonable work load, job stress and achievable targets, job stress and sufficient time for tasks, and job stress and changing policies while positive

relationships can be identified between job stress and un matching work with skills and job stress and supervisor assistance (Table 2).

Table 2 Correlation of work life stress factors

		WL	WNMS	AT	SD	SA	CCP
Job stress level	Correlation coefficient	-0.122	0.074	-0.068	-0.207	0.015	-0.031
	Sig (2-tail)	0.282	0.513	0.547	0.066*	0.894	0.784
	N	80	80	80	80	80	80

Source: Authors' own

* Significant at 10% level

** Significant at 5% level

Further, the p-values, which are greater than 0.05 indicate that there, are no significant relationships existing between the job stress level and the selected work life stress factors.

Discussion

Even though a research conducted by Thilakasiri (2014) found that over workload, excessive responsibility, short deadlines, conflicts, unrealistic goals and the constantly changing policies have significant impact on stress, the insignificant relationship which has been identified in this study through the six variables, Therefore, the researcher comes to the conclusion that the stress that causes an impact on employee productivity might have occurred from personal life stress factors.

Personality issues describe the ability of an individual to handle stress. According to (Freidman, 2012) there are two main personality types that can be seen in each and every person. They are named as “Personality A” and “Personality B”.

The A type; tend to be time conscious and very much occupied with work. This category of individuals are very competitive and has a massive desire to achieve recognition, hence, they have a hyper awareness of time and prefer to finish their work as soon as possible.

The type B individuals focus mainly on here and now and much more laid back. They have a completely different perspective on advancement and achievements. Hence, type A individual tends to get more stressed than type B individuals.

The researcher strongly believes that the above mentioned personal life factors may have indirectly made an impact on the employee productivity of the travel executives in Sri Lanka. Also, there is a significant possibility that the travel executives are going through personal life stress due to their age. Further to the statistics on age, all employees fall between 19 years to 39 years. Which is an age period people go through a lot of changes in life.

Conclusion and Recommendations

In this research the researcher mainly focused on the work life stress factors to identify the impact of them on employee productivity. Even though the majority of employees rated their job stress level as 4 out of 5, according to the correlation only a weak negative relationship was discovered in relevant to the work life stress factors as summarized above. Hence, the researcher came to the conclusion that the stress the travel executives are currently going through is not mainly related to the work life stress factors but to the personal life stress factors.

Personal life stress can also create a huge impact on employee productivity. Which means the problems in your personal life can cause issues in your work life as well. Everyday challenges and the personality issues are main personal stressors in an individual's life. Everyday challenges are the stresses that you have to repeat each and every day. Endless traffic, unfriendly neighbours or a cheating spouse are some of the challenges an individual should face. By experiencing these stresses repeatedly people get used to them and find ways to survive.

To reduce the weak negative relationship to a moderate negative relationship, both the employer and the employee can follow different tactics to manage and reduce their stress level. In order to create a stress free working environment for the employees the organization can follow strategies such as, providing sufficient deadlines and resources, proper guidance, suitable work environment and also by recruiting a professional counsellor the employees will feel more safe and secure within the organization.

To avoid the personal issues that cause stress in your life the researcher recommends the readers to follow a stress management personal plan, which will make a person, feel more organized. Also, it is very important for an individual to learn how to say “no”. Sometimes an individual might feel that the burden on his shoulder is getting bigger and bigger, but since he is unable to refuse he can get stressed out. It is essential for a person to identify his limits and capabilities and stick to them.

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**EMPLOYER BRANDING: FACTORS ASSOCIATED WITH GRADUATES
BEHAVIOR AND ATTITUDES TOWARDS SELECTING AN EMPLOYER.**

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Abstract

Employer Branding (EB) can be understood as how an organization functions to place their 'brand image' in the mindset of their current and potential employees. EB is an important aspect of an organization since this directly has a link between the human resources and the profitability of the business. This study was conducted to identify the factors which are associated with employer branding and interest of graduates' behavior and attitudes towards selecting future employment. Data were collected through a structured questionnaire using 131 students; selected through convenience sampling. The respondents were students whom are completing or has completed their higher educations and seeking for a job opportunity. Ordinal Logit Analysis was used to identify the impact of factors associated with employer branding and interest of graduates' behavior and attitudes towards selecting future employment. The results indicate that Company Reputation and Work Environment have positive impact or towards applying for a Job.

Keywords: Employer Branding (EB), Human Resource (HR), Brand Image, Sri Lanka, Graduates, Behavior, Attitudes, Employment.

Introduction

Employer Branding can be explained as how the brand of an organization can influence an employee (potential and existing) to perceives or thinks about an organization in terms of the type of employees working, employment packages offered, organizational culture followed and business functions practiced within that organization. The branding concept came from the marketing tools that organizations has applied and later on this concept has been adapted by HR personnel after identifying its positive impact on businesses whom wanted to gain a competitive advantage over their competitors. (Parmar, 2014) Today, HR function has evolved the branding concept to attract, retain, train and develop their employees by creating an impressive employer brand image to capture the attention of potential employees.

According to Aldousarai, et al, (2017) organizations who has a strong Employer Brand image can offer a less incentive or benefit packages to graduates, compared to organizations who does not have a strong employer image. Although the graduates have the same qualification and skills, organizations have strong employer branding have been selected by graduates since they aspire to work in a company that represents particular values (Edwards, 2005). The literature found that an organization's internal culture, management practices, how they do business and treat their employees, shall help to create a strong perception about the organization in the mindset of potential employees (Backhaus & Tikoo, 2004).

Further, a research conducted by Malati, et al, (2012), on Employer Branding in IT Companies to find the ‘difference on perception’ between employees and students. It was found that there is a significant difference between how students and employees perceives on employee branding. Eventhough the flexible working hours was a factor considered by employer, students most preferred choices were a good reference for future career, international career opportunities, challenging work, good leadership and managment, and financial stability and strenght. Even though organizational culture, leadership, communication, decision-making, team working, motivation, and development associated with, job satisfaction, the conflict between the expectations of graduates and actual experiences may influence their satisfaction as well as their commitment (Jusoh, et al., 2011).

In Sri Lanka, different organizations are promoting and using to create awareness among potential future employees in relation to their company brand name. Many organizations are becoming recognized on international platforms for their contribution in using brand image in relation to HR practices (Employer Branding Awards, 2018). Since employer branding is playing with the mindset of how current and potential employees understand and behave towards a particular idea or concept. This research was focused on the reasons behind recruits selecting potential employers as per Employer Branding. Even though above companies has been recognized and awarded by Employer Brand Awards.

Research Questions

- What are the factors associated with employer branding and interest of graduate’s behavior and attitudes towards selecting an employer?
- What is the impact of these factors associated with preference among graduates to choose a company who is recognized under Employer Branding awards?

Research Objectives

- To find the factors associated with employer branding and interest of graduate’s behavior and attitudes towards selecting an employer.
- To find out the impact of these factors associated with preference among graduates to choose a company who is recognized under Employer Branding awards.

Methodology

A structured questionnaire was used to collect data. A set of five point likert scale questions were used to measure the independent variables such as Company Reputation, Growth Perspective and Work Environment. In order to measure the response variable, respondents were asked to rate their willingness to applying for a job at selected 12 organizations. These organizations were selected on the basis of being recognized as Best Employers in Sri Lanka in 2017 at employer Branding Awards. Convenience sampling method was chosen to select respondents as the sampling frame was not available. Data were collected from selected 131 students from different higher educational institutes in Sri Lanka.

A descriptive analysis was done to find out the most preferred two organizations among 12 organizations. Further, Ordinal Logit Regression was used to analyze the impact of exploratory variables on the response variable of willingness to applying for a job at selected

12 organizations since the ordinal nature of the response variable. Therefore, two ordinal logit models were run based on most preferred two organizations.

Results

Among the 131 respondents, there were 3 age groups participated in this survey. The age of respondents that took part were in between the age group of 16-25, 26-35 and 36-45 years. 125 respondents were in the age group of 16-25. There were 62 females and 69 male participants.

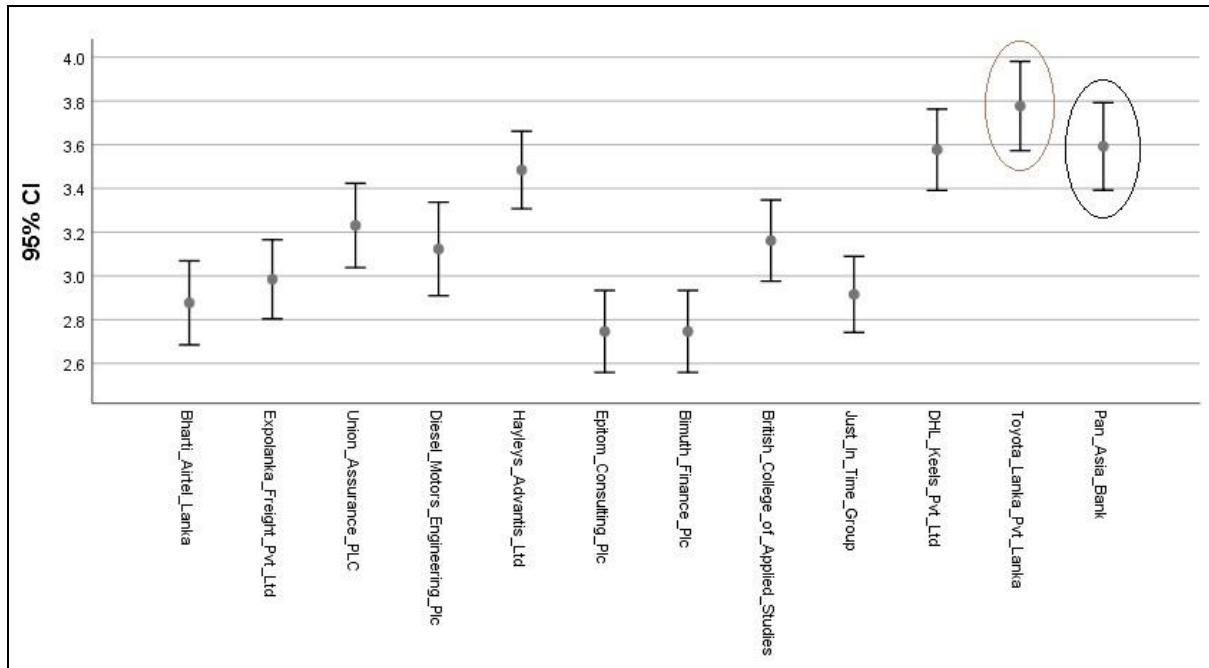


Figure 6 Preference for selected organizations

Figure 1 shows the preference levels for selected organizations. According to the results, it can be identified that most preferred two organizations among the respondents were Toyota Lanka and Pan Asia Bank. Most preferred two organizations were used to run ordinal logit regression in order to find out the impact of exploratory variables.

Table 1 Parameter Estimates - Toyota
Lanka

Parameter Estimates						
		Estimate	Std. Error	Wald	df	Sig.
Threshold	[Toyota Lanka Pvt Ltd = 1]	-0.205	1.773	0.013	1	0.908
	[Toyota Lanka Pvt Ltd = 2]	1.119	2.154	0.270	1	0.603
	[Toyota Lanka Pvt Ltd = 3]	2.319	2.955	0.616	1	0.433
	[Toyota Lanka Pvt Ltd = 4]	3.996	4.360	0.840	1	0.359
Location	Company Reputation (X ₁)	3.681	3.985	0.853	1	0.356
	Growth Perspective (X ₂)	-1.258	2.067	0.370	1	0.543
	Work Environment (X ₃)	1.282	2.279	0.316	1	0.574

Link function: Logit.

Even though, sig-values greater than 0.05 indicates that there is not any significant impact of independent variables, it can be observed that there is a positive impact of Company Reputation and Work Environment while Growth Perspective shows negative impact on applying for a job at Toyota Lanka (Table 1).

Therefore, the Ordinal Logit Model can be expressed for Toyota Lanka as dependent variable as follows:

$$\begin{aligned} \ln \left[\frac{\text{Prob}(Y)}{1-\text{Prob}(Y)} \right] &= -0.205 + 3.681X_1 - 1.258X_2 + 1.282X_3 \\ \ln \left[\frac{\text{Prob}(Y)}{1-\text{Prob}(Y)} \right] &= 1.119 + 3.681X_1 - 1.258X_2 + 1.282X_3 \\ \ln \left[\frac{\text{Prob}(Y)}{1-\text{Prob}(Y)} \right] &= 2.319 + 3.681X_1 - 1.258X_2 + 1.282X_3 \\ \ln \left[\frac{\text{Prob}(Y)}{1-\text{Prob}(Y)} \right] &= 3.996 + 3.681X_1 - 1.258X_2 + 1.282X_3 \end{aligned}$$

Table 2 Parameter Estimates – Pan Asia Bank

Parameter Estimates						
		Estimate	Std. Error	Wald	df	Sig.
Threshold	[Pan Asia Bank = 1]	-4.500	5.547	0.658	1	0.417
	[Pan Asia Bank = 2]	0.022	3.980	0.000	1	0.996
	[Pan Asia Bank = 3]	2.779	4.796	0.336	1	0.562
	[Pan Asia Bank = 4]	6.843	7.472	0.839	1	0.360
Location	Company Reputation (X ₁)	6.603	7.113	0.862	1	0.353
	Growth Perspective (X ₂)	-2.133	4.715	0.205	1	0.651
	Work Environment (X ₃)	0.062	4.471	0.000	1	0.989

Link function: Logit.

According to Table 2, it can be observed that the company reputation and work environment have positive impact on applying for a job at Pan Asia bank while growth perspectives show a negative relationship. However, it shows insignificant impact at 5% level since sig-values were greater than 0.05.

Therefore, the Ordinal Logit Model can be expressed for Pan Asia Bank as dependent variable as follows:

$$\ln \left[\frac{\text{Prob}(Y)}{1 - \text{Prob}(Y)} \right] = -4.500 + 6.603X_1 - 2.133X_2 + 0.062X_3$$

$$\ln \left[\frac{\text{Prob}(Y)}{1 - \text{Prob}(Y)} \right] = 0.022 + 6.603X_1 - 2.133X_2 + 0.062X_3$$

$$\ln \left[\frac{\text{Prob}(Y)}{1 - \text{Prob}(Y)} \right] = 2.779 + 6.603X_1 - 2.133X_2 + 0.062X_3$$

$$\ln \left[\frac{\text{Prob}(Y)}{1 - \text{Prob}(Y)} \right] = 6.843 + 6.603X_1 - 2.133X_2 + 0.062X_3$$

Discussion

According to the results, it can be identified that three factors have no significant impact on interest of graduates towards applying for a Job at the two companies. There were some negative figures which were found from the Ordinal Logit Analysis method run for Growth Perspective. This can be due to the answers given by respondent may be incorrect or bias and lack awareness on how these companies' places value in terms of EB.

According to a research done by Joo & Mclean (2006), had stated that the way that an organization's HR entity handles and functions the *HR philosophies, policies, and practices* impacts and indicates how an organization *HR reputation*. It can be found that HR has a high influence when it comes to creating and maintaining the employer brand image. Further, a research conducted by Khalid & Tariq (2015) using two companies, one who practices EB and the other who does not. The outcome of that research strengthens the outcome of this study since it was found that by a company who follows a positive EB practices can attract more potential recruits to a company rather than a company who does not acknowledge it.

Conclusion and Recommendations

According to the feedback given by the respondents via the open-ended questions, regarding why they preferred the company of their choice (Toyota Lanka and Pan Asia Bank). The feedbacks received mostly indicates that graduates are seeking to be employed at companies who offer; financial and nonfinancial benefits, the working environment and the workforce, interest in certain sectors (like financial and automobiles), employee development and growth opportunities, and most importantly companies known for a 'well reputation company', 'well known company' 'good brand image' 'excellent reputation' and 'brand advertising company'. All the feedbacks received by respondents indicates how an organization can impact and influence to attracting these potential employees. In order to reduce the conflict between employer and employee expectations, organizations need to enhance the role of HR in creating these perceptions on company's brand image. These feedbacks have an indirect and direct link to the HR practices and policies implemented to create a foundation around maintaining the employer brand name and image. Since then graduates and students are not the only subject to lay the study on employer branding and they may not have direct

relationship with organizations, this study creates an opportunity to further assess the topic of this research in future.

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**FINANCIAL DISTRESS AND BANKRUPTCY PREDICTION FOR HATTON
NATIONAL BANK, SRI LANKA**

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Abstract

Financial health is of great concern for any business firm. In modern world, Corporate failures are frequent within the financial sector which raises the need to employ models to predict financial distressed or bankruptcy state of the financial sector. This study has used two different methods to evaluate financial status of HNB bank plc. Using secondary data, which obtained from the published sources i.e. Annual report for the period of 5 years (2013 to 2017). Multivariate discriminant analysis (Altman Z-Score) and Univariate analysis (financial ratios analysis) were the two techniques used in this report for analysis. The study evaluates whether that the HNB bank has been maintained a stabled financial status with higher Z score than the benchmark along with positive financial ratios or not. The findings of the study may be useful for the stockholders to choose investment options and others to look after their interest in the concerned bank in Sri Lanka.

Key words: Financial distress, Bankruptcy, Altman Z score, Financial ratio analysis

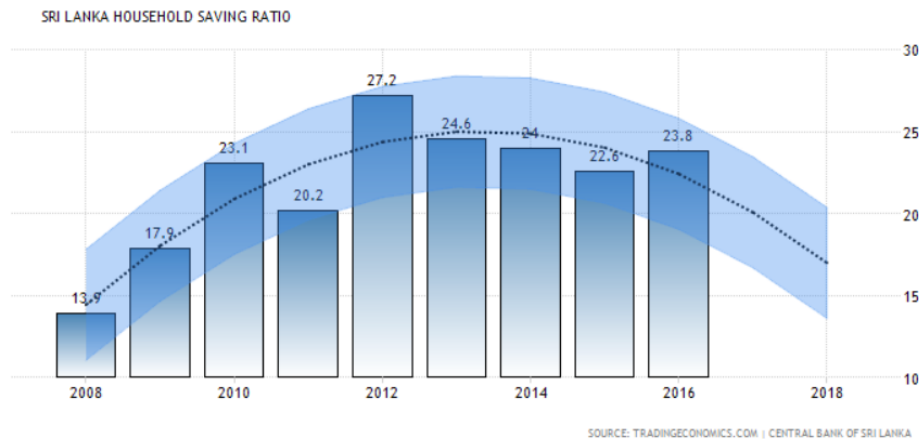
Introduction

In recent past, there have been many cases of corporate failures all around the world, companies becoming financially distressed or labelled totally bankrupt. The phenomenon is increasingly becoming worrisome in the banking industry. Collapse in Edirisingha Trust Investment is the most recent case experienced by Sri Lankan public investors and it arise the need of research financial stability of local banks.

Hatton National Bank PLC (HNB) has been a leader in the banking industry in Sri Lanka for 129 years, supporting the economic growth of the country. Approximately 2.5 Mn Shareholders and Investors in HNB use accounting information to make, buy, sell or keep decisions related to shares, bonds, and other assets. Therefore, judging the financial capacity of HNB delivers enormous information for the institutions and people around it. (PLC, 2017)

Objective of the research will be:

1. Measure fiscal fitness or credit-strength of HNB bank using Altman Z score formula and data of company financial statements.
2. Determine the sustainability of HNB financial position by analysing basic financial ratio values with their continuity and predict their future movements.



(Figure 1) Sri Lanka household savings ratio

Since 2012 Household savings of Sri Lanka is in a decline and this expected to be 23.00 percent by the end of this quarter (2018), according to Trading Economics global macro models and analysts' expectations. However, to increase the savings rate or investments, people should be encouraged through showing positive financial status of banks. (economics, 2018)

In this paper researcher, intend to look at two different approaches to assess the financial health of the firm and figure out whether there is any tendency of financial distress or bankruptcy of selected bank.

Early bankruptcy prediction provides company with the possibility of implementing urgent measures to limit the scope of such danger and eliminate it while its threat is not yet full-fledged. Further, this will help investors to assess the credit worthiness of the bank and give precautions to take necessary actions towards minimize risks such as credit risks.

Limitations

(Altman Z score model)

1. The models are not substitute calculations for the probability of default.
2. The models based on large companies and may not be appropriate for smaller companies that have much less than \$100 million in sales.
3. This provide only two meaningful outcomes, likely or not likely. Grey area is inconclusive.
4. The original model created over 40 years ago and based on a sample of 66 companies, each with assets over \$1 million. This sample base is outdated and the \$1 million minimum asset size of these sample companies are relatively small compared to today's large public manufacturing company assets.
5. The A and B models based on an outdated sample that are over 25 years old.

(Ratio analysis model)

1. The unavailability of all required detailed data in annual reports or websites.
2. Some elements of the balance sheet may be stated at historical cost; therefore, data selected for the study is only for a limited time period with the effect of inflation.
3. Different companies may have different policies for recording the same accounting transaction. For example, one company might use accelerated depreciation while another company uses straight-line depreciation, this could lead some misleads.

In 2014, Lim Hilman conducted a research on the bank bankruptcy prediction models based on financial risks and found discriminator variables as many as 27 financial ratios, and estimator variables as many as 20 financial ratios. Ihsan Ilahi (2005) has done a research on financial performance analysis of Pakistan banking sector using the Altman Z score model of corporate bankruptcy. It recommended so take decisions on multiple models like the report of State Bank of Pakistan and ratio analysis. However, taking decision on only Z score models is inaccurate.

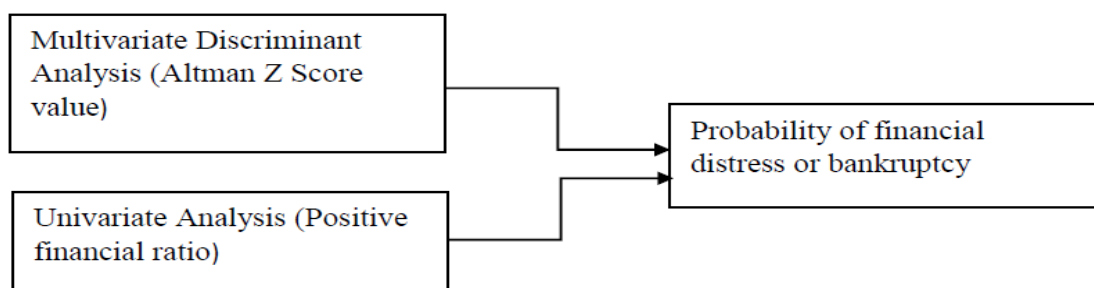
Most of the times researchers use Altman Z score to substantiate the results generated through ratio analysis. In 2011, Majumder and Rahman conduct a financial ratio analysis of selected pharmaceutical companies in Bangladesh. It concluded that the financial position and operational performance of the most of the selected pharmaceuticals were not satisfactory.

In 2014, similar research has done by Roli Pradhna with a topic of Z score Estimation for Indian Banking Sector and proved that, the trained BPNN has been able to forecast the Z-score values in approximation to the actual values suggesting that the BPNN has the ability to forecast the Z-score parameters financial ratios.

Methodology

In the past, researches related to probability of distress or bankruptcy has conducted in many occasions. There are several tools used as potential predictors, in previous models such as Beaver, 1966; Altman 1968; Deakin, 1972; Ohlson, 1980; Ding et al. In this way, 53 potential predictors are available as population of this research. (MICHAL KARAS, 2011)

The below model exhibits the variables that are involved in financial distress and bankruptcy prediction process of HNB bank. According to this conceptual model, different analytical tool such as multivariate discriminant analysis and Univariate analysis are the independent variables and probability of financial distress or bankruptcy can recognized as the independent variable



Data analysis tool

Model 01 (Altman Z score)

The Altman Z-Score is a linear financial model that used to predict the likelihood of corporate bankruptcy. There are three variations of the model. The original version, created in 1968, was intend for only large public manufacturing companies. In 1983, there was a model develop for private general firms and service companies (model B).

Model B (private general firms and services):

$$Z = 6.56 X_1 + 3.26 X_2 + 6.727 X_3 + 1.05 X_4$$

Where

X_1 = Working capital / Total assets

X_2 = Retained earnings / Total Assets

X_3 = Earnings before interest and taxes / Total assets

X_4 = Book value or equity / Total liabilities

X_5 = Sales / Total assets

Original	A	B	Likelihood of bankruptcy
> 3.0	> 2.9	> 2.60	Not likely
1.8 - 3.0	1.23 - 2.9	1.1 - 2.60	Gray area
< 1.8	< 1.23	< 2.60	Likely

Model 02 (financial ratio analysis)

Financial ratios derived from the information given in the company's financial statements. The historical trends of these ratios can used to predict future possibilities financial distress and bankruptcy. Under ratio analysis, it has evaluated liquidity, operational turnover, leverage, profitability and valuation and growth ratios.

Findings and analysis

Following required data collected from the annual reports issued by HNB bank from 2013 to 2017.

Variable	2017 (‘000)	2016 (‘000)	2015 (‘000)	2014 (‘000)	2013 (‘000)
Working capital	210,814,452	176,490,253	146,522,056	106,780,399	97,791,369
Retained earnings	15,193,585	9,524,236	5,270,848	7,808,059	3,465,419
Earnings before int. & tax	83,597,795	65,735,190	44,144,285	41,532,631	43,091,361
Book value or equity	108,147,599	77,017,227	65,051,053	60,898,663	51,453,855
Total liabilities	846,729,982	781,946,210	660,156,657	511,952,685	458,856,583
Sales	106,295,194	84,350,823	61,153,466	59,500,495	61,006,414
Current assets	373,876,145	428,363,104	316,879,863	288,371,422	262,815,454
Current liabilities	744,063,130	682,473,183	578,685,654	466,070,949	412,519,069
Cash and bank balance	21,739,800	17,511,446	14,909,598	13,141,295	11,624,645
Current investments	24,097,065	28,753,613	60,939,596	5,418,263	17,043,552
Debtors	761,301,109	683,673,425	582,548,331	431,646,201	385,069,913
Avg debtors	722,487,267	633,110,878	507,097,266	408,358,057	353,930,781
Net sales	39,649,315	34,371,588	26,335,529	24,901,507	25,346,768
Avg net fixed asset	17,905,320	13,945,002	11,473,569	9,304,665	9,521,496
Avg total assets	906,920,509	792,085,573	649,029,529	541,580,893	478,334,428
Total assets	954,877,582	858,963,436	725,207,710	572,851,348	510,310,438
Total equity	108,147,599	77,017,226	65,051,053	60,898,663	51,453,854
Interest expenses	56,526,138	41,236,605	26,279,934	26,966,826	31,423,945
Gross profit	46,628,106	42,786,464	33,842,985	29,943,820	25,229,702
Net profit	16,466,790	14,143,406	10,448,786	9,005,274	7,010,106
Net income	18,727,799	13,970,939	9,242,064	12,486,813	7,446,457
Avg stockholder's equity	92,582,413	71,034,140	62,974,858	56,176,259	49,176,454
Avg common sharing Outstanding	449,227	421,765	411,176	400,798	398,450
Market price per share	249	225	210.6	194.9	147
Earnings per share	36.66	33.53	25.41	22.47	17.59
Dividend per share	8.5	8.5	8.5	8.5	8.5
Book value per ordinary share	221.36	186.11	160.29	151.26	128.78

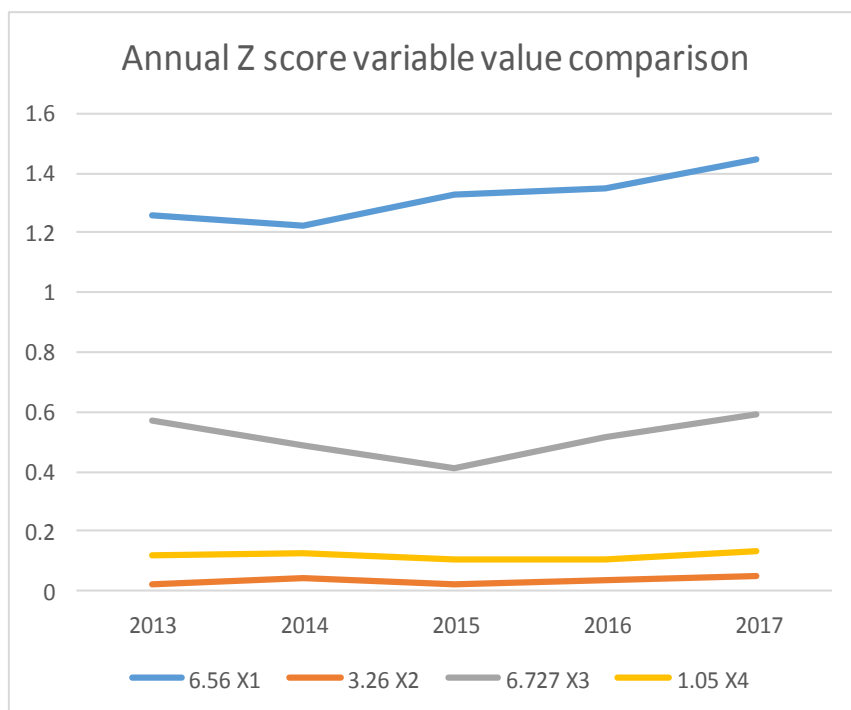
(Figure 2) Required data table collected from annual reports

Altman z-score

Using above collected data, Altman Z score has been calculate as follows.

Variable	2017	2016	2015	2014	2013
X1	1.448293301	1.347875836	1.325392262	1.222794395	1.257100253
X2	0.051871662	0.036147068	0.023693852	0.044434341	0.022138026
X3	0.588936611	0.514807272	0.409480761	0.487718166	0.568037735
X4	0.134110025	0.103418991	0.103465753	0.124901379	0.117741686
Z value	2.223211599	2.002249167	1.862032629	1.879848281	1.9650177

(Figure 3) Altman Z score calculation table



(Figure 4) Annual Z score variable value comparison

X2:

It is observe that HNB bank has low retained earnings since 2013 to 2017. During last five years HNB maintaining X2 between positive 0.022-0.051 with small drops and highs. It shows the low profitability of company. However, slight increasing trend of retained earnings during the study period indicate that there is a growth of the HNB bank and it's possible to predict, this X2 value will stay positive and fall between 0.025- 0.055 during next few years.

X3:

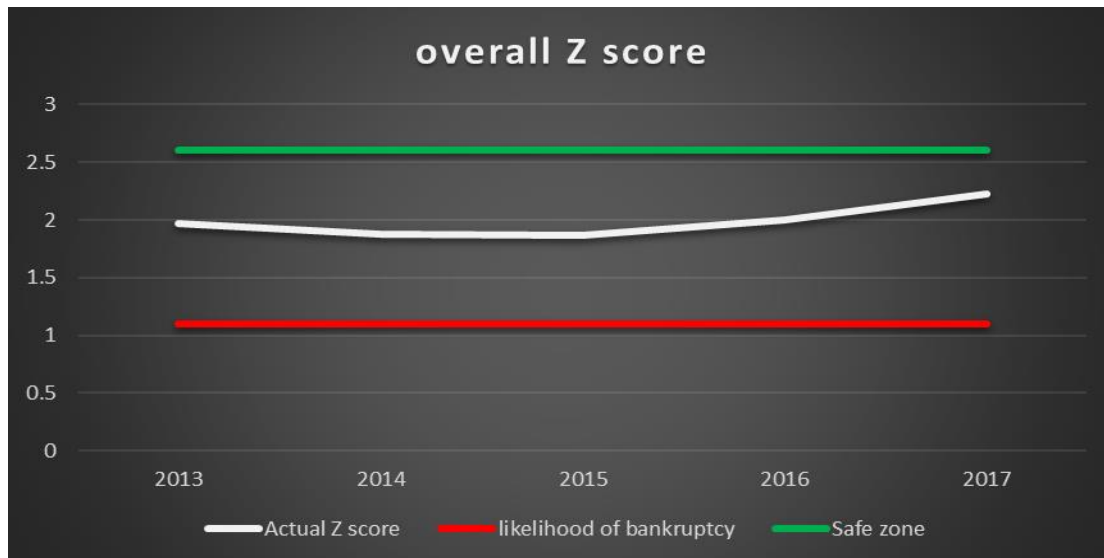
The Earning power of the company was fluctuating. It decreased from 2013 to 2015 and then increased. Because compared to earnings there was more increase in total assets. In short, this ratio indicates that the overall profitability of the company was increasing with a positive value between 0.40-0.58. However, few instances where it has decreased. However, it is possible to predict, this X3 value will stay positive and fall over 0.4 with generating considerable earnings in next few years.

X4:

In HNB bank, the market value of equity and total liabilities increased every year but not in the same proportion. Often Total liabilities increases with a higher rate than equity. Therefore, X4 has been decrease from 2014 to 2016. Here debt is more, the company has an obligation to pay interest to the creditors and thereby the shareholders risk may be increased. There is a sudden high of X4 in 2017, however this may drop within next few years but it will stay positive over 0.10

X1:

X1 of HNB bank had been around 1.22 to 1.44. This ratio of company is quite stable. The total assets increased year by year which shows the company had more concentration on the investments and lending's. The working capital is showing an increasing trend, which is satisfactory. By analyzing the table, it is possible to predict, the X1 value will stay positive and fall between 1.3- 1.6 during next few years.



(Figure 5) Overall Z score annual Comparison

Above figure 5 shows the Z score values of the company. During last five years, the Z score value has remained between 1.1 and 2.6 or within the grey area in all years, which arise doubts regarding financial performances and its structure. However, illustration implies that overall z score is getting close to the safe zone with a growth.

Ratio analysis

Researchers use ratio analysis to substantiate the results generated through Altman Z-score. This instance, it would be more useful as Altman analysis didn't provide a clear picture of bankruptcy possibility.

Liquidity ratios					
Current ratio	0.502479064	0.62766291	0.547585482	0.618728592	0.637098922
Cash ratio	0.061603462	0.067790296	0.131071495	0.039821315	0.069495447
Operational turnover ratios					
Fixed asset turnover	2.2143874	2.464796204	2.295321447	2.676238962	2.662057307
Total asset turnover	0.043718622	0.043393781	0.040576781	0.045979294	0.052989638
Leverage ratios					
Debt ratio	0.886741922	0.910337015	0.910300108	0.893692032	0.899171463
Equity ratio	0.113258077	0.089662985	0.089699892	0.106307968	0.100828535
Debt-equity ratio	7.829392329	10.15287424	10.14828549	8.406632589	8.917827283
Times interest earned	1.478922813	1.594098011	1.679771532	1.540137909	1.371290619
Profitability ratio					
Gross profit margin	43.86661734	50.72441795	55.34107421	50.32532923	41.35581875
Net profit margin	41.5310832	41.14853815	39.67562603	36.16357034	27.65680421
Return on assets	0.020649879	0.017638169	0.014239821	0.023056229	0.01556747
Return on stockholders' equity	0.202282468	0.196679217	0.146757997	0.222279184	0.15142322

Valuation and growth ratio					
Earnings per share	36.66	33.53	25.41	22.47	17.59
Price earnings ratio	6.792144026	6.710408589	8.288075561	8.673787272	8.357021035
Dividend pay-out ratio	0.231860338	0.253504324	0.334513971	0.378282154	0.483229107
Dividend yield ratio	0.034136546	0.037777778	0.040360874	0.043612109	0.057823129
Book value per share	221.36	186.11	160.29	151.26	128.78

(Figure 6) Ratio analysis table

Liquidity ratio

Both Current ratio and cash ratio of HNB bank falls below 1.0 during last five years. Traditional business requires liquidity ratios of at least 1 or more. In banking firms, current ratio of slightly lower than 1 might also be considered acceptable but results indicate in figure 6 compromise that HNB bank has unacceptable values and therefore, liquidity issues.

Operation turnover ratio

Usually banks operation turnover ratio is low. HNB has good fixed asset turnover ratio with average of 2.5, but its total asset turnover ratio is poor as 0.04. This can be due to excess long-term investments, poor collection methods, or poor sales.

Leverage ratio

Average debt-to-equity (DE) ratio commercial banks is approximately higher, about 3.1. But in HNB it is more than 8. A relatively high DE ratio commonly indicates an aggressive growth strategy by a company. For investors, this means potentially increased profits with a correspondingly increased risk of loss. Times interest earned ratio should at least be 1 and bank maintain an average around 1.5 or this company's income is 1.5 times higher than its interest expense for the year and creditors would favor a company with a much higher times interest ratio.

Profitability ratio

In terms of ROA and ROE, 1% and 10%, respectively considered good performance numbers. HNB maintaining good profitability with average ROA of 1.8% and average ROE of 18%. Even a relatively low ROA of 1 to 2% may represent substantial revenues and profit for a bank. HNB maintain consistent average gross profit margin of 48%, which reflects a higher efficiency of core operations. Further, it maintains average net profit margin of 37% with consistent growth, that provides the final picture of the high profitability and its growth.

Valuation and growth ratio

In HNB earning per share has been risen from 17.59 LKR to 36.66 LKR during last five years where market value also risen from 128 LKR to 221 LKR within that period simultaneously. However, price earnings ratio of the company is in a decline, from 2013 to 2017 it has reduced from 18%. This indicates doubtful future performance and investors may not be willing to pay more for this company's shares. HNB maintaining a low dividend yield

ratio about 4% with negative growth. It can be an indication; the company overvalued or is attempting to enhance the value of its capital.

Conclusion

Result generated through the Altman formula indicates, the Z score value has remained between 1.1 and 2.6 or within the grey area in all years, which arise doubts regarding financial performances and its structure. To get a clear image of the situation, Author carried out a ratio analysis. However, by analyzing both models, following recommendations introduced.

Altman model suggest HNB to increase retained earnings and to take required actions to avoid increase in rate of total liabilities compared to rate of total equity. That will strengthen its financial health and need to continue other elements as they have done last few years. If they unable to make significant improvement in management and financial structure, firms may be in danger of bankruptcy within few years' time. Ratio analysis emphasize that HNB suffer from liquidity issues, which need to fix immediately. Overall ratio analysis has produced positive results, which called off the probability of distress or bankruptcy related to both multivariate discriminant analysis and Univariate analysis.

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ENGINEERING AND CONSTRUCTION

Invited Talk

**Intelligent control system for prevention elephants' attacks in lower income countries,
Case Study: Sri Lanka**

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Overview: The aim of this research is to develop an intelligent control system to enable prevention of wildlife damages in lower income countries.

Wildlife damage is a major source of conflict between landowners and wildlife agencies. Wildlife depredation is the act of animals causing damage to property, resulting in economic loss to the owner. Depredation to agricultural and aquaculture farms, livestock producers, and other property owners, is often severe and many may result in significant financial loss. Some researchers found that landowners who perceive their income is adversely affected by wildlife tolerate less damage. The amount of damage stakeholders tolerate varies depending on livelihood. For example, farmers' and rural landowners' tolerance of deer is strongly influenced by concerns about crop damage. Agricultural producers typically accept damage levels of $\leq 10\%$ of the crop value. In most situations, the public supports actions to control wildlife that are causing economic loss or threatening human health and safety. According to Sri Lanka reports elephants are the major concern in Udawalawe National Park. For example in Pokunuthanna over 100 families have been attacked over the years. Around the national park 52 villages created wire electric fences to stop attacks without a major success. Every year in Sri Lanka there are well over 200 elephant deaths and around 65 to 75 human deaths on average, based on the fact of human-elephant conflicts, which is when an elephant raids a village to get its agricultural crops. There is a need for novel solution to prevent future attacks.

The ultrasonic frequencies were successfully used by LJMU team in monitoring of the life feedstock in UK. The BEST Research team have a proven track record in a rapid and non-destructive sensing technologies, which can be demonstrated through journal publications, research projects and secured patent applications.

The main objectives of this research are:

1. Determine baseline frequency that will make elephants feel uncomfortable in the restricted areas. This will provide a guidance required for the control system development.
2. Develop initial control system using results obtained in objective 1. This system will have artificial intelligence algorithms built in for the decision making process
3. Carry out a case study in Sri Lanka to test developed control system platform designed in objective 2

**VALUE ENGINEERING; AS A TOOL TO ENHANCE SUSTAINABILITY IN SRI
LANKAN CONSTRUCTION INDUSTRY**

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Abstract

Sri Lankan Construction Industry is a great contributor to the country's GDP with clients seeking the highest project value for their investment. Sustainability is essential for Sri Lanka with this increasing focus on value and concern of natural resource shortages. However, the application of sustainability in construction projects is still rare. Therefore, to address this growing concern, Value Engineering (VE) has been identified as an ideal technique to enhance the sustainability. This research is focused on to study VE concept along with its benefits and application in the construction industry to strengthen the sustainability. A mix methodology is adopted in this research to collect the data. Findings of this research paper reveal that there is a dire need to improve VE in Sri Lankan context with the support of the government and the local parties.

Keywords: Sustainability, Sustainable Construction, Value Engineering, Value Management

Introduction

The Construction Industry (CI) in Sri Lanka is experiencing a steady growth with some unexpected challenges arising, mainly from the lack of skilled labourers and, an emphasized focus on sustainability due to natural material shortages (Trading Economics, 2018; LMD, 2018). Companies and professionals now face a challenge in delivering 'more for less' for their clients. Therefore, decisions have to be made to resolve the conflict of project factors such as sourcing resources, cost, time, environmental impact, and so forth.

Karunasena, Rathnayake and Senarathne (2016), identifies Value Management (VM) as a technique which can be used to benefit the Client to achieve a better value for their investment. According to Ramus, Birchall and Griffiths (2006), VM process ensures the construction of best value projects by improving value, reducing waste and providing a competitive advantage. VM is a systematic approach consisting of three main processes [Value Planning (VP), Value Engineering (VE) and Value Analysis (VA)].

VE is applied in the definition phase of the project. VE is aimed in decreasing costs, increasing profits, improving quality, expanding market share, saving time, solving problems and effective and efficient ways in using resources (Kelly, Male and Graham 2004).

Abidin (2014) states that while the term sustainability is not frequently used, its core areas such as energy, efficiency, aesthetics, durability and availability are common criteria used in the VM process. Therefore, VM and VE are two of the most suitable techniques to integrate sustainability in ensuring Sri Lanka meets its goals towards sustainability. The FAST diagram in the Figure 1 shows the application of VE to achieve sustainability under environmental, social and economic parameters.

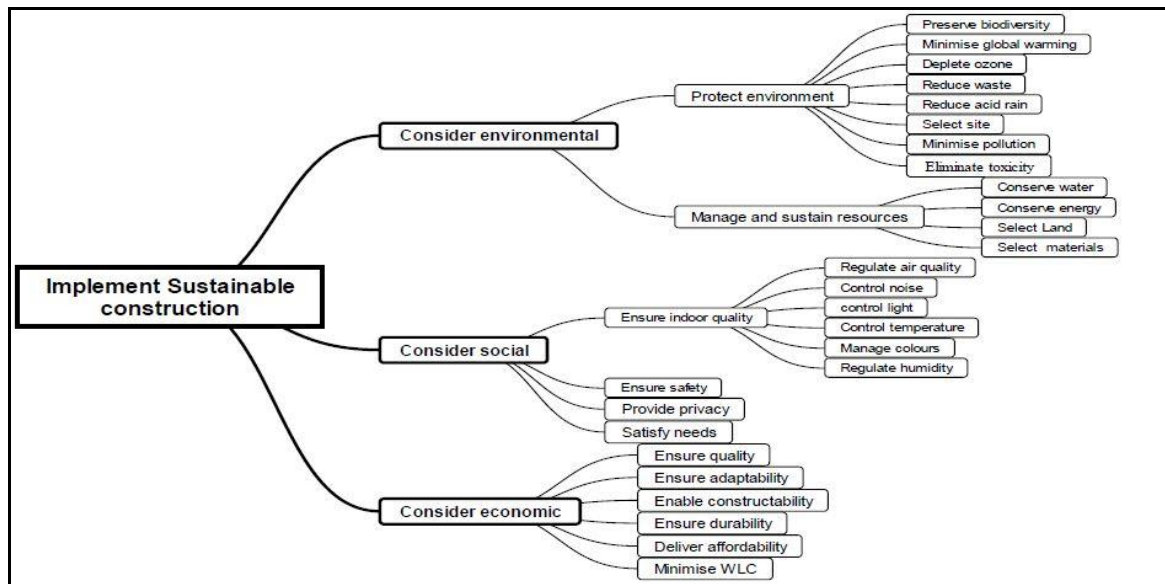


Figure 7 Sustainable construction FAST diagram *Source: Al-Yami (2006)*

Sustainability barriers can arise in the VE process through time constraints and the commitment to the project scope and design, depending on the stage of the project (Karunasena, Rathnayake and Senarathne 2016). The view of the sustainability which may add certain cost to the project, makes it less accepted by clients; therefore requiring stakeholders to have a changed attitude towards the sustainability (Al-Yami, 2006).

Objectives

- To identify the concept of Value Engineering, it's importance, application and relationship with sustainability in the Construction Industry
- To evaluate the current practice of Value Engineering in the Sri Lankan Construction Industry
- To provide a recommendation to enhance the Value Engineering practice to ensure sustainability

Methodology

This research adopted a mixed research approach. An in-depth literature review was carried out on VE to identify its concept, importance, application and benefits to achieve the first objective of this research.

The second objective, to evaluate the current practice of VE in the Sri Lankan CI, is achieved in two phases, phase one through a Questionnaire survey and phase two by conducting an interview survey through expert discussions. Through the above methods, the collected data sample is analysed and a recommendation is provided to enhance the VE practice to ensure sustainability achieving the third objective.

A sample group is taken for this data collection and it comprised of CI professionals and experts with high exposure and experience in the CI.

Results & analysis

Phase 1

The collected data revealed that the application of VE not being implemented into projects, is a noticeable 31%. Further it revealed that, 54% do not have VE teams in their companies. This could be due to the practicing of the VE without any standards or guidelines.

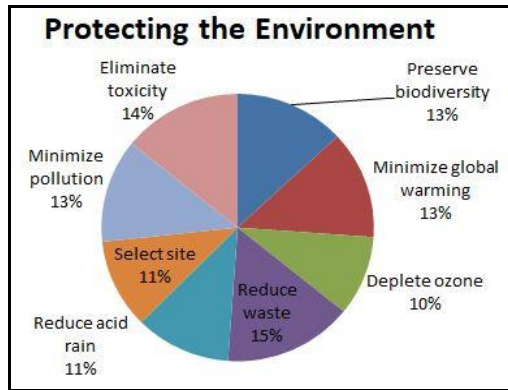


Figure 8 Protecting the Environment

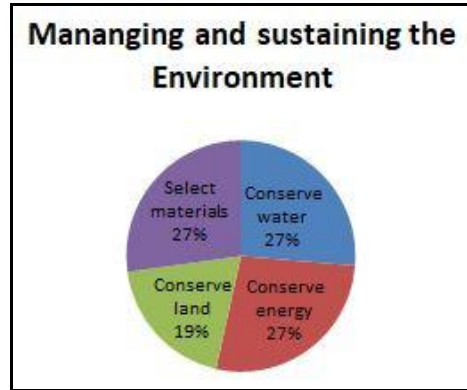


Figure 9 Managing and sustaining the Environment

Figure 2 and Figure 3 show that the respondents are conscious about sustainability and environmental factors such as reducing waste, minimising global warming and managing and sustaining the environment. Thus, it agrees with Abidin (2014) which stated that the core areas of sustainability are highly considered in the VE process.

Additionally, the misconception between VE and CR is evidently surfaced through this data analysis, thus supporting SAVE (2016) and Barton (2012).

Finally, revealing the many reasons for not implementing VE arising from the lack of VE awareness, knowledge and practices amongst others, further agree with the barriers identified by Plessis (2007).

Phase 2

All experts agree that VE is vital for the current Sri Lankan CI. Expert A stated the following:

- “VE is a great necessity and is required in the current market since there are a lot of foreign construction companies coming in with a lot of commodities and work gangs”
- “Unless VE is used in the local CI to optimise the construction strategies, method statements, etc., local contractors would be challenged in securing large scaled projects mainly arising from the low tender prices of foreign companies in the current market”.

Promoting VE in the current Sri Lankan CI

Few experts stated that “certain project parties still do not know what VE is. Therefore, educational seminars and conducting VE workshops are required”.

Experts E and G stated that “VE has a negative perception when implementing, since parties are reluctant to accept the new ideas or that the ideas are taken personally rather than professionally”. Expert D suggests that “VE can be successful once the current perception on it is changed”. Expert E pointed-out that “In the current context, VE is used to identify the

real requirements of the client”. Therefore, VE can be regarded as a competitive advantage during contract or project negotiations”.

Expert B suggests that “VE ideas should be proposed together with a financial gain to the consultants or the clients”, to avoid rejection of individual ideas. Expert G highlights that “VE is sometimes carried out in the tendering stage for complex projects in which executing the project is challenging”.

It is strongly agreed that the current Standard Bidding Document 2 VE clause is insufficient for the current industry. Expert D stated that “Local professional organisations (such as IQSSL, IESL, IIESL, etc.) should come forward and together promote VE in the Sri Lankan CI”.

Expert B suggests that “VE should have its separate publications with all the guidelines and procedures in carrying out VE”. Several Experts suggested that the VE recognition will gradually increase if VE is encouraged and included in future contracts, suggesting that “the best way to standardise and promote VE is, if it is made mandatory by the Governing bodies”.

VE and sustainability

The link between VE and sustainability is strongly agreed.

- Expert A states “Sustainability is the reason VE is required, due to everything not existing in abundance. VE can also bridge the gap in the shortages coming from construction technologies, materials, equipment, etc.”.
- Expert D agrees with the statement that Ramus, Birchall and Griffiths; (2006) stated, “VE is used as a tool for gaining a competitive advantage”. Further going on to state that “it is more often used as a tool during the contract negotiation stage due to the disclosure of the VE ideas of one Contractor to the competition by the consultants”.
- Expert C agrees that design changes may come under scrutiny from the architect or consultants in the projects.

Current VE barriers and misconception between VE and CR

Several experts stated that “VE is mainly used as a cost reduction tool in the current CI”, further strengthening the same practice which is being observed in the Singapore CI (Barton, 2012). The same barriers identified by Kim (2016), such as lack of knowledge, guidelines, technical norms and standards and a lack of experts, are still present in the Sri Lankan CI. Few Experts agree that the impression received from consultants and clients are based on short term investments, thus additional costs deriving from implementing VE proposals to lower life-cycle costs are almost always overlooked.

Conclusions

Although the current literature agrees that VE or VM can be used as a tool to integrate sustainability, the results show that its current exposure and practice is still not fully accepted or is not properly carried out due to the incapability of carrying out VE. Further it is indicated that there is no emphasis on carrying VE and the current Standard Bidding Document 2 (Clause 13.2) has to be improved along with the support of Government or professional bodies. Furthermore, unprofessional practices arising within Consultants and Contractors should be penalised and come to an end in order to have a bias-free CI.

Recommendation

VE must first be accepted, practiced and conducted through a proper dedicated guideline published by a local professional body. VE must be implemented into the contract of all types of projects to enhance the sustainability. Moreover, VE should be enforced by the law and, the generated ideas in VE must be confidential among the stakeholders.

Since experts strongly agree that VE is an ideal tool to enhance the Sri Lankan CI and its capability of competing with foreign contractors, the local governing bodies and professional organisations should step up and take initiatives to implement it in the future projects to pave the way for a more efficient CI. Therefore, further research is necessary to contextualise the progress of the applicability of VE in the Sri Lankan CI.

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STUDY ON CONSTRUCTION WASTE RECYCLING IN SRI LANKA

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Abstract

During the past decade, construction and demolition waste has taken attention around the world where approximate waste generation due to construction is 40%. The recycling of solid waste in construction has been developing over a long time. The main benefit of waste recycling is to reduce the demand for new resources. There is an important relationship between recycling and sustainability. This research mainly focused on providing a sustainable solution to the solid waste generation in the Sri Lankan construction industry through recycling. The results revealed that there is a considerable gap in current practice and required practice.

Key Words: Construction waste, Materials, Recycling, Sustainability.

Introduction

Construction activities are ever rising in the whole world. The construction industry is one of the major waste contributors to the environment. (Lu and Yuan, 2011). Some of the major negative impacts of this industry are land depletion, waste of nonrenewable natural resources and environmental pollution. Due to improper management of resources, the construction industry has to face more difficulties such as scarcity of waste disposal areas, scarcity of construction materials and harmful environmental effects, etc. (Barros *et al*, 1998). The waste management is one of the suitable and most important factors to minimize the material shortage.

The society is now offering more attention to the environmental issues. The present status-quo of the waste management in Sri Lanka is at a primary condition. It is reported that more than 50% of the construction waste in western and European countries are recycled (Barrors *et al*, 1998). There is an important co-relation between the recycling and the sustainability. The recycling converts the waste into re-usable material. It reduces the natural resources extraction. To sustain or reduce the depletion of natural resources, the extraction must be lower or equal to replenishment rate. This paper suggests some techniques to improve the current practices of the construction waste recycling. The paper focuses on the following aim and objectives.

The main aim of this research is to provide sustainable solution to the solid waste generation in the Sri Lankan construction industry through recycling.

1. To identify the sustainable solutions to minimize the construction waste generation.
2. To identify the possible solid waste categories for recycling; generate in construction industry.

3. To identify the Sri Lankan construction industry involvement in construction waste recycling.
4. To provide recommendation to improve the construction waste recycling in Sri Lanka.

The demolition of buildings produces more waste than the construction, when the demolition stage waste generation cannot be minimized. There are several ways to manage the construction waste. Last few decades, the construction waste was used for landfilling. It was the convenient and cheapest method to dispose the waste. When the landfill was reached the optimum capacity, the construction industry adopted concept such as 3R, 7R, Zero waste, etc.

To achieve the sustainable development, the waste management is identified as one of the key contributory factors. Thus waste recycling is at the heart of the waste management. The community is environmentally, economically and socially benefited when it practices the recycling (Klang et al, 2003).

The major solid waste materials are identified as cement, concrete, tiles, bricks and blocks, timber and asphalt in construction sites. 25% of sand, 20% of lime, 14% of cement, bricks and blocks, 10% of tiles have been identified as wastes in the Sri Lankan construction sites (Rameezdeen et al, 2004). All of above mentioned material can be recycled and the ultimate recycled result can be summarized as follows;

Construction & Demolition Waste Recycling and Ultimate Result.

C & D Material	Recycling Technology	Recycled product
Concrete	Crush into aggregate	Recycled aggregate, Backfilling material
Glass	Grind to powder, crush into aggregate.	Cement replacement, Glass fiber, Aggregate.
Asphalt	Cold recycling, Heat generation	Recycled asphalt, Asphalt aggregate.
Bricks and blocks	Burn to ash, Crush into aggregate	Slime ash, Filling material, Hardcore material
Timber	Re use directly, cut into aggregate, Chipping	Source of energy, Aggregate, Chemical production.

(Tam and Tam, 2006) *Resources, Conservation and Recycling* 47 (2006) 209–221

Barriers in recycling of construction waste.

According to Rao et al (2007) there is a low acceptability of recycled materials due to poor association with recycling activity, and lack of confidence about recycled materials. Cost of the recycling is higher than the cost of land filling (low dumping cost). Chong and Hermreck (2010), suspect that recycling material harmfully affect more than helpfully. Therefore following reasons can be identified as main barriers to recycling of construction waste. Rao et al (2007).

1. Lack of enough recycling facilities.
2. Shortage of adequate technology.
3. Lack of confidence of stakeholders.
4. Poor involvement of the government.
5. Unavailability of proper Standards in the recycling process.

Methodology

Recycling is not yet properly established in the Sri Lankan context; thus, this research is more towards the investigation its potential. Hence the qualitative research method has been utilized to collect the data. The selected people were interviewed through structured interviews. Therefore, the interviews were finalized through the data collection. The content analysis technique was used for the data analysis.

Results

According to ICTAD categorization construction companies has categorized CS2 to C9, considering their financial and other resources. The interviews consisted CS2 to C9 construction organization. Thereby, Project directors, Project managers, Engineers and Quantity surveyors were interviewed. Out of all the receive respondents, 7% were from CS2 companies, 27% from C1 companies, 53% from C2 – C5 companies and, 13% from C6 and below grades companies. 90% of them are practicing the reuse. The data analysis has identified waste material recycling barriers into three main categories as follows.

- Involvement barriers.
- Implementation barriers.
- Market barriers.

Results can be elaborated as follows.

Construction waste recycling barriers in SL

Category	Sub category	Interview Response
1. Involvement barriers.	Lack of Resources	“At the initial stage, we need more resources to start a recycling business than other thing. A considerable land space is pivotal to maintain a proper storage of inputs and outputs” (INV 09)

	Machinery and Equipment cost	“Most of waste separating and crushing machines must be imported” (INV 06)
	Initial investment	“Construction and Recycling are two separated fields, we are doing construction if someone involves with the recycling. We can support him to continue the business by sending separated solid waste of our sites, etc.”(INV 02)
	Misconception	“Who wouldn’t like to invest their money for non-profitable businessHmmm” (INV 07).
2. Implementation barriers.	Lack of technological staff.	“We have no sufficient experience in the recycling field and workmanship. We have to hire them..... (INV 10)”
	Quality of the product and standards.	In the Sri Lankan practice, there is no sufficient quality standards for the recycled products. Therefore customers are scared to use recycled products. (INV 10)
3. Market barriers	Client expectation and lack of knowledge about recycled products.	“I have more than 20 years’ experience in the industry. Most of the clients dislike to use recycled products. The buyers have no clear idea about the recycled products. Due to lack of past project experience, clients refuse to embrace it”. (INV 09)
	Consultant influence and written specification.	“Most of the consultants are not allowed to use other reinforcement except XYZ reinforcement to the construction, as the contractor, we have to accept the consultant instruction for the successful completion of the project (INV 08).

Conclusion and Recommendation

The study discloses that wastage in the Sri Lankan construction industry has become a major problem due to exceed in the acceptable limit. The construction industry is one of the major waste contributors (Approximately 40%) to the environment. The wastes can be affected on economically, environmentally and socially.

There are several solutions available for the wastage management. The recycling is one of the best sustainable solutions. In the developed countries, the construction and demolition waste are frequently recycled. According to the observed literature, 70% of construction waste can be recycled. Among them concrete, asphalt, glass, quarry waste and timber are identified as major recyclable waste materials. The benefits of the recycling spans over major environment, economic and social sectors. It causes to reduce the environmental pollution and the natural resource extraction. Moreover, the recycling can be used as an extra income source generating many job opportunities. However, the current practices in waste recycling is not at an acceptable level.

The identified practical barriers can be further elaborated. The higher initial investment cost, man power and machinery requirements, lack of previous experience, lack of awareness about the recycled products, rapid changes in the market trends, low quality products and, finally, lack of written standards and consultants highly affect the construction and demolition waste recycling.

Recommendation

The study suggests that the construction waste can be recycled under certain restrictions and barriers. The suggestions and recommendations are summarized as follows.

1. Central government assistance is needed to implement the recycling concept.
(Implementing new rules and regulations to improve the use of recycled products, introduce interest free loans)
2. Introduce low interest loan for investors. (From the bankers and other financial bodies can introduce low interest rate loans for recycling business.)
3. Introduce proper quality standard for recycled products.
(ICTAD and other construction standards makers need to implement new standards for recycled productions.)
4. Create good market for recycled products through giving publicity.
(Need to make a market trend to use recycled products)
5. Consultants' involvement in promoting awareness among clients.
(Consultant is the bridge joint the contractor and client, consultant can motivate both parties to use recycled materials)
6. Encouragement and implementation of green entrepreneurship.

Possible appropriate actions must be identified to reduce the construction and demolition waste in sustainable manner. The research project is continued to quantify the actual site wastage and recycled quantity. This study can convey the results to the public and it is expected that more attention is drawn to the matter.

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**A CLASSICAL CONTROL APPROACH TO INCREASE THE POWER
EFFICIENCY OF A SHORT-WAVE RADIO TRANSMITTER**

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Abstract

Thermal emission tubes are expensive electron devices regularly used in numerous applications such as Radio Frequency (RF) amplifiers, medical instruments, etc. Such a thermal tube designated as TH558E is used as an RF amplifier within a 250KW Short Wave transmitter in the Sri Lanka Broadcasting Corporation in Trincomalee. In this RF amplifier circuit, a control scheme is integrated with the thermal emission tube to maintain the desired power efficiency. The present control system configured by the tube manufacturer shows poor control capabilities and, as a consequence the lifetime of the thermal emission tube is significantly reduced. In this work, we propose a control scheme which is based on multiple PID controllers and H-infinity optimality criterion to overcome the deficiencies of the original control set-up. Firstly, the required experimental data is gathered to obtain the transfer functions of the plant. Secondly, the plant is confronted with a new PID controller which is embedded with an optimal automated tuning method. It is tested for fine-tuning of the amplifier's final stage. The PID control gains are found using an algorithm based on Linear Matrix Inequality ensuring the stability. The simulation results prove that the proposed control architecture is capable of providing the desired performance.

Key Words: Fine-tuning, PID controller, Radio frequency, Thermal emission tube

Introduction

Sri Lanka Broadcasting Corporation (SLBC) is a government radio service which owns eight island wide FM (Frequency Modulation) services and two international high-power MW/SW (Medium Wave/Short Wave) radio stations. This research has focused to enhance the power efficiency of a Short Wave (SW) Radio Broadcasting Transmitter (Figure I) (Ampegon, 2014) employed in one of the high-power radio stations in Trincomalee. The transmitter consisting of a Radio Frequency (RF) circuit is integrated with the output of a high-power electron emission tube designated as THALES-TH558E (Figure II) (Thales, 2013). The tube works as a class C amplifier (Boylestad, 2012), (Seely, 1958) within the frequency range of 6MHz-21MHz. Here, the input and output RF signals of the thermal emission tube must be controlled in a way such that, the tube converts input electrical power to RF power at its highest operational efficiency (Seely, 1958). For that, two tuning criteria named coarse-tuning and fine-tuning for pre and final RF amplifier stages are used. Here, both coarse-tuning and fine-tuning are achieved by changing the values of variable inductors and capacitors coupled with DC servo motors (Dunker, 2015). The motors are operated based on the voltage signals issued by a separate digital motor control board set by the transmitter

manufacturer. In coarse-tuning, the variable inductors and capacitors are set to predefined values in the motor control board.



Figure I: SW Transmitter Plant at
SLBC, Trincomalee



Figure II: THALES-TH558E, Thermal
Emission Tube

Since the thermal emission device operates as a class C amplifier, the phase difference between input and output RF must be 180 degrees to attain its highest operational efficiency (Seely, 1958). The phase of the output RF depends on the load or antenna which is connected to the output terminal (anode) of the emission tube. The impedance of the anode of is 290Ω (Thales, 2013). The function of the final tuning stage which is employed between the load and the anode is transforming the impedance of the load (or antenna) to 290Ω at the anode terminal of the emission tube.

The present fine-tuning control system in the digital motor control board, occasionally malfunctions due to its poor fine-tuning capabilities. More often, the tube does not operate at its optimal or highest efficient point. As a consequence, a large amount of power is dissipated as heat in the anode. It is harmful for the internal structure of the tube. Excessive heat can shorten the lifetime of this expensive device (Laurențiu Teodorescu, 2016), (D. Dharshana, 2017). Further, this substantial power wastage adds an extra operational cost. In our work, we propose a control system which can replace the existing motor control board, thereby extending the lifetime of the emission tube.

Methodology

Present fine-tuning algorithm

Figure III shows the overview of the entire operation of the plant. Here, the purpose of fine-tuning of the final RF stage is to optimize two parameters;

1. Phase difference between the sinusoidal input frequency signal and the RF output signal of the TH558E emission tube (PHI_2)
2. RF power on the transmitting antenna (PWR)

These two control variables interact with each other. When the control algorithm tries to optimize one variable, other variable is also affected resulting a complex control strategy. The phase difference can be measured using two RF sensing probes designated as phase probe 1 and phase probe 2 as shown in Figure III.

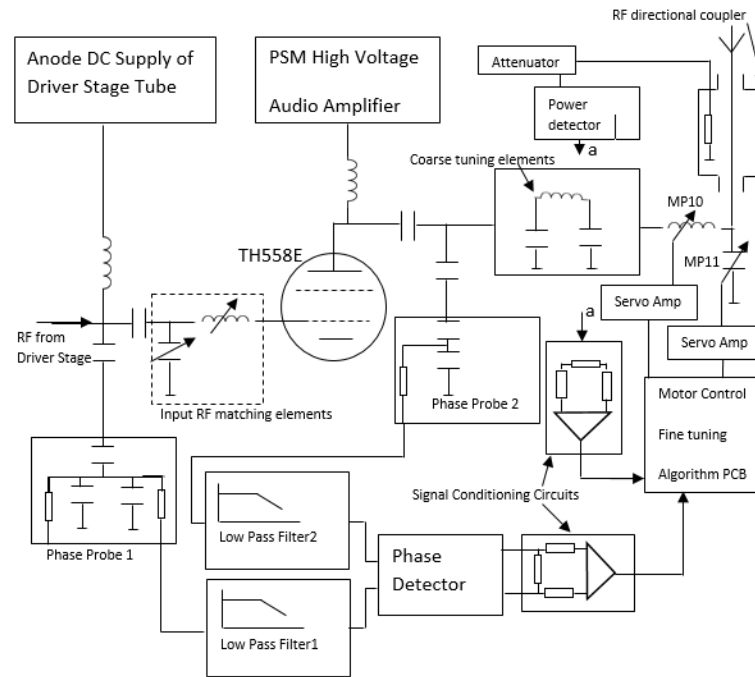


Figure III: Overview of the Transmitter Plant with Final RF Stage Fine-tuning

The sensed RF wave forms are routed via two low pass filters to a device called phase detector where phase difference is calculated. The low pass filters are used to filter-out harmonic components and keep the required RF wave as expected. The output of the phase detector is a DC voltage which linearly varies between -5V and +5V corresponds to the phase difference. Here -5V corresponds to -180° phase difference and +5V corresponds to +180°. As a restriction of the original design, the motor control board only accepts the input voltages between 0V to +10V. Hence, two signal conditioning circuits are employed between the phase detector and the control board to convert the voltage levels. The remaining variable; RF output power is measured using a probe commonly known as directional coupler. The motor control board is dedicated to control the positions of variable inductors and capacitors in all coarse-tuning and fine-tuning stages. Fine-tuning algorithm acts on both driver and final amplifier stages. In this work, only final stage is considered. According to the manufacturer, the present controller is a simple bang-bang one. The motor control board issues control DC voltages for the intermediate servo amplifiers.

By considering two control loops which incorporate with the control variables, it can be easily identified the two main transfer functions and, two crossed couple transfer functions from input to the servo amplifiers and from input to the motor control board. The DC motor in which the position designated as MP10 is connected to a sliding inductor. The position of the sliding bar governs the value of inductance. The torque or power of the DC motor is transferred to the bar via a flexible transmission belt. The DC motor in which the position designated as MP11 is connected to a variable capacitor via coupling gears.

Process Identification

Identification of the transfer functions between the input signals and the output signals is a main task in the process of control design. Inputs or manipulated variables are the voltage signals issued by the controller. Here the two manipulated variables are routed from the controller to the two servo amplifiers. The output variables; ‘Phase difference between the sinusoidal input RF signal and the output RF signal of the TH558E emission tube (PHI2)’ and, ‘RF power on the transmitting antenna (PWR)’ are measured. The relevant transfer functions are built between the input signal to the servo amplifier and the respective controlled variable. As a result of natural interactions between two main control loops, it is necessary to build four transfer functions. For that, the experimental data is gathered as shown in Table I.

Table I: Selected Input and Output Pairs to Gather Experimental Data

Manipulated (Input) Variable	Exciting I/P Voltage (V) to the Servo Amplifier	Measured O/P Variable of the Plant
I/P to Servo amp of MP10	0.4V	PHI2
I/P to Servo amp of MP10	0.4V	PWR
I/P to Servo amp of MP11	1.0V	PHI2
I/P to Servo amp of MP11	1.0V	PWR

The variations of measured output variables are shown in the Figures IV, V, VI and VII.

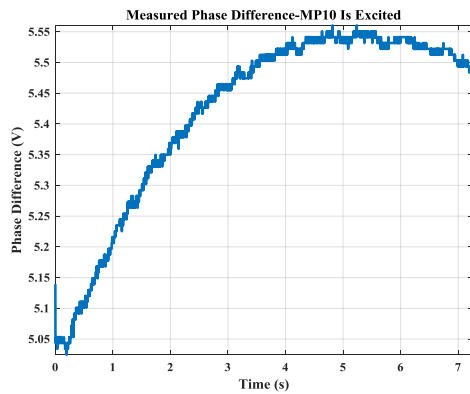


Figure IV: Measured Phase Difference of the RF Signal When the Servo Amplifier of MP10 Is Excited.

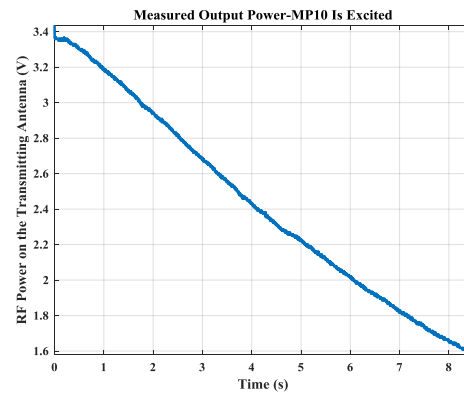


Figure V: Measured Output Power of the RF Signal When the Servo Amplifier of MP10 Is Excited.

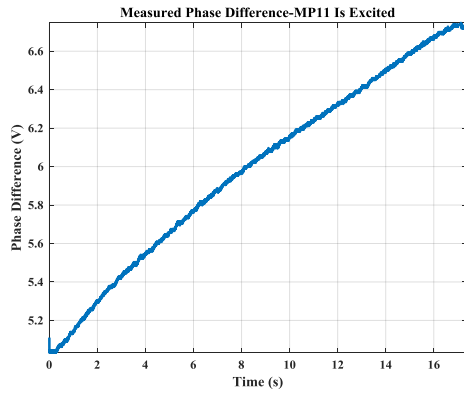


Figure VI: Measured Phase Difference of the RF Signal When the Servo Amplifier of MP11 Is Excited.

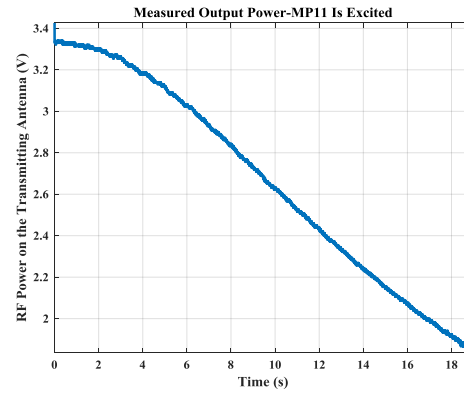


Figure VII: Measured Output Power of the RF Signal When the Servo Amplifier of MP11 Is Excited.

With respective to above experimental data, relevant transfer functions are obtained with the help of linear regression curve fitting in Matlab software. The plant is shown in Figure VIII.

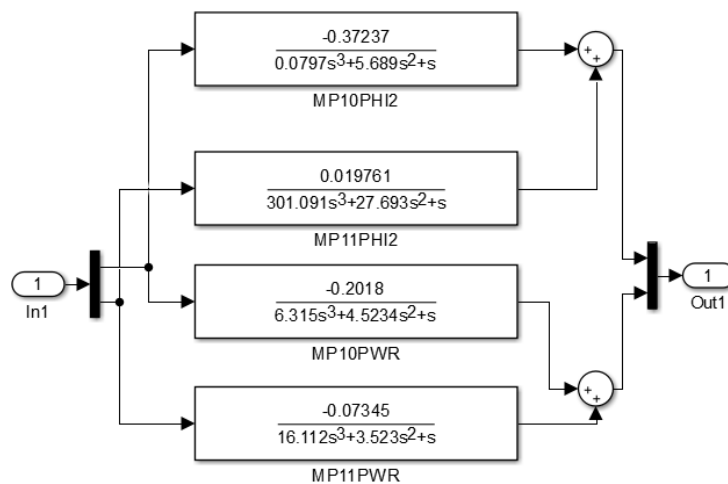


Figure VIII: Obtained Transfer Functions through Experimental Data

Results and Discussion

Two controlled (output) variables to be optimized are the phase difference between RF input signal and output signal of the emission tube (PHI2) and, the generated RF power output of the emission tube (PWR). The set point for the PHI2 is decided as 5V. It corresponds to +180° phase difference. The set point for the PWR is decided as 6.3V. The value is consistent with the 250KW RF power of the thermal emission tube.

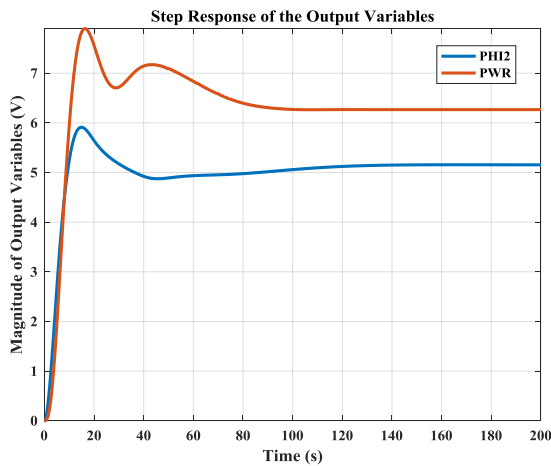


Figure IX: The Step Response of the Plant with PID Controller

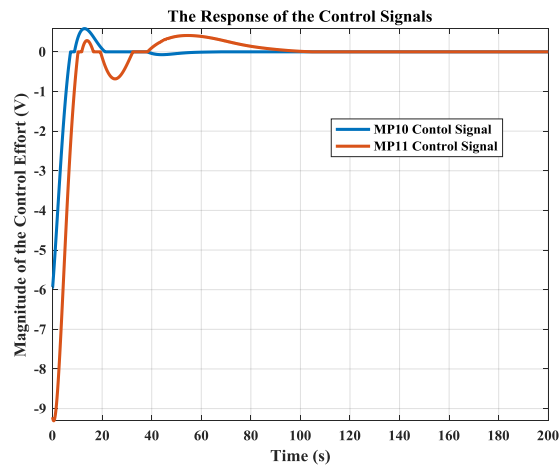


Figure X: Variation of the Manipulated Variables

The simulation results depicted in Figure IX clearly shows that the introduced closed loop control system is capable to achieve the desired time domain performance with better stability in the plant. In the step response, two output variables obtain their stability around the set point on 5V with fewer overshoots and negligible steady state errors. Figure X shows the variation of manipulated control variables. The servo amplifiers which are employed in the present system can accept manipulated voltages within the range of -10V to +10V. Figure X reveals that it is possible to achieve the desired performance if the controller can issue an output signal which lies inside -10V to +10V range.

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DETERMINATION OF BLOOD GROUP USING IMAGE PROCESSING TECHNIQUES

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Abstract

Determination of blood group is a vital need for blood transfusion. Errors in determination of blood group can have fatal consequences. Thus availability of fast techniques with high level of accuracy is important in the case of blood group detection. In this project, a new method of detecting human blood group using basic image processing techniques is being presented. In the present context, slide test is widely used in detection of blood group, but this test is susceptible to human errors. Further many other techniques available at present are unable to provide immediate results during emergency situations irrespective of the rate of accuracy (Ramya. S, *et al* (2014)). Thus, availability of a fast low cost system with high accuracy is a vital need. This software developed in this project aims to fulfill that need. The images captured after the slide test are inserted to the system through JAVA interface. The images are processed using basic image processing techniques like color plane extraction, thresholding, morphological operations, quantization etc. Base on the presence or absents of clots in each sample, the blood group is determined. Availability of clots can be determined by calculating standard deviation of the processed image. The software was validated using 500 samples from each blood group and it acquired an accuracy of more than 99%; for each of blood group tested.

Determination of blood group using a faster, accurate and low cost method is a vital need. This software fulfills all the above aspects. The results can be obtained within one minute or less with high accuracy. Further MySQL database keeps records of all the past tests. Environmental factors and the nature of blood from individuals may affect the accuracy of results on very rare occasions.

Introduction

Blood group is the classification of human blood according to the antigens present in red blood cells of an individual. These antigens can be proteins, carbohydrates, glycoproteins or glycolipids depending on the blood group of the individual. In currently used ABO system there said to be four major blood types namely A, B, AB and O (Ferraz. A, *et al*(2010)). O is said to be universal donor while AB is universal acceptor. Further according to the presence or absence of Rh factor, each group can be Rh positive or Rh negative (Mujahid A. *et al* (2015)). Accordingly, there are said to be eight blood groups. Determination of human blood type is a vital need and for blood transfusion it is important to determine one's blood group correctly. Incorrect determination of blood group can lead to fatal consequences. Thus, determination of blood group and ensuring the compatibility between the blood types of the donor and the recipient is a major test which is performed before a blood transfusion is done at such consequences throughout the globe.

In the present context, blood group is determined by human inspection through a test known as slide test. Here, blood group is determined based on occurrence or absence of agglutination of red blood cells with anti-A, anti-B and anti-D antibodies (Ferraz. A. *et al* (2010)). But the error rate of this process is high. Thus, it has become a vital need to produce an autonomic system for blood group detection. With the intention of filling this lacuna, some devices were developed, namely, Technicon AutoAnalyzer, Groupamatic, AutoGrouper, Olympus PK 7200, Immucor Galileo, Ortho AutoVue ® Innova System, Tango ® Automated Blood Bank System and Techno Twin Station. But irrespective of the high accuracy they achieved, none of these systems are able to provide the results immediately during emergency situations. Further, using the above mentioned techniques in blood group detection is often recorded as quite expensive procedures.

In this project, blood group is determined using a software developed with image processing techniques in Mat lab. The interface of the software is user friendly and developed in JAVA and it consists of a database developed with MySQL. The images obtained from blood samples after the slide test are processed using Mat lab and blood report is prepared in JAVA interface in less than a minute (Mary L. *et al* (1999)).

Determination of blood group is a vital need. At present there are many techniques to detect one's blood group. The focus of this project is towards developing a cost effective software using basic image processing techniques that gives fast results with high level of accuracy.

Methodology

Images from the slide test were obtained with a DSLR camera. In slide test, blood sample is tested with anti-A, anti-B and anti-D antibodies separately.



Figure 10- Original input image

The obtained images are then run through image processing operations like color plane extraction, thresholding, morphological operations etc.

A. Color Plane Extraction

A RGB image contains three planes Red, Green and Blue. They carry out color information of an image. Here green plane of the image is extracted. Because a large portion of color information of the image is contained in the green plane.



Figure 11- Color plane extraction

B. Global Thresholding

Thresholding is used to generate a binary image from a gray scale image. In local thresholding the threshold value depends on the pixel value at a given location. The thresholded image is denoted as follows:

$$g(x, y) = \{1: f(x, y) > T \text{ \& } 0: f(x, y) < T\}$$

Thus the image is segmented into two parts as image and background.

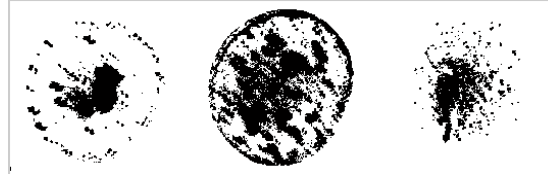


Figure 12- Global Thresholding

C. Local Thresholding (Niblack function)

The Niblack algorithm calculates a pixel wise threshold value by sliding a window over the image.

$$T = m + S * k$$

Here “m” is the mean of the all the pixels within the window at a given location while “s” is the standard deviation. Further, here k is a constant and -0.2 was selected as the most preferable value for k.

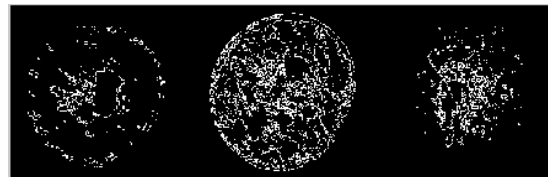


Figure 13- Local Thresholding (Niblack function)

D. Morphological Operations

Dilation and erosion are two fundamental morphological operations. Erosion reduces the size of objects with respect to background while dilation expands the size of objects. Here closing and opening operations are used in order to remove noise and spikes.

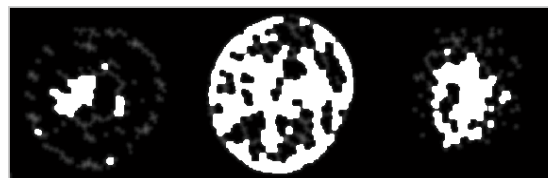


Figure 14 -Closing Operation (Removing of small objects)

Closing operation is used to fill gaps and holes. It is a process where dilation follows the erosion.

$$A \cdot B = (A \oplus B) \ominus B$$

Opening is a process where erosion is followed by dilation. It is used to smooth the contours of cells and parasites.

$$A \cdot B = (A \ominus B) \oplus B$$

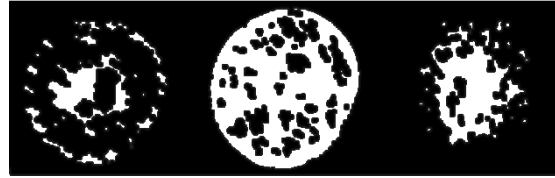


Figure 15- Opening (Filling holes)

E. Quantization

Standard deviation of each of the images are obtained. The SD values are checked with pre-determined threshold values. Here presence or absence of clots is determined using standard deviation values. Standard deviation of blood drops with Anti A, B, and D are measured separately and the blood type is determined based on the presence or absence of clots with each antigen.

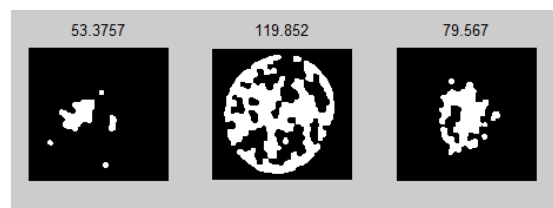


Figure 16- Determination of Standard deviation of each sample

F. Graphical User Interface

GUI is created with JAVA platform. It consists of well secured user login system, Patient data inserting form, Search options etc. The GUI is user friendly at a maximum level with high level of error and exception handling. Further the system consists of MySQL database where information of all the past tests is stored.

Results

By testing around 150 images of blood samples, with anti A, B and D separately it was noticed that when there are clots, the standard deviation value is larger; all values are greater than one. However, in the absence of clots, standard deviation values are below one. According to the values obtained for standard deviation, the blood group is determined as follows:

Anti A	Anti B	Anti AB	Anti D
Std > 1	Std < 1	Std < 1	A -
Std > 1	Std < 1	Std > 1	A+
Std < 1	Std > 1	Std < 1	B-
Std < 1	Std > 1	Std > 1	B+
Std > 1	Std > 1	Std < 1	AB-
Std > 1	Std > 1	Std > 1	AB+
Std < 1	Std < 1	Std < 1	O-
Std < 1	Std < 1	Std > 1	O+

500 blood samples from each image were checked to assess the accuracy of the software. The resulting accuracy for each of the blood groups is as follows:

A-	A+	B-	B+	AB-	AB +	O-	O+
100 %	98 %	99%	98%	100 %	97%	99%	498

Discussion

Availability of a method to determine blood group of a patient accurately using a fast method with low cost is a vital need. By using the above mentioned software, blood group can be determined in less than a minute with accuracy rate above 99%.

Here, simple image processing techniques like color plane extraction, thresholding, morphological operations (Opening and Closing), quantization etc. have been used. Blood group is determined based on the presence or absence of clots and the obtained standard deviation values.

Further, highly user friendly GUI in this software enables one to enter patient details and images easily and obtain the prepared report within a very short time period. MySQL database can keep records about all past tests and they can be accessed when necessary.

The accuracy of obtaining correct results is more than 99%. On some occasions the results can differ from the actual type as the occurrence of clots and the time taken for clotting depends on the time of the day the test is performed and the nature of blood of the individual. The limitation of the software is that it does not take these variable factors into consideration.

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REVIEW ON SELF-HEALING CONCRETE WITH *BACILLUS SUBTILIS*

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Abstract

Formation of Cracks in concrete is a common phenomenon in the concrete structure. These cracks diminish the strength, and durability of the concrete. Repairing these regular cracks is an expensive process. Hence, a self-healing concrete, which helps to repair these cracks with the production of calcium carbonate crystals that block cracks and pores would be an immense solution. This state-of-the-art facility is a more cost-effective, eco-friendly, and an efficient solution for cracks in concretes. Since the concretes highly alkaline, a bacterium that has the endurance for alkalinity would be the best choice. *Bacillus subtilis* is an ideal bacterial species for self-healing concrete. Bacterial concrete claims to have a higher tensile strength, compressive strength, high water permeability, and durability compared to conventional concrete. However, with the navel technological advancement, usage of a GMO bacterium instead of conventional *Bacillus subtilis* would be a better choice.

Key Words: Alkalinity, GMO, Self-healing

1. Introduction

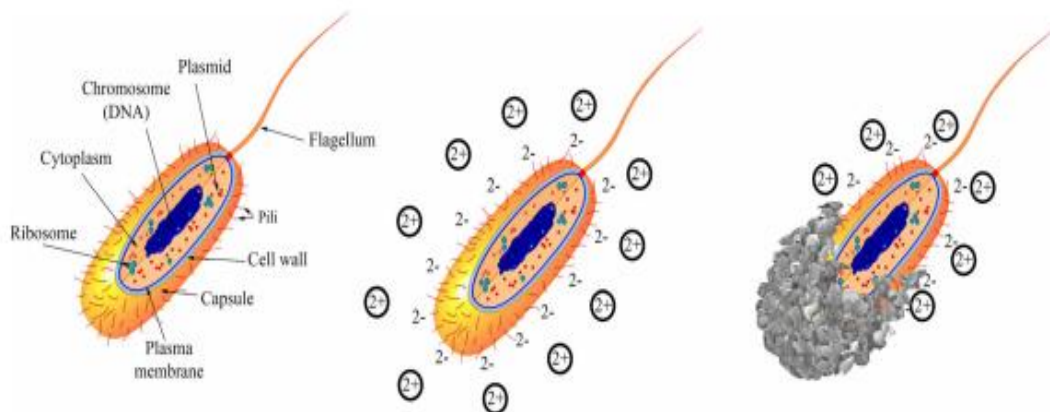
Even though concretes are widely used as a construction material, cracks in concretes are unavoidable. Treatments for the cracks are a very expensive procedure. Also on par with the occurrence of crack properties of concrete such as durability, permeability and strength of the concrete structure will get diminished. Hence water will eventually get in contact with the reinforcement structures and the corrosion of those structures will occur. By the introduction of bacteria that produce calcium carbonate into the concrete mixture, the cracks can be avoided with the self-healing mechanism. Once the bacteria is introduced these self-healing concrete will produce calcium carbonate crystal that blocks the cracks. Microbial induced calcium carbonate precipitation (MICP) is an interdisciplinary field of study combining microbiology, engineering, and chemistry (Van Tittelboom & De Belie, 2013).

A bacterium that is selected for the process should be stable and survive at a high alkaline environment that is usually in the pH of 10 or above. However, several mechanisms such as usage of polyurethane can enhance the survivability of microbes at higher pH. Bacteria of *Bacillus* strain are renowned to have a high stability at a high alkaline environment. Because they form viable endospores in harsh conditions and become activated once spores get in to contact with water and other nutrients. Once the concrete starts cracking it will also reduce the highly alkaline pH into lesser range of 10-11.5 (Borah & Chetia, 2016).

Several pieces of research have used different strains of bacteria in the *Bacillus* family such as *Bacillus sphaeroides*, *Bacillus pasteurii*, *Bacillus lintus*, and *Bacillus subtilis* etc. Once the Ca^{2+} in the process of demineralization negatively charged bacterial cell wall will draw cations from the environment. Ca^{2+} will eventually get deposited on their cell surface. These Ca^{2+} ions subsequently react with the CO_3^{2-} ions, leading to the precipitation of CaCO_3 . Bacterial cell surface serves as a nucleation site. Carbonate is produced extracellularly through

autotrophic and heterotrophic metabolic pathways. In the Autotrophic pathway in the presence of carbon dioxide, microbes convert it to carbonate through non-methylotrophic methanogenesis, oxygenic photosynthesis, and anoxygenic photosynthesis. Whereas in heterogenic pathway calcium carbonate crystals precipitate as a result of their growth in different natural habitats. *Bacillus* species follow the heterotrophic pathway (Monteiro, 2008).

1.1 Process of Biomineralization



2. *Bacillus subtilis* Species on Self-Healing Concrete

Bacillus subtilis is a microbe that was originally found in 1835. It is also known as *Bacillus uniflagellatus*, *Bacillus globigii*, and *Bacillus natto*. *Bacillus subtilis* is a gram-positive, rod-shaped bacteria that are naturally found in soil and vegetation. It has an optimal temperature range of 25-35 degrees Celsius. *Bacillus* has evolved with strategies to survive under harsh conditions. One such strategy that is vital for self-healing concrete development is stress-resistant endospores (Joshi, Kumthekar & Ghodake, 2016).

Soil is the main habitat of endospore-forming *Bacillus* organisms. *Bacillus subtilis* strains also act as bio fungicides and benefit the agricultural crops and antibacterial agents. It also reduces mild steel corrosion. *Bacillus subtilis* is a non-virulent bacterium, which leads to a consumer-friendly interface in self-healing concrete.

Bacillus subtilis should be fully grown in liquid and aqueous states before impregnating with the concrete mixture. Usual concentration of bacteria needed is 56 x10⁶ bacteria/ ml. Bacterial concentration can be calculated with the following formula,

$$\text{Bacterial count} = \frac{\text{Full grown no. (no/ ml)} \times \text{solution used (ml)}}{\text{Total solution used (ml)}}$$

Results may vary with the bacterial count. Bacteria should be added in full-grown stage, which lasts for about 2-3 hours. Consolidation of a higher number of bacteria is shown to have negative effects on the compressive strength; hence the addition of the optimal amount of bacteria is crucial (Joshi, Kumthekar & Ghodake, 2016).

3. Tests for Assessment of Self-Healing Concrete

3.1 Strength Tests

According to literature, compressive strength and the tensile strength of the bacterial concrete is higher than the conventional concrete. Tensile strength and compressive strength are claimed to be increased with the addition of the optimal amount of bacteria. Meantime results

prove that the consolidation of a higher number of bacteria may be shown to have negative effects on the compressive strength, hence the addition of the optimal amount of bacteria is crucial.

3.2 Capillary Water Suction

This test is used to compare the absorption capacity between bacterial and conventional concrete. Value of the capillary index lower than 1 indicates the increase in water absorption. Different experiments have proved that conventional concrete has a lower value of relative capillary index than bacterial concrete. Moreover, pure cultures of *Bacillus subtilis* have a higher value of relative capillary index compared to urolytic mixed cultures.

3.3 Gas Permeability

Gas permeability is measured using the Hagen- Poiseuille relationship. Bacterial concrete has low gas permeability compared to the conventional concrete. Hence, bacterial concrete may have a higher lifespan.

3.4 Oxygen Consumption Measurement

This is done by measuring oxygen consumption of aerobic bacterial metallic conversion of calcium lattice. Optical oxygen microsensors can be used for quantification. Oxygen concentration can be determined by the Fick's first law of diffusion.

$$J = -D_{\text{Oxygen}} \cdot \frac{dC(z)}{dz}$$

Doxygen is the diffusion coefficient of O₂ in water, and C (Z) is the concentration of O₂ at depth Z (Borah & Chetia, 2016)

4. Genetically Modified *Bacillus subtilis* for Self-Healing Concrete

Reports claim that the integration of anaerobic hot spring bacteria in cementitious material will provide a higher mechanical strength. Because bacteria tend to form a new phase inside the cementitious matrices. However, due to the high alkalinity nature in the concrete true nature of the self-healing property of these bacteria is compromised. Therefore by use of biosilification gene of *BKH2* (silica leaching rRNA gene), it is possible to transform spore-forming bacterium *Bacillus subtilis*. Sarkra et al have proven that transformed *Bacillus subtilis* is a proper self-healing agent to macro and microcracks. Endospores remained in the dormant phase resistant to ultraviolet radiation, desiccation, high temperature, extreme freezing, and chemical disinfectants. Further transformed bacterial spores have been active after the prolonged time of dormancy and in favorable conditions; until spores undergo biosilification and biomineralization (Sarkar, 2015).

5. *Bacillus subtilis* vs Transformed *Bacillus subtilis* for Self-Healing Concrete

Bacillus subtilis and *T-Bacillus subtilis* are vital bacteria for self-healing bacterial cement production. However, with the integration of *BKH2* gene *t-B. subtilis* gain the property of biosilification. Hence, it is applicable and efficiently effective for both macro and micro cracks whereas conventional *B. subtilis* is actually more effective against macro cracks. Because an optimal amount of water and other nutrients to become viable.

Dormancy period of endospores in *T-Bacillus subtilis* is higher because they have an extra resistant to harsh conditions such as disinfectants but conventional *B. subtilis* endospores are not highly resistant to conditions such as disinfectants etc.

Transformed *Bacillus subtilis* self-healing concrete claims to have a higher tensile and compressive strength than *B. subtilis*.

But the production culturing and maintenance of *B. subtilis* is relatively simple and easy procedure compare to genetically modification involved in *t-B. subtilis* (Sarkar, 2015)

6. Conclusion

Introducing the bacteria into the concrete makes it very improves the overall quality of the concrete more than the conventional concrete. Bacteria repair the cracks in concrete by producing the calcium carbonate crystal, which blocks the cracks and repairs it. According to the literature done on self-healing concrete researchers have found that bacterial concrete has a higher strength than conventional concrete, which increased by 13.75% in 3 days, 14.28% in 7 days and 18.35% in 28 days (Borah & Chetia, 2016).

Use of *Bacillus subtilis* in self-healing is a safe and cost-effective method which is also very eco-friendly, cost-effective, and convenient. *Bacillus subtilis* is a nonpathogenic microorganism. This process of biomineralization in self-healing will reduce the labor cost. This microbial concrete may revolutionize the existing processes.

This method also has the potential to be developed to treat for cracks on conventional concrete. That is by spraying a liquid medium containing *Bacillus subtilis* into the cracked concrete, which is more eco-friendly. Because every production of concrete releases carbon dioxide to the atmosphere.

New approach with genetically transformed *B. subtilis* strain enhances the autonomous healing property of concrete because of the gehlenite phase it forms this leads to the longevity of the concrete. This suggested development with a newly transformed *Bacillus* strain would increase the overall property of green concrete.

Use of *Bacillus subtilis* in self-healing is a safe and cost-effective method which is also very eco-friendly, cost-effective, and convenient. Also, *Bacillus subtilis* is a nonpathogenic microorganism. This process of biomineralization in self-healing also will reduce the labor cost. This microbial concrete may revolutionize the existing processes.

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CANCER DETECTION USING MATLAB BASED IMAGE PROCESSING

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Introduction

At present, image processing is becoming a new trend to understand histology reports. These image processing techniques reduce the time for analysis and also minimize human errors. There are various image processing based systems to understand histology reports, but these systems are limited to detect a specific type of cancer. (Kleihues P.*et al* (2003)). Image classification method can be used to accurately differentiate cancer cells from normal surrounding cells. (Kleihues P.*et al* (2003)). Building up a computer aided decision making system that has the ability to quantitatively analyze similar images and return informative output which can assist radiologists to improve their diagnosis and reduce time consumption for the diagnosis procedure with regard to understanding of histology reports which aid in diagnosis of cancer.

According to Amrutha *et al.* cancer is a generally spreading ailment in the cutting edge society. During cancer, extra cell growth happens which is not normal in human body. These additional cells make mass of cells which is known as tumor. As indicated by American Academy of Family Physicians hazard components for this disease are way of life style specially food, working environment, tobacco utilization and etc.

Different methods used to detect cancer

According to Blum A.L. *et al* there are various methods to detect cancer. Some of them are Magnetic resonance imaging, Computed tomography, Biopsy, Mammogram, Barium Enema, Colonoscopy, Bone scan, Digital Rectal Exam (DRE), Cancer screening, etc. Histology reports are used to recognize most types of cancers. This is one of the best ways proven to make a clear finding regarding a specific cancer type. Initially a biopsy procedure is followed, tissue sample taken from specific locations of interest in body will then be tested under electron magnifying lens.

Use of Image processing to detect cancer

Image processing technique is widely used in understanding histology reports, with the main focus placed on the threshold of the image. At present, various techniques have been developed to detect tumors which can be used to diagnose specific types of cancer (E.g. - Colon cancer).

Methodology

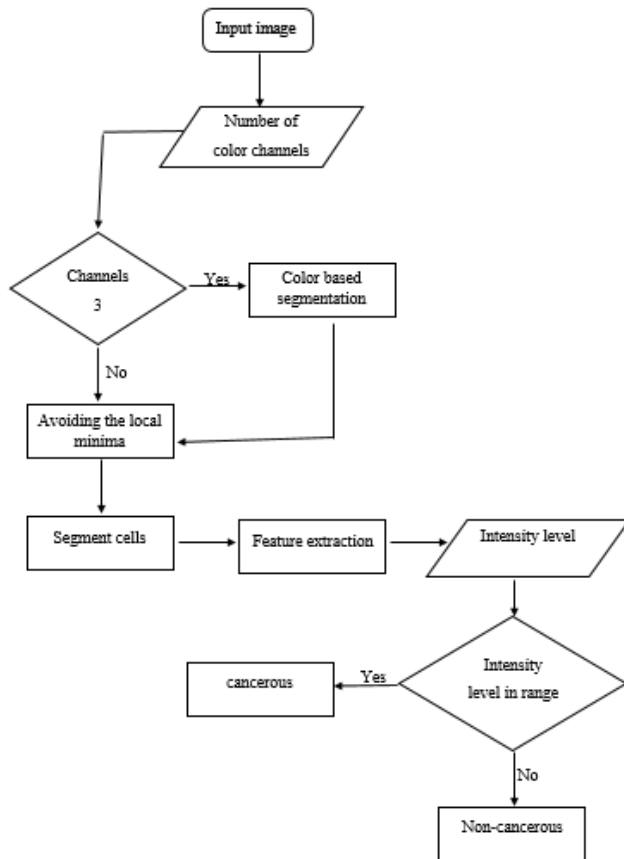


Figure 1 – Flow chart of software implementation

Color based segmentation and minimize squared error function using K – means clustering

Input biopsy image is a color image. Every color image has 3 color channels (Red, Green, and Blue - RGB) which is contained with group of many categories of pixels. The main purpose of using the K –means clustering method is that image is grouped into similar objects that are put together and their squared function minimized. The K – means cluster is represented as,

$$\sum_{j=1}^n \sum_{i=1}^n ||x_i^j - c_j||^2$$

Equation 1

where,

$||x_i^j - c_j||$ – choosen distance between data point (x_i^j) and cluster center (c_j)

n – data points from respective cluster centers

(Gunjan M. and Hemant P. (2014))

Feature extraction

Automated classification of cancer cells using image processing requires higher accuracy. The main concept of the project is the differential intensity based cancerous and non-cancerous cells classification. A number of intensity features are extracted from the K – means clustered biopsy image. The textural features are taken into the final consideration. Cancerous cells / abnormal cells have distinctively different color intensity distribution. Compared to a normal cell, a cancerous cell has a relatively larger distribution of darker pixels. As compared to previous research conducted by Jeremiah *et al.*, the color intensity interval for normal cell is 151-200 while color intensity level for cancerous cell is 51-100.

$$\frac{\partial \phi}{\partial t} + F|\nabla \phi| = 0$$

Equation 2

where,

F – speed function

ϕ – Level set function

The reinitialized method is used to overcome drawbacks of the traditional level set method.

Cell classification

From the feature extracted image, the morphology is used to smooth the original region of the image.

Equation for open image;

$$I_{opened} = I \cdot SE$$

Equation 3

$$I_{masked} = I_{bin} \odot SE_E$$

Equation 4

Image enhancement is an essential step during this procedure. For that purpose Gaussian filter was used.

$$f(x, y) = \frac{2}{2\pi\sigma^2} \exp\left(-\frac{x^2 + y^2}{2\sigma^2}\right)$$

Equation 5

where,

σ – standerd deviation of gaussian function

$f(x, y)$ – original image

In general medical scan images are binary image at some stage. In such an image foreground objects are surrounded by background regions. Boundary separating background and foreground image is the edge and edge detection is a critical task in image processing. Edge detection and dilation was performed as follows.

$$|G| = \sqrt{G_x^2 + G_y^2}$$

Equation 6

$$\theta = \tan^{-1} \frac{G_y}{G_x} + \frac{1}{4} \pi$$

Equation 7

Where,

G_y and G_x – x and y derivatives separately

ϕ – image gradient

Sometimes background is totally within foreground regions due to imperfections in binary conversion. These regions are called holes. Hole-filling is performed to prevent errors by such presence.

Results

Cancer detection using MATLAB based image processing programming is produced in image processing tool kit in Math work MATLAB programming 2014.

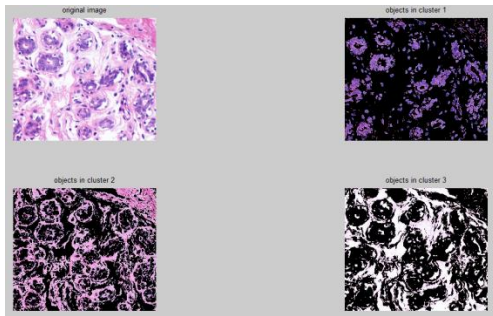


Figure 2 - Image clustering

Original histogram image is a color image. It is converted to gray image and each cell in the tissue sample is segmented by extracting features such as intensity, size and etc.

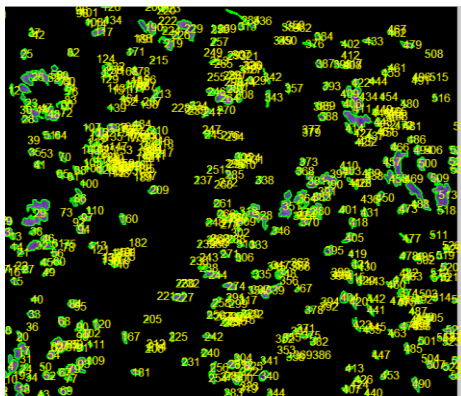


Figure 3 - Cell numbering

After segmenting, each and every cell in the tissue sample number of cells in the tissue is counted and numbered.

# 9.574615e+00	15.0 non - cancerous# 524
# 1.246336e+01	15.0 non - cancerous# 525
# 1.117038e+01	15.0 non - cancerous# 526
# 3.191538e+00	15.0 non - cancerous# 527
# 1.954410e+00	15.0 cancerous# 528
# 1.575696e+01	9.0 cancerous# 529
# 1.178062e+01	9.0 non - cancerous# 530
# 1.518079e+01	15.0 cancerous# 531
# 1.225734e+01	9.0 non - cancerous# 532
# 5.046265e+00	15.0 non - cancerous# 533
# 1.172646e+01	15.0 cancerous# 534
# 9.574615e+00	9.0 non - cancerous# 535

Figure 4 - Final result

In the previous figure it is shown that each and every cell in the tissue sample is numbered. As the final result, the system displays whether cells in the tissue sample are cancerous or not. It is displayed with the cell number as shown in the above figure.

Discussion and Conclusion

Cancer detection using MATLAB based image processing is a software that aids in understanding histology reports using MATLAB programming language.

The designed algorithm differentiates cancer cells from normal healthy cells, reduce human errors that happen when evaluating histology reports, reduce time and specifically any type of cancer can be detected.

Since this system separates each and every cell in the histology report and shows the result whether it is a cancerous or non-cancerous cell within minutes ; it is capable in eliminating the requirement of complex histology reports which at all times requires expertise. In turn it minimizes potential human errors which may lead to wrong diagnosis.

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**DESIGN A MODEL AND MATHEMATICAL APPROACH FOR VECTORED
TRUST CONTROLLED TRI ROTOR AERIAL PLATFORM & HARDWARE
IMPLEMENTATION**

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Abstract

There are many versions of multi rotor designed platforms such as tri-rotor, quad rotor, octal rotor and even more rotors installed platforms. Above all tri-rotor and quad rotor platforms are more popular and considered to be probable future of autonomous rotor machines. This research has identified and demonstrated the suitability for the development of tilted tri-rotor platforms over quad rotor. Their advantages were identified on single tri-rotor platform over single quad rotor platforms. They are lesser cost involved, since tilting mechanism only one rotor with servo motor is needed for pitch and yaw movement where as in quad rotor two rotors must synchronize to achieve the same effect. These improved the efficiency of six directional movement, resulting fast response of the platform. Compared to quadrotors, tri-rotor UAVs were found to be smaller in size, less complex, less costly and have longer flight time due to the reduction in number of rotors, which made tri-rotor vehicle ideal for future deployments.

Introduction

Autonomous flying systems today play a vital role in military systems, surveillance, agriculture and so on. Fixed wing autonomous flying systems have dominated the fields in the military and surveillance since they are able to carry heavy payloads with long endurance. However they have got disadvantages as well. Rotor type autonomous system or Vertical Take-off and Landing (VTOL) autonomous systems have dominated the field of Agriculture due to the fact that they actually need to take-off and land at agricultural fields. Additionally, they need extra hovering at different weather conditions. Due to these rotary wing capabilities, thinking process and engineering approach have changed towards developing rotary wing autonomous platforms. Rotary wing platforms can overcome encountered issues in fixed-wing areal platforms. Today autonomous rotor flying has been evolved as multi-rotor platforms. These autonomous flying systems are trying to engage in day to day activities since they are able to overcome major drawbacks discussed earlier ().

There are many versions of multi-rotor platforms such as tri-rotor, quad-rotor, octal-rotor, and even more rotors installed platforms. These tri-rotor and quad-rotor platforms are more popular and considered to be probable in the future of autonomous rotor machines. There are many advantages on single tri-rotor platform over single quad-rotor platform. Less power requirement, Reduced air frame drag, Less likelihood of rotors being affected by the airframe itself, Only three arms leave space for a wide camera angle, Less cost involvement, More endurance and Small in size are few of them

Methodology

Here, the mathematical approach of the design and controller design are mainly considered. The tri-rotor platform closed-loop system can be shown as shown in the Figure 2. Here U_1 , U_2 , U_3 and U_4 are controlled thrust force, actuated roll, pitch, and, yaw moments respectively.

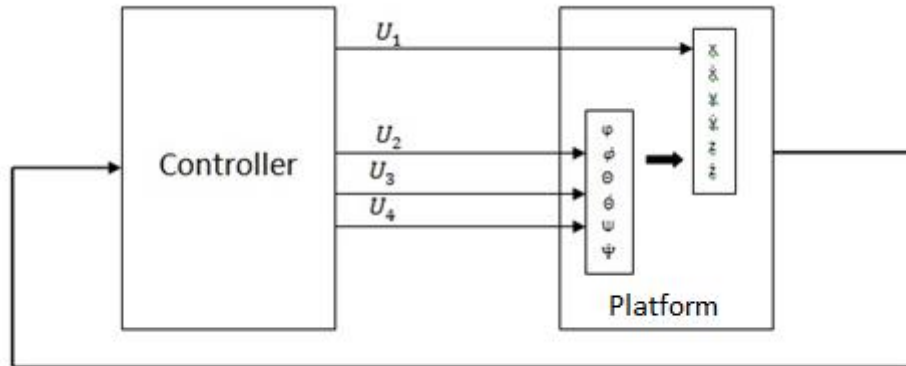


Figure 01- Control Architecture

Proposed controller design

There are few control design implementations which are popular among the multirotor platform designers.

- Proportional Integral Derivative (PID) Controller based methods
- Model Predictive Controller (MPC) based methods
- Linear Quadratic Regulator (LQR) based methods

The project has selected the PID controller-based method since some limitations are applied with MPC and LQR based methods. The structure of the proposed PID controller is shown in the Figure 2.

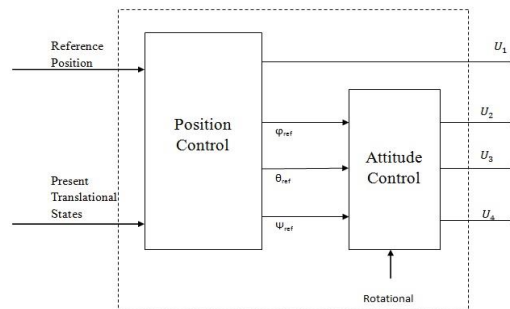


Figure 02- Basic Control Architecture

Design of the Control System

Here $R(s)$, $E(s)$, $U(s)$, $D(s)$ and $Y(s)$ are reference signal, error signal, controlled signal, external disturbance, and desired output respectively.

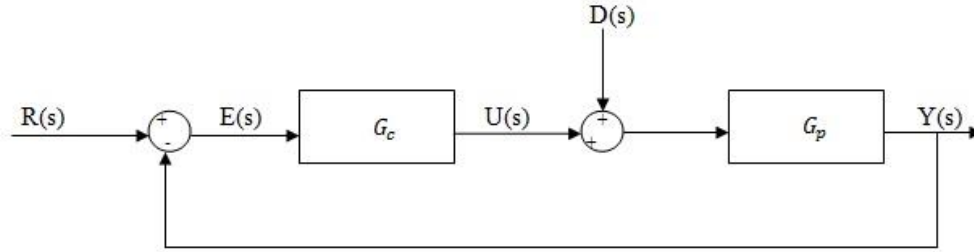


Figure 03 - Controller Design Block Diagram

Following control relationships are obtained from the block diagram shown in the Figure 6. If “G” is the total system transfer function and the “S” is the sensitivity of the system then,

$$G = \frac{G_c G_p}{1 + G_c G_p} \quad (1)$$

$$S = \frac{1}{1 + G_c G_p} \quad (2)$$

$$Y(s) = G \times R(s) + S \times D(s) \quad (3)$$

Roll and Pitch Control

Following facts are considered for designing the PID controller for the control of roll and pitch.

- Need speed up response and stability
- Need not to consider about the accumulated error
- Since there is no concern on accumulated error can consider about proportional and derivative (PD) controller
- Since the use of PD controller sudden and rapid compensation is possible

As the result of above discussion, the controller for pitch and roll is written as in eqn.

$$u(t) = \left(K_p + K_d \frac{d}{dt} \right) e(t) \quad (4)$$

The controller transfer function can be written as,

$$G_c = K_p + K_d s \quad (5)$$

Here, it is possible to obtain the transfer function of the uncontrolled plant. Here “ l , p , h and k ” are known values and they can be obtained from the DC motor specifications.

$$\text{Therefore, } G_p = \frac{l}{ps^2 + hs + k} \quad (6)$$

$$\text{This equation can be written as, } G_p = \frac{1}{\frac{p}{l}s^2 + \frac{h}{l}s + \frac{k}{l}} \quad (7)$$

From eqn.(1), “G” can be obtained as,

$$G = \frac{G_c G_p}{1 + G_c G_p} \quad (8)$$

$$G = \frac{K_p + K_d s}{\frac{p}{l}s^2 + \left(\frac{h}{l} + K_d\right)s + \frac{k}{l} + K_p} \quad (9)$$

Optimum Tuning Method

To tune the PD controller, the Integral Time Absolute Error (ITAE) criterion is chosen. ITAE criterion provides following advantages over other optimization methods such as Ziegler-Nichols method and Cohen-Coon method.

- Smaller overshoots
- Smaller oscillations
- Best selectivity (according to performance indices)
- Very sensitive to the changes

From the ITAE criteria table since we have second-order characteristic equation in the transfer function “G” following equation is obtained.

$$s^2 + 1.4\omega_n s + \omega_n^2 \equiv s^2 + \frac{\left(\frac{h}{l} + K_d\right)}{\frac{p}{l}}s + \frac{\left(\frac{k}{l} + K_p\right)}{\frac{p}{l}} \quad (10)$$

$$\omega_n = 4 / \varepsilon t_0 \quad (11)$$

From ITAE criteria PD controller constants can be found,

$$K_d = \frac{1.4\omega_n p - h}{l} \quad (12)$$

And

$$K_p = \frac{\omega_n^2 p - k}{l} \quad (13)$$

Hence PD controller can be implemented. Hence “G” and “S” can be found.

From eqn. (3), the roll and pitch angles compensated for disturbances are obtained.

Yaw Control

The following facts are considered in the yaw control. In the proposed control structure, the position is controlled without yaw angle.

- Integral action must be employed since the accumulated error is considered.
- Therefore, PID controller is selected to control the yaw movement.

$$G = \frac{K_d s^2 + K_p s + K_i}{\frac{p}{l}s^3 + \left(\frac{h}{l} + K_d\right)s^2 + \left(\frac{k}{l} + K_p\right)s + K_i} \quad (14)$$

ITAE criteria (Zero Steady State Step Error Systems) gives,

$$s^3 + 1.75\omega_n s^2 + 2.15\omega_n^2 s + \omega_n^3 \equiv s^3 + \frac{\left(\frac{h}{l} + K_d\right)}{\frac{p}{l}}s^2 + \frac{\left(\frac{k}{l} + K_p\right)}{\frac{p}{l}}s + \frac{K_i l}{p} \quad (15)$$

As in PID control, the natural undamped frequency as in equation (10) ,

When selecting the ω_n , need to have a minimum settling time t_0 and low overshoots ε (usually selected between $0.7 < \varepsilon < 0.9$). Hence, ω_n can be found.

From ITAE criteria PID controller constants can be found,

$$K_d = \frac{1.75\omega_n p - h}{l} \quad (16)$$

$$K_p = \frac{2.15\omega_n^2 p-k}{l} \quad (17) \quad \text{and}$$

$$K_i = \frac{\omega_n^3 p}{l} \quad (18)$$

The PID controller can be implemented. Hence “G” and “S” can be found. The yaw angle can be obtained to compensate disturbances.

Implementation Results

The platform was auto-tuned and flew. The following parameters and behaviors have been identified for the obtained PID gains. With above implementations, the identified PID gains are checked for the platform. The optimum PID gains have been taken for $\varepsilon = 0.9$ from the Root Locus Analysis as depicted in the Table below.

Table 01 – Final PID values

$\varepsilon = 0.9$ Value	K_P	K_I	K_D
Roll	1.23	-	1.055
Pitch	1.23	-	1.055
Yaw	1.63	1.36	1.44

Discussion

Following facts are to carry forward as the project continues forward. It is expected to complete the mathematical model by studying motor behaviors without assumed values for ω_n . This is intended to achieve for pitch and roll PD controller design and yaw PID controller design. It is required to find best PID gains to withstand against wind forces.

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HEALTH SCIENCES

INDOOR AIR POLLUTION IN SRI LANKA

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Abstract

Air pollution is a well-known environmental health threat to developing countries and developed countries. The major air pollution is particle pollution often called as particulate matter (PM). Many countries have developed solutions for outdoor pollution, but indoor air pollution has no proper solution yet.

In Sri Lanka the increase demand for energy in daily lives increase the personal exposure of indoor air pollutant of a person. Indoor air pollution health problem is mostly associated with level of exposure to an indoor air pollutant, durations of exposure and the toxicity. The health impacts due to indoor air pollutants can be respiratory illness, cancer, and eye disease and low birth weight.

This article reviews the various aspects of indoor air pollution relevant to Sri Lanka, the major causes and solutions for emerging health threat.

Keywords

Exposure levels, Health problems, Indoor air pollution, Middle low income country.

Introduction

Air pollution has been a significant issue in Sri Lanka since it is a developing country. Several measures have been taken to reduce outdoor air pollution, but there are no reliable data to take proper measurements to reduce indoor air pollution. The resulting indoor pollution has severe health threats (Bruce et al., 2002); where about 80% of the population in Sri Lanka still relies on traditional cooking methods in their homes. The majority of burning solid fuels in open fires or simple stoves in a household which release biomass smoke in the home particularly contains many harmful pollutants such as sulfur, nitrogen oxides, and hydrocarbons that can cause cancer (Uni.edu, 2018).

Air pollution is measured as particulate matter (PM) which gives us the air quality. PM_{2.5} is fine particles produced from any combustion about 2.5μm that can potentially cause serious health problems by directly getting into lungs (Marshall, 2013). The primary pollutants are carbon compounds (CO, CO₂, and VOC), sulfur compounds (SO₂ and H₂S) and nitrogen compounds (NO). Secondary pollutants do not directly emit from sources, instead form in the atmosphere from primary pollutants can also be called as precursors.

Mostly indoor air is concentrated with carbon dioxide by burning fossil fuels about 300-450 parts per million (PPM), carbon monoxide can be by any combustion when exposed to 12,800PPM CO at about 60 seconds can cause death by inhibiting the oxygen carry capacity of hemoglobin, volatile organic carbon (VOC) is used in many household products such as paints, varnishes and wax, mainly used VOC is formaldehyde (Lindgren and Norback, 2002). These all indoor air pollutants can affect human health; especially in Srilanka, we can see higher indoor air pollutants in rural areas and low economic families. Researchers have found that cooking smoke release over 370 particles, when biomass fuel is burned in poorly ventilated kitchen or space, the air pollutants exposed is more than a 100 cigarettes per day and this smoke will be distributed throughout the house via smoke (Bradford and Gwynne,

1995). Other sources of indoor air pollution are tobacco smoke, mosquito's coils, Joss sticks. (Lankanewsweb.net, 2016).

Results

Nature and Causes of Indoor Air Pollution

Sri Lanka is a middle-low income country where the weak economy, competitiveness is a problem to address (Bruce *et al*, 2002). Low-income families suffer from serious indoor air pollution, where poverty is a major issue which leads to indoor air pollution (Santamouris, 2007).

In fact, as stated by the World Health Organization (WHO) poverty and inequality are two of the main influencing factors to poor environmental situations and poor health. Poverty leads to socio-economical difference that eventually make its way to less social awareness and education among the rural area population (Hardoy and Satterthwaite, 1991). As an outcome, much of the health effects from indoor air pollution locally seem to occur among the poorest and most susceptible populations is women and young children (K. R. Smith, 2002).

Sources of Indoor Air Pollution

Seventeen million people in Sri Lanka still rely on traditional cooking which is burning biomass fuels for meal preparation (Phillips *et al.*, 2016). Burning biomass fuels is the primary cause of indoor air pollution mostly used as firewood, dung, charcoal and crop residue (Ezzati and Kammen, 2002)

The usage of open fires besides of non-appropriate fuels in overcrowded houses makes every indoor air quality complications contributing to acute respiratory infections. Incomplete combustion of biomass causes mostly kitchen related indoor air pollution (Chakraborty *et al*, 2014). Environmental tobacco smoke (ETS) has a growing anxiety about the health effects of exposure to ETS and it is also as called passive smoking, involuntary smoking, or secondhand smoking. A large selection of consumer products can contribute to indoor concentration of VOCs and SVOCs.

Exposure Level

People in developing countries are frequently exposed to very high levels of indoor air pollutants for 3 to 7 hours regularly over many years. Usual 24 hours average PM10 levels recorded in homes with open wood fires are 800–1000mg/m³.

Concentration of carbon monoxide (CO) in homes using biomass fuels is stated in the range of 2 to 50 ppm for 24 hours, on average, and 10– 500ppm ranged during cooking, when compared the USEPA 8 hours average CO standard is 9ppm or 10mg/m³(Bruce *et al.*, 2004)

In Sri Lank further studies should take place to have reliable data on personal exposure and the amount of exposure of IAP.

Health Impacts

In Sri Lanka there are not many case studies carried out related to indoor air pollution to get more data about the disease involved with IAP but with the data we can elevate the health outcomes.

Diseases discussed are

- Acute lower respiratory infection (Bruce *et al*, 2002)

- Upper respiratory infection and otitis media (Bruce *et al*, 2000)
- Chronic obstructive lung disease
- Lung cancer (Ochieng *et al*, 2016)
- Low birth weight (Pathirathna *et al*, 2017)
- Cataract

Table 7-Health Outcomes (Bruce et al., 2002)

Health outcome	Age	Status of evidence
<i>Sufficient evidence of burden-of-disease calculation</i>		
Acute lower respiratory infections	Children< 5 years	Strong. Some 15-20 observational studies for each condition, from developing countries. Evidence is consistent (significantly elevated risk in most though not all studies); the effects are sizable, plausible, and supported by evidence from outdoor air pollution and smoking.
Chronic obstructive pulmonary disease	Adult women	
Lung cancer (coal exposure)	Adult women	
Chronic obstructive pulmonary disease	Adult men	Moderate- I. Smaller number of studies, but consistent and plausible.
Lung cancer (coal exposure)	Adult men	
<i>Not yet sufficient evidence for burden-of-disease calculation</i>		
Lung cancer (biomass exposure)	Adult men	Moderate-II. Small number of studies, not all consistent (especially for asthma, which may reflect variations in definitions and condition by age), but supported by studies of outdoor air pollution, smoking, and laboratory animals.
tuberculosis	Adult	
Asthma	Child and adult	
Cataracts	Adult	

Conclusion

Sri Lankan studies suggest that indoor air pollution is a major health threat, which mostly affected population to be lower income families and rural area people. This conclusion is made based on limited studies which limit the ability to quantify the exact risk and health problems accurately (Chakraborty *et al*, 2014)

To improve the situation of exposure to indoor air pollutants, cook stoves should be placed in a properly ventilated space and use of chimney reduces the exposure. In addition Sri Lankan government should take actions to reduce VOCs in household products, increasing the incomes of the people and giving fuels at affordable prices to our citizens.

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ETHICAL CONCERNS OF USING GENETICALLY DESIGNED BABIES AS POTENTIAL ORGAN AND BONE MARROW DONORS

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Abstract

The main objective of this article to give the reader an insight of saviour siblings, the process of making a saviour sibling and as well as the ethical concerns regarding them. With the rising demand for genetically designed babies as potential organ donors, most commonly known as “saviour siblings”, the ethical concerns and controversies circulating them has not ceased since the birth of the first saviour sibling in the August of 2000. Saviour siblings are genetically engineered children with their HLA typing matched when they are still in embryo form to a sick older sibling suffering from a terminal disease. From the creation of a saviour sibling to the harvesting of tissues or organs from them, it has its own risks and welfare concerns. But these concerns have failed in creating regulations about saviour siblings in most countries of the world, including the USA. Assistive reproductive techniques (ART) used in creating saviour siblings are PGD (Pre-implantation Genetic Diagnosis), IVF (*In vitro* fertilisation) and ICSI (Intra-cytoplasmic sperm injection). Saviour siblings are now, ‘the new future preventing GVHD (Graft vs Host Disease) after transplantations’.

Keywords

Ethical Concerns, IVF, PGD, Savior Sibling, Transplantation

Introduction

Graft vs Host disease (GVHD) occurs after an allogenic transplant. In this disease the recipients body recognizes the donated organ as ‘non-self’ and it leads to the body’s immune system to attack the donated organ (Cleveland Clinic, 2018). To prevent this from happening, the Human Leukocyte Antigen (HLA) of the donor and the recipient should be matched perfectly. In the body, there is more than 100 HLA types and 6 from these 100 HLA are important in organ transplantation. These 6 HLA should be perfectly matched in the donor and the recipient. The chances of these antigens matching are very rare even if the donor is a close family member like a parent or sibling (Center, 2018). Young children suffering from terminal diseases such as Fanconi Anemia or a malignancy like leukemia requires a bone marrow transplant or organ transplant to extend their life span. When a matching donor is not found, creating a savior sibling is suggested by doctors to the parents (Amc.edu, 2018).

Preimplantation Genetic Diagnosis (PGD) is the process by which embryos are screened for genetic defects and perfectly matched HLA typing with the sick sibling. (American Pregnancy Association, 2018).

The main ethical concerns regarding savior siblings

1. Psychological effects

Being an organ donor has its own psychological effects. When a young child has to undergo high risk procedures like organ donation or bone marrow transplantation it affects the mental wellbeing of the child. especially due to the psychological effects that one must undergo in doing so. When a young child has to experience this, it raises concerns over the savior sibling's mental wellbeing (Saving Savior Siblings, n.d.). There is high possibility that the child would struggle with mental health issues because of the knowledge that they were born for the sole purpose of saving their older sibling instead of being born for themselves. It certainly is a huge responsibility to a young child and they might feel like they have fewer rights to their own body. It would also create resentment towards parents by the child. There is also a high chance the savior sibling would not enjoy a close, loving relationship with their parents who are more likely to value the child that they created the savior sibling for. These children might be pressured by their family situation to donate tissue, bone marrow or even organs so that they fail to understand whether they themselves are willing to donate in the first place. If any of these procedures fails in curing the older brother or sister, they might feel guilty of being responsible for the cause.

Birth of a saviour sibling might also have an adverse psychological effect on the other siblings in the family. For example, if there are three children in a family where;

A- The child is suffering from a serious health condition

B- Child who was conceived naturally and has a good health

C- Saviour sibling created to help in curing A,

Child B, might feel like a big disappointment since they couldn't help in saving their older sister or brother. This might create a rivalry between Child B and Child C.

It is also possible that the savior sibling might feel satisfied by the fact he/she was able to save his/her older sibling (Rbmojournal.com, n.d.).

2. Slippery slope argument

There are arguments that the creation of saviour babies might pave the path for more designer babies to be created. Designer babies are different from saviour babies in a number of ways. This is because a designer baby is made to the liking of parents and the traits that they desire. These traits might be hair, colour of eyes, sex, height, level of intelligence and even good immune system. If more designer babies are created despite the strict rules and regulations surrounding them, it might create a conflict between naturally conceived babies and designer babies in the near future.

Because of these reasons, if saviour babies are allowed to be created then there is a high chance of designer babies therefore if designer babies are banned there is an argument of banning saviour babies as well. Since banning of saviour siblings isn't done, in the near future there is a possibility of conflicts between these test-tube babies and naturally conceived children (Rbmojournal.com, n.d.).

3. Complications from medical procedures

Saviour siblings undergo several medical procedures such as blood transfusions, bone marrow aspirations, bone marrow donation. Even though these complications can be minimized using medications, when these procedures are done to young children who are unable to understand everything happening to them, it raises an ethical concern about the

wellbeing of these savior siblings. There are several medical complications that are associated with each of these procedures. These are listed below;

1. Complications from blood transfusions: Bruising, Continuous bleeding, Dizziness, light-headedness, and nausea, Pain, Physical weakness (Healthline, n.d.)
2. Complications from bone marrow aspirations: Excessive bleeding, Infection (Mayoclinic.org, n.d.)

Methodology

This extended abstract was written by referring sources such as research articles, review articles, journals, books, blogs and newspaper articles.

Discussion

The aim of this article is to make sure that the reader would be able to empathize with the position of a savior sibling and be able to understand the ethical concerns regarding them. It is hoped that it would also help any parent facing the dilemma of creating a savior sibling in making the correct suitable decision by considering the welfare of a savior sibling as well.

Conclusion

A savior sibling in general doesn't have a choice when it comes to donating organs or bone marrow, and since this is very young children that we are concerned about. It is obvious that these children don't understand the meaning of "giving consent". Parents will simply be able to bribe them to donate. Savior siblings should be given more right to their own bodies

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EMERGENCE AND SPREAD OF ANTIBIOTIC RESISTANCE AMONG HUMAN POPULATION

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Abstract

Infectious diseases count for the major causes of death in developing countries. This is mainly due to the emergence of newer infectious agents and more specifically due to the emergence of antibiotic resistance. Antimicrobial resistance is identified as a critical problem for the treatment of microbial infections. Bacterial antibiotic resistance mechanisms include inactivation of antibiotic, target modifications, permeability changes and bypass of metabolic pathways. Determination of all classes (phenotypes) responsible for bacterial resistance to antibiotics and of the mutation responsible for resistance to antibiotics (mutation analysis) is useful. A better understanding of the mechanism of antibiotic resistance will help clinicians to use antibiotics appropriately and identify new methods to design antibiotics that are harder to be resistant towards.

Key Words: Antibiotic, Antibiotic resistant, Infection, Resistant genes

Introduction

The emergence and spread of antibiotic resistance among human pathogens is a worldwide threat to the human health. Many scientists and healthcare providers, as well as policymakers, believe that the resistance levels of antibiotics has now put patients in danger (Frieri, *et al*, 2017). The past decade has seen an increase in human pathogenic bacteria which are resistant to individual or multiple antibiotics. Most of the infections are caused by resistant microorganisms failing to respond to conventional treatment, and even last-resort antibiotics have lost their power (Frieri, 2017).

However, the gradual emergence of populations of antibiotic-resistant bacteria caused by the use, misuse and outright abuse of antibiotics by humans have all lead to the current situation where antibiotic resistant bacteria have become a major global public health problem. Some resistance occurs without human action, like bacteria can produce and use antibiotics against other bacteria, resulting in a low-level of natural selection for resistance to antibiotics. However, the main reasons for antibiotic resistance are linked to humans, such as over-prescription of antibiotics, patients not finishing the entire antibiotic course, over use of antibiotics in livestock & fish farming, poor infection control in health care settings, poor hygiene & sanitation and a lack of new antibiotics being discovered as needed.

Steps can be taken at all levels of society to reduce the impact and limit the spread of resistance. To prevent/control the spread and emergence of antibiotic resistance, an individual can only use antibiotics when prescribed by a certified health professional, follow health worker's advice when using antibiotics, never use leftover antibiotics, prevent infections by washing hands, avoiding close contact with sick people, practice safer sex, keep vaccinations up to date, prepare food hygienically (World Health Organization (WHO), 2017).

Finding approaches against the development of antibiotic resistance is a major global challenge for public health. Recently, World Health Day by the WHO with the theme

‘Combat drug resistance: no action today means no cure tomorrow’ prompted an increase in research activity, and several promising strategies have been developed to restore treatment options against infections by resistant bacterial pathogens (Frieri, 2017).

Antibiotic Resistance and its Spread

Antibiotic-resistant bacteria are consequence of misuse of antibiotic. The emergence and spread of antibiotic resistance can be dependent on the way antibiotics are used. Antibiotic-resistant bacteria are able to multiply to increase their population as a result of mutation and natural selection within a population of organisms because mutation prevent the effects of antibiotic (Laxminarayan *et al.*, 2007). In the absence of antibiotics, antibiotic-resistant bacteria immediately spread to other people through the inhalation of droplets from coughing & personal contact. If antibiotic-resistant bacteria are robust enough, they can spread widely among different populations. In most of the cases, bacteria attain resistance to antibiotics by the genetic material from other species of bacteria (Laxminarayan *et al.*, 2007).

Since the introduction of *penicillin*, the aspect of antibiotic resistance has been prognosticated. Due to resistance of bacteria to older drugs, new drugs are constantly needed. For that, the production of new antibiotics always aim at more effective products. Early on, the potential for new and better antibiotics might have seemed limitless. Today, the need for them is urgent. Today, the challenge is how to increase the activeness of antibiotic & gain more effects of antibiotic (Laxminarayan *et al.*, 2007).

Hospitals too, neglect the response to infection. They prefer treatment over prevention. Hospitals presume that they can manage the costs of antibiotic treatment, because antibiotics are less expensive. Currently, hospitals have no pressing reasons to ensure that the patients are not carrying a resistant pathogen from them to other health care institutions (CDC 2004). Thus, the combat between the interest of individual decision makers and the interest of society is the barrier to discussing the problem of antibiotic resistance. Patients, hospitals, physicians, and pharmaceutical companies can ponder the impact of their decisions with the help of incentive- based policy to help emerge the solution (Laxminarayan *et al.*, 2007).

Table 2: Resistant mechanism of individual antibiotic (Source: Kapoor, *et al*, 2017).

Antibiotic class	Resistance type	Resistance mechanism	Common example
Aminoglycoside	Decreased uptake	Changes in outer membrane	<i>P. aeruginosa</i>
	Enzymatic modification	AGE's	Gram-negative bacteria
Beta-lactams	Altered PBP	PBP 2a	Mec A in <i>S. aureus</i> , CONS, <i>S. pneumoniae</i>
	Enzymatic degradation	Penicillinase which are classified as per ambler classification	Gram-negative bacteria
Glycopeptides	Altered target	D-alanyl-alanine is changed to D-alanyl-D-lactate	Vancomycin resistance in <i>E. faecium</i> and <i>E. faecalis</i>
Macrolides	Altered target	Methylation of ribosomal active site with reduced binding	<i>erm</i> -encoded methylases in <i>S. aureus</i> , <i>S. pneumoniae</i> , and <i>S. pyogenes</i>
	Efflux pumps	Mef type pump	<i>S. pneumoniae</i> and <i>S. pyogenes</i>
Oxazolidinones	Altered target	Mutation leading to reduced binding to active site	<i>E. faecium</i> and <i>S. aureus</i>
Quinolones	Altered target	Mutation leading to reduced binding to active site(s)	Mutations in <i>gyr A</i> in enteric Gram-negative bacteria and <i>S. aureus</i>
	Efflux	Membrane transporters	Mutations in <i>gyr A</i> and <i>par C</i> in <i>S. pneumoniae</i> . Nor-A in <i>S. aureus</i>
Tetracyclines	Efflux	New membrane transporters	<i>tet</i> genes encoding efflux proteins in Gram-positive and Gram-negative bacteria
	Altered target	Production of proteins that bind to the ribosome and alter the conformation of the active site	<i>tet</i> (M) and <i>tet</i> (O) in Gram-positive and Gram-negative bacteria species
Chloramphenicol	Antibiotic inactivation	Chloramphenicol acetyl transferase	CAT in <i>S. pneumoniae</i>
	Efflux pump	New membrane transporters	<i>cml A</i> gene and <i>flo</i> gene efflux in <i>E. coli</i>
Sulfa drugs	Altered target	Mutation of genes encoding DHPS	<i>E. coli</i> , <i>S. aureus</i> , <i>S. pneumoniae</i>

DHPS=Dihydropteroate synthase, *P. aeruginosa*=*Pseudomonas aeruginosa*, *S. aureus*=*Staphylococcus aureus*, *S. pneumoniae*=*Streptococcus pneumoniae*, *E. faecium*=*Enterococcus faecium*, *E. faecalis*=*Enterococcus faecalis*, *S. pyogenes*=*Streptococcus pyogenes*, *E. coli*=*Escherichia coli*, PBP=Penicillin binding protein, AGE's=Aminoglycoside modifying enzymes, CAT=Chloramphenicol acetyl transferases

Origin of Resistance Gene

Comparisons between pre- and post-antibiotic eras showed that bacterial populace is acquiring resistance genes previously unidentified in human pathogens. The origin of resistance gene was first discovered some decades ago by Julian Davies. Most antibiotics which are used currently are made by microorganisms naturally or are derivatives of these natural antibiotics (Martínez and Baquero, 2014). These resistant elements must have ability to inhibit the activity of the antibiotics they produce. These resistant elements can be resistance genes, dependent on their transformation to human pathogens. Discovery of the genomes of antibiotic producers showed that they contain similar genes as resistance genes contain, currently present in populace of human bacterial pathogens. However, to date none of the genes present in producers has been found in human pathogens (Martínez and Baquero, 2014).

Particularly, there are only two cases in which the origin of resistance has been certainly recorded. Namely, *qnrA* from *Shewanella algae* and *blaCTX-M* from *Kluyvera* the original organisms, where these genes were emerged, were not antibiotic makers. Various kind of genomic and functional meta genomic works showed that certain genes which can develop resistance depend on expression in an heterologous host can be found in any microorganism in the environment and ecosystem (Tenover and McGowan, 1996).

Some genes do not act as resistant genes in their original host, because their expression level is very low. They can resist antibiotics (without any mutation) when present in increased number by more copies of plasmids or when their expression is prompted by a strong promoter (Martínez and Baquero, 2014).

Altogether, this reveals that a gene that does not emerge in its original host to confer resistance can be an appropriate resistance gene when it is transferred to a human pathogen. This mechanism of progression in which the function of fundamentals changes, without any genetic change, but just because of a change of environment has been named exaptation and

is fundamental to identifying the first step in the development of resistance by human pathogens (De la Cruz and Davies, 2000).

Consequence of Antibiotic Resistance

Every year, an estimated 25,000 patients die due to multiple drug resistance bacterial infections in Europe. More than 63,000 patients from the United States of America die every year from hospital-acquired bacterial infections active for most of the pharmaceutical companies to distribute antibiotics that may no longer be effective or lacking regulatory approval (Dr. Tom Frieden, MD, 2013). The consequences of these bacterial infections can be catastrophic and could include civil disturbance, violence, famine and natural disaster. The World Health Organization has warned that a post-antibiotic era will result in frequent infections and small injuries may result in death if we fail to act against antibiotic resistance (Dr. Tom Frieden, MD, 2013).

Prevention and Treatments

In addition to attempts to increase the understanding of the factors that mediate the emergence and spread of antibiotic resistance, there are prevention strategies that could help mitigate this global threat. Controlling the spread of infections in the first occurrence would decrease the need to use antimicrobials and therefore, might decrease the development of resistant infections. There are a many number of ways in which this might be attained (Allcock *et al.*, 2017). For example, immunization, preparation of food hygienically, measures of infection control (e.g. hand wash hygiene, barrier precautions and avoiding close contact with infected patients) and improved waste management to inhibit the spread of resistant organisms in health care centers, community, agricultural and environmental settings (Allcock *et al.*, 2017).

Conclusion

It is clear that antibiotic resistance is currently a global threat and causes enormous losses through the production of invalid antibiotics and man hours spent developing treatments. The spread and emergence of antibiotic resistance in the environment mainly occur through inappropriate sanitation, poor quality of water, inappropriate prescribing, overuse of antibiotic, and absence of new antibiotic being discovered. The challenge will be the application of novel technologies to treat clinically applicable infections. Understanding fully the various mechanisms of resistance may be a key to develop treatments against antibiotic resistance.

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COMPLEMENTARY AND ALTERNATIVE THERAPIES FOR BREAST CANCER WORLDWIDE

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Abstract

At the face of the failure of conventional healthcare, patients' prefer 'holistic' or 'natural' remedies such as **Complementary or Alternative Medicine (CAM)**. CAM is a group of various medical and health care practices which originate from outside the *mainstream medicine*. CAM has begun to find its place in breast cancer treatments and currently used to help the patients to cope with disease symptoms and side effects of treatment to improve their quality of life. CAM use is common among breast cancer patients worldwide. Many cancer patients are discussing CAM therapy options with their physicians. However, a subgroup of patients using such alternative therapies seems to have adjustment problems. Immediate research is needed to systematically estimate the efficiency and safety of CAM use, mainly for the use of herbal medicines.

Keywords: Complementary and alternative medicine, Effectiveness, Quality, Regulation, Retrospective or cross-sectional studies, Safety, Traditional medicine

1. Introduction

Cancer is fast in replacing heart disease as the number one cause of death in adults worldwide (Michael lam, 2003). Breast cancer is the second most common disease diagnosed and second top cause of cancer-related death among women. In many countries, including China, the United States, India, Sri Lanka, and Germany standard treatment choices for breast cancer include surgical methods, chemotherapy, radiotherapy, and endocrine therapy, which also have severe side effects that may be difficult to manage, therefore Patients all over the world are in search of better choices to improve their quality of life (Michael lam, 2003).

When conventional healthcare fails to provide optimal health outcomes and quality of life, patients lean toward holistic remedies such as CAM remedies (Bodeker et al., 2005). Retrospective or cross-sectional studies have identified that the use of alternative medicine among the cancer patients population is substantial. Mutually, these studies have proven that level of income, education level, and age are predictors of the use of alternative medicine, which includes mind therapies such as hypnosis, mental imagery, and relaxation and body therapies such as acupuncture, herbal treatments and chiropractic (Harold *et al.*, 1999).

For thousands of years, traditional medicine has played a significant role in people's health. For example, 42% of the population in the USA, 48% in Australia, 70% in Canada and 77% in Germany use CAM therapies. Specific CAM therapies and practices vary from country to country and from region to region, and among them, the most familiar are 'Ayurveda'-the traditional Indian medicine (TIM) and Traditional Chinese Medicine (TCM).

2. Development of Complementary and Alternative Medicine (CAM)

World health organization (WHO) evaluates one-third of the world's population including Africa, Asia, and Latin America as no regular access to modern medicines, however rich

resources of traditional remedies are available and accessible (Bodeker et al., 2005). North America and Western Europe also have searched for other options and, reported to use various types of CAM (Cui *et al.*, 2004). The public's interest of CAM is high due to increased side effects in conventional treatment, lack of curative therapies for several chronic diseases and the high cost of new drugs and microbial resistance (Patwardhan *et al.*, 2005). Pharmaceutical companies have improved their approaches in favor of natural drug product improvement and discovery (Patwardhan *et al.*, 2005).

2.1. Types of Complementary and Alternative medicine therapies

2.1.1 Herbal Therapies

Ayurveda is an ancient healing technique which helps to regulate detoxification and cleansing of the body. Homeopathy originated in 18th century Germany before the arrival of modern medicine; healing process is encouraged by highly diluted substances derived from plants, minerals, or animals (Barrie R. Cassileth and Gary Deng, 2003).

2.1.2. Mental Therapies

Meditation and relaxation techniques are psychologic techniques that are used to calm the body and mind by aiming attention on different objects, a repeated word or mantra, an image, or by body and breathing workouts (Barnett and Shale, 2012). Guided imagery and visualization are psychologic techniques that involve generating a mental image or method to represent bodily functions to give individuals a sense of control over their illness (Lee *et al.*, 2000). Hypnosis is a psychologic method that involves the generation of a positive mental state of healing and the use of a therapeutic idea (Montgomery *et al.*, 2007). Biofeedback is another psychologic method that uses a variety of monitoring machines that deliver feedback to the patient about how the body is responding to mental control (Barnett and Shale, 2012).

2.1.3 Physical Therapies

Acupuncture is a traditional Chinese medicine combined with herbal treatments; it is done by placing of tiny needles at specific points on the body highpoint to direct the flow of energy, to specific organs in an attempt to restore health (Lee *et al.*, 2000). Acupressure is a form of acupuncture, to chi points on the surface of the body pressure is applied with the fingers and thumbs instead of needles (Cassileth, 2011). Reflexology is applying pressure to specific chi points on the end of the feet (Cassileth, 2011). Massage therapy is found by Asian's but now it is involved in West too, in this therapy pressure is applied by the fingers and hands to various parts of the body to relax muscle tension and reduce stress (Cassileth and Vickers, 2004). Yoga, which is originated in India and involves stretching, breathing, and physical exercise to help the flow of energy and to make healing processes within the body (Barnett and Shale, 2012). Tai Chi and ChiGong are a part of traditional Chinese medicine, which is similar to yoga (M. M. Lee et al., 2000). Chiropractic and Osteopaths are treatment of manipulation and massage of skeleton and musculature (Cassileth, 2011)

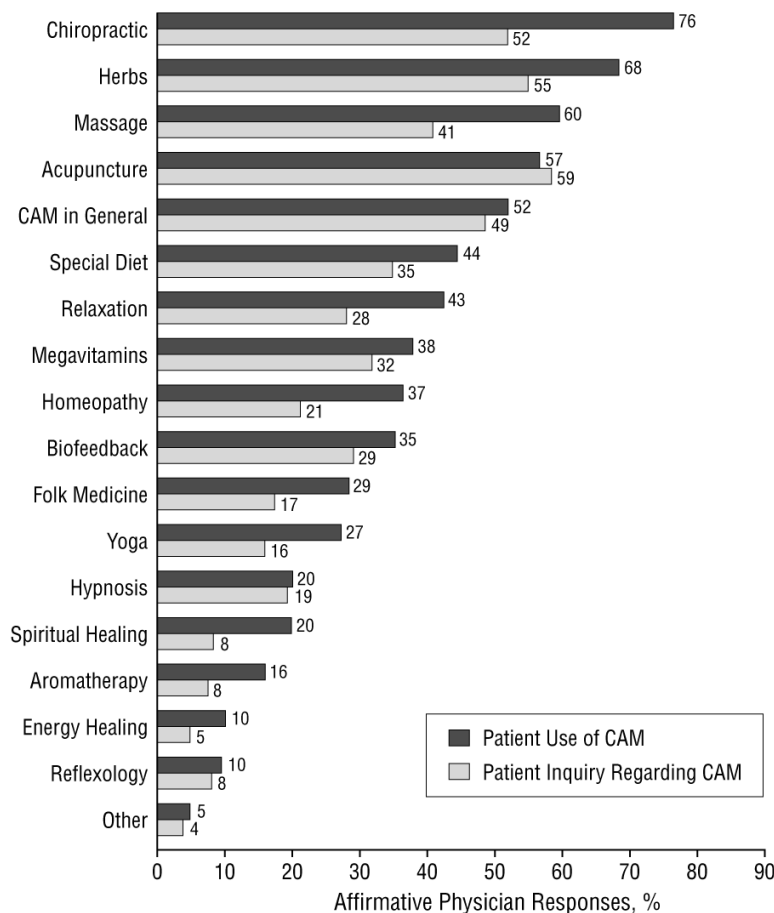


Fig 1. - Physician reports of patient use of and inquiries regarding complementary and alternative medicine (CAM).

The top bar shows what percentage of physicians had at least one patient using that method, and the bottom bar shows the percentage of physicians who had been asked by patients about that method. All numbers indicate percentages of physicians. Adapted from (Corbin and Shapiro, 2002)

3. Safety and Side Effects of CAM for Breast Cancer

Acupuncture helps to relieve hot flashes caused by some breast cancer treatments also includes less vomiting, pain, and fatigue. Women with lymph nodes removed under one arm should not have acupuncture needles inserted into that arm if not a condition called lymphedema causes with the risk of swelling and excess fluid (Melinda, 2015). Acupressure decreases chemotherapy-induced acute nausea severity, though researches did not involve a sample control. (Ezzo *et al.*, 2005). In China, Chi gong is used as an addition to chemotherapy and radiation, as a primary treatment for patients with advanced cancer since tai chi and chi gong are gentle they carry few risks (Melinda, 2015). Yoga increases energy and quality of life with breast cancer patients especially after surgery, some women depending on the treatment more athletic styles of yoga, such as power yoga, work the upper body may not be right. (Jaqueline, 2005) Antioxidants found in herbs prevents or treats cancer, but a higher dose of supplements can be a risk to the body (Melinda, 2015). Meditation, journaling, music or art therapy and guided imagery, helps the cancer patients to relax mentally, make patients feel less alone and help create a positive mental and physical state but mechanically does not cure cancer (Melinda, 2015).

Patients undergoing standard treatment should be told to stop using herbal remedies because, some herbs may cause, tricky interactions with chemotherapeutic agents, dangerous blood pressure changes, sensitization of the skin to radiation therapy, and other unwanted interactions with anesthetics during surgery (Adriane Fugh-Berman, MD, 2000). Overall and

common side effects for herbal treatments can be transient such as stomach aches, gastric upset and nausea, headaches, migraine; diarrhea and poor renal (Molassiotis, 2005).

3.1. The effectiveness of CAM in Breast cancer

Some of the CAM treatments have been evaluated scientifically and found to be safe and effective. However, there are some CAM treatments which are found to be ineffective or possibly harmful. Little is known about many CAM therapies and research studies focused on these treatment methods has been declined due to a number of reasons:

- ✓ Time and funding issues
- ✓ Problems finding institutions and cancer researchers to work with on the studies
- ✓ Regulatory issues

CAM treatments need to be assessed with the same long and careful research process that includes clinical trials with large numbers of patients (Ferreira, 2015). Some patients might use ineffective alternative therapies instead of effective cancer treatments which may hinder their recovery and reduce their quality of life (Edzard Ernst MD, 2003). If the patients take self-medication without proper doctor's prescription, they will decrease the effectiveness of many mainstream medications (Edzard Ernst MD, 2003).

4. Role of oncologists when dealing with patients using CAM

Many cancer patients use CAM therapies, and they appear enthusiastic to discuss the use of these therapies, especially when asked by their oncologists (Barrie *et al.*, 2003). Current studies recommend that oncologists should be educated about the most commonly used therapies, or at least be able to direct patients to trustworthy sources (Barrie *et al.*, 2003). On the other hand, complementary therapies that help manage pain, fatigue, nausea, anxiety, and other warning sign should be incorporated into the patient's standard treatments (Barrie *et al.*, 2003). Complementary therapies have been shown to improve the physician-patient relationship, quality of life and patient satisfaction (Barrie *et al.*, 2003).

5. Conclusion

CAM is a developing field in health care and mainly among breast cancer patients. Studies show that only a small number of patients completely take out from all conventional medicine. Instead, most patients combine CAM with their biomedical routine during cancer treatment (Lambe, 2006). Physicians, particularly oncologists, should pay attention in gaining the knowledge of CAM. It is our belief that, oncologists should be willing to confer the role of CAM with their patients and encourage patients to participate in CAM, when necessary (Nahleh *et al.*, 2003). Many CAM treatments lack sufficient scientific evidence regarding their safety and effectiveness. Studies are underway to determine the safety and efficacy of many CAM agents and practices for cancer patients (Brien *et al.*, 2002).

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ANALYZING THE HEALTH STABILITY OF ICBT STUDENTS, VIA SELF-REGULATION OF EATING BEHAVIOR AND PHYSICAL ACTIVITIES

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Abstract

This study describes the impact of eating habits and physical activities on health status in young population. The main aim of the study was to determine the prevalence of overweight, obesity and the associated food consumption behavioral and physical activities among ICBT Kandy campus students (250 students, aged 18-30 years). Anthropometric parameters (weight, height, waist circumference (WC) and BMI) were measured individually and using a questionnaire collect the information on eating habits, physical activities and life style, dietary beliefs and nutritional knowledge of each individual. In ICBT for male and female participants, mean weight, height and waist circumference (WC) were 68.87, 55.65 kg, 170.6, 158.4m, 85.59, 77.11 inches respectively. Based on World Health Organization, proposed cut-off values for Asians, the percentage of ICBT students in the overweight and obese were 25.2% and 9.2% respectively. Findings of the current study were compatible with prevalence of obesity in regional countries. In addition, gender, level of higher education, fast food preference, physical activities, dieting habits were shown to be associated with overweight and obesity. In conclusion, moderate number of students in ICBT were of perfect weight.

Key words

Dietary behavior, Healthy eating, ICBT, Physical activity

Introduction

Engaging in physical activities play a major role in maintaining a good health. In a previous study, participants with the highest levels of physical fitness at baseline and who maintained or improved their physical fitness over a prolonged period had the lowest risk of premature death (Erikssen,1998). However, physical activities alone cannot help to maintain the health stability of the body. Along with physical activities a healthy diet should also be taken. The precise amount of exercise needed to achieve or maintain a healthy weight varies based on a person's diet and genes (Haskell, 2007). Therefore, our current research discusses the preference of physical activities and preference of food on health stability. The main objective of the study is to determine whether physical activities and dietary habits synergistically impact on health stability or both individually impact on the health stability of a certain individual. In addition, the results of this study could be used to design relevant intervention programs that will address the needs of physical activities and dietary habits in maintaining stability in the health of the community.

Literature review

Physical activity is one of the most basic human functions and needs, which has benefits across the lifespan. People who are physically active also have a better cardiorespiratory and

muscle performance, a body composition, and a biochemical profile more protective for the development of cardiovascular diseases, diabetes, and bone diseases (Sbraccia *et al.*, 2012). According to WHO (2006), obesity is considered as one of the greatest public health challenges of the twenty-first century. Furthermore, the dramatic increase in body weight affecting all age groups has been defined by the WHO as a global epidemic with immense consequences for public health. The development is, to a large extent, a result of reduced physical activity and changes in eating and dieting habits as a consequence of environmental changes. These changes are related to urbanization, industrialization, economic development and increasing food market globalization.

Non-communicable diseases such as cancer, coronary heart diseases and obesity have been linked to unhealthy eating behavior and inappropriate food habits. These behaviors also have the potential to increase the risk of diabetes, osteoporosis, obesity and cardiovascular diseases. Furthermore, decreased levels of physical activity and leisure have enabled the increase in prevalence of overweight, obesity and diet related non- communicable diseases (Conn *et al.*, 2011).

During the past decade, researchers have proposed a range of interventions to reduce obesity. Specifically, restricting the advertisement of unhealthy foods, improving meals, using taxation to reduce consumption of unhealthy foods, providing subsidies to increase intake of healthy foods, and using supply-chain incentives to increase the production of healthy foods are considered as most effective ways to control the obesity (Murrar, 2017). Gillman *et al.*, (2013) suggested that once obesity is present, it is challenging to treat because of multiple physiological, behavioral, and cultural feedback loops.

Methodology

A cross sectional survey was conducted via a sample of college, undergraduate and postgraduate students being at academic year 2018 - 2019, in order to analyze the health stability of ICBT Kandy campus students, via dietary habits and physical activities. A sample of 250 students (85 females and 165 males) were taken in this survey.

Data Collection

Data collection was completed by two steps in this research. First step being anthropometric parameters while second step was deemed as asking participated students to complete questionnaires being distributed.

Anthropometric Parameters

Weight (Kg), height(m) and waist circumference (inch) were measured according to WHO protocol and BMI was calculated using the standard formula (Kg/m²)

Questionnaire

Participated students completed the questionnaires that included questions related to their eating habits, physical activities and life style, dietary beliefs and nutritional knowledge. Overall, 250 questionnaires were distributed among ICBT college, undergraduate and postgraduate students in this research.

Data Analysis

To describe the data gathered, MS Excel 2013 software was utilized in this survey. Statistical analyses were performed using the R-Studio software (DMCA, Boston, USA).

Results

A total of 250 students (165 males and 85 females) fully completed the survey. More than half of the students were undergraduates. 3.2 % of students from the majority had described that they eat at least one meal from out per day. 29.6% of students reported not taking any special diet. Males had significantly higher waist circumference, height, weight and BMI, compared to females.

Anthropometric measurement.

Result indicates that 52.94% of the female and 51.50% of the male students were within healthy BMI range, and 28.23% female and 32.72% male were either overweight or obese (Figure 1). The mean estimated BMI for all students was 23.25 kg/m² and for females was 22.18 kg/m², whereas for males, the mean BMI was 23.64 kg/m². The mean body weight percentage was higher in males than in females. (Table 01) Waist circumference was significantly higher in males (85.59 cm) than in females (77.11 cm).

Table 8: Mean anthropometric measurements

Sample characteristics	Mean	Male	Female
Waist circumference (inches)	33.086	85.59	77.11
Weight	64.37	68.87	55.65
Height	166.53	170.69	158.42
BMI	23.25	23.64	22.18

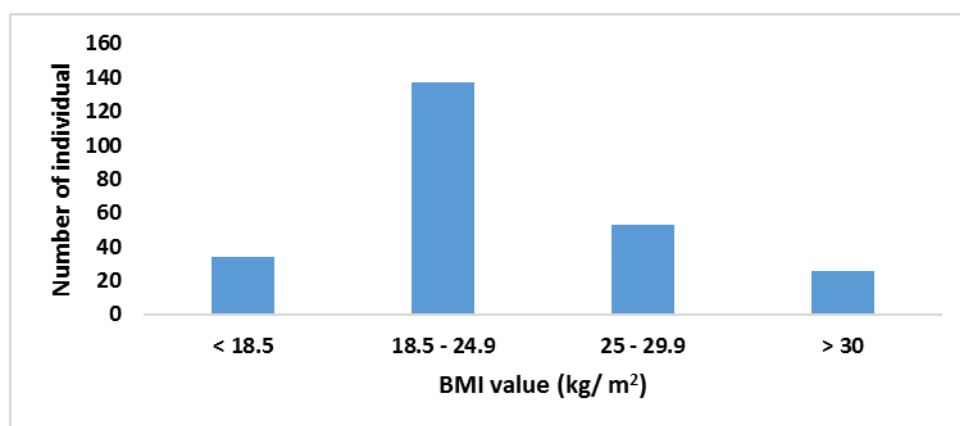


Figure 1: BMI Analysis of ICBT students

Dietary patterns

Results indicate that the majority of students reported daily consumption of rice and curry for breakfast, lunch and dinner. Considering the breakfast, the first three selection of students is rice and curry, bread and string hoppers. For the lunchtime, most of the 98.4% of students have reported they have rice and curry, as dinner rice and curry, noodles, and bread. More than 32% of the students reported daily intake of fruits. However, females reported less

frequent intake of fruits than males. Results indicate that the majority of students reported drinking more than 07 glasses of water per day. Most students (70.8%) prefer home cook foods, on the other hand 15.2% of students had reported that they choose fast foods. One third of students agreed that they used to have at least one meal per day from outside (31.2%).

Restaurant preference

Result indicate that presents student's preference on restaurants. Majority of students have reported that they prefer to eat from Pizza Hut. Low number of students had selected Dominos.

Physical activity

Outcomes of this section indicate that the majority of students were not physically active. 22.4% of students have reported that they do not do exercise in the morning, and 31.6% students had agreed that they do not do exercise at night after dinner. 20.4% students had reported that they exercise daily and from that 18.8% students go to gym, and 16% of students follow under a professional trainer. Finally, 12.4% of students described their lifestyle to be active.

Discussion

Based on classification of weight status, results indicated that the majority of students were within the healthy weight category and less than 30 students were overweight or obese ($BMI \geq 30$). The rates of overweight/ obesity in our sample were lower than the national averages reported in National Health and Nutrition Examination Surveys (2011–2012) data for adults aged 20–39 years (males: 62.0%; females: 58.5%), but higher than the 2012 state based Behavioral Risk Factor Surveillance System (BRFSS) survey's prevalence of overweight for adults aged 20–24 years old (Ogden, 2012).

Conclusion

Based on the eating habits among our sample of students, the results indicate that male students might benefit from a nutrition education program that focuses on translating theoretical nutritional knowledge into daily-life applications, and females would benefit from reducing the time spent in sedentary activities and being more physically active. Developing gender-specific programs for promoting healthy lifestyle behaviors among students is recommended.

Cross-sectional design of the study does not permit causal relationships to be inferred. However, results of this study contribute to the literature as this study explored in depth the weight status, dietary habits, physical activity, dietary beliefs, and nutritional knowledge in a sample of college students.

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CANCER STEM CELLS AND ITS RESISTANCE TOWARDS THERAPIES

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Abstract

Study of cancer stem cells (CSCs) has attracted researchers' attention from the beginning of the 21st century because cancer is a significant health problem worldwide. This study aims to get an understanding of CSCs and their characteristics, mechanisms and the therapies targeting them. The key characteristics of CSCs are self-renewal, tumorigenicity, differentiation and resistant to some of the drugs. Under mechanism and regulation of CSCs, some of the major signaling pathways were explained. The current cancer treatments such as chemotherapy and radiotherapy responsible for targeting tumor bulk and not the CSCs. There also some cancer therapies such as surgery, hormonal therapy, anti-angiogenesis therapy, immunotherapy, and natural therapies. Identification of surface markers on CSCs and their molecular features which are associated with CSC phenotypes may help with the design of effective treatments in the future. Approximately 40 published literature reviews, research papers, medical journals, and online publication pages were used to gather information for this study.

Keywords: CSCs, Metastasis, Therapy resistance, Signaling pathways, Tumorigenicity

Introduction

Cancer is one of the major causes of mortality in the world. CSCs are derived from normal stem cells, differentiated cells and progenitor cells through acquired mutations during their cell division. CSCs are involved in both initiation of tumors (cancers) and contributing to tumor resistance for treatments. There are major similarities between normal stem cells and tumorigenic cells such as long lifespan, resistance to drugs and toxins, resistance to apoptosis. Both of the cells have comprehensive proliferative potential and the ability to give rise to new tissues, composed by heterogeneous proliferative potentials. CSCs differ mainly from normal stem cells in their tumorigenic activity (Guo, 2006; Reya, 2001.).

CSCs have key characteristics. Morphological diversity of cells can be visible under a microscope, and there are differences among tumor cells such as expression of surface antigens and cytoplasmic proteins, and the activity of biochemical processes. Functional differences such as minor population in a tumour, self-renewal, proliferation rate, invasion, metastases forming, relapses, activation of neoangiogenesis, resistance to systemic therapy, responsible for tumour heterogeneity, hierarchical organization of tumour tissue, environmental influences and random processes (Bao, 2013).

Some molecules such as CD133, CD44, ABCG2, ALDH are known as the biomarkers of cancer stem cells. The most common method used to detect CSCs is fluorescence-activated cell sorting (FACS) based on cell surface markers or intracellular molecules such as CD133, CD24, and CD44 are typically identified (Hu, 2012).

Genome alteration is a major cause of growth in cancer cells and an important source of genome alteration is mutation. During carcinogenesis any cell type is lead to malignant transformation depends on the degree of accumulation of nononcogenic or oncogenic

mutations. MicroRNAs regulate gene expression during post transcriptional level. Signaling pathway networks plays an important role in CSCs to keep stem cell properties. The pathways and elements are involved to the control of self-renewal and differentiation of cancer stem cells and normal stem cells include PI3K, PTEN36, JAK, Wnt/ β -catenin, hedgehog, Notch, NF- κ B, Bcl-2, and others (Sampieri, 2012).

The progresses of understanding of the molecular basis of cancer stem cells, involved in to the progress in cancer detection and treatment. The current treatments responsible to limited the survival benefits for most advanced stage cancers, because these treatments primarily target tumor bulk and not to cancer stem cells. Many advanced cancers are returned because of the use of chemotherapeutic and radio therapeutic agents that known as conventional therapies are initially lead to therapeutic responses. They have a less ability to target cancer stem cells and toxicity due to non-specific effects on normal cells. Identification of surface markers and their molecular features which associated with CSC phenotype may help with the design of effective treatments recently.

Other main current therapies are surgery, hormonal therapy, anti-angiogenesis therapy, and immunotherapy. They show a lack of efficacy to long-term outcome. These therapies are mediating with microenvironment signals, inhibiting of drug-efflux pumps, miRNA expression, induction of CSCs apoptosis and differentiation. Current therapies also fail to take into account the heterogeneous nature of tumors and the differences in tumors between patients, instead applying broad treatment principles rather than personalized treatment regimens (Chen, K., 2013).

Recently, several compounds were found which have the ability to kill cancer stem cells, such as salinomycin, curcumin, sulforaphane, vitamin D3 analog and so on. The more recent developments of CSC research are undergoing on carcinomas that are able to undergo an EMT (epithelial-to-mesenchymal transition) program. Therapeutics that based on CSCs has been developed and some are on under research now. The natural compounds which can target the cancer stem cells, the mesenchymal stem cells may able to induce cell differentiation in tumor bulk and some other therapies including gene therapy. Current researches and their study of cancer stem cells will help to develop recent therapies to eliminate cancer and the initiating cancer stem cells.

Methodology

For this study 40 literature review articles and journals related cancer and stem cells and online articles were used as resources.

Discussion

CSCs are the cells that initiate tumors and derived from normal stem cells, progenitor cells and mature differentiated cells. And they contribute to tumor resistance on treatments. They have some key characteristics such as self-renewal, tumorigenicity, metastasis, differentiated, drug resistance etc. there are lots of mechanisms and regulatory pathways are involved to CSCs like ABC transporters, signaling pathways and genome alterations. The proper understanding of the molecular basis of CSCs may involve to invent lot of therapies for cancer. Mainly chemotherapy and radiotherapy are known as the conventional therapies and

there are more other therapies like immune therapy, hormonal therapy, anti-angiogenic therapies. There are more treatments still undergoing the clinical trials.

Conclusion

Cancer is a major cause of mortality in the world. Better understanding of the molecular characteristics of CSCs contributes to the current progress in cancer detection and treatment. However, currently there is no cure for cancer, especially drug-resistant cancer types. The improved understanding of the molecular mechanisms responsible for CSCs' therapeutic resistance may aid in improvement of the modern cancer therapies. The majority of traditional therapies are targeting the tumor bulk and not the CSCs. Therefore, researchers have done a lot of clinical trials and experiments targeting CSCs. There are several research studies and clinical trials designed by remodeling traditional therapies to target CSCs. These therapies mainly target to destroy the CSCs and their niches and may have some hope in developing effective cancer treatments.

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BABY DESIGNING – GENE EDITS IN HUMAN EMBRYO

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Abstract

The genetic modification of an organism is a fascinating field of research. In the past, chemical and radiation tools were used to cause mutations, but those are now outdated and efficiency was also not to the level. Currently, a new gene editing technique called Clustered Regulatory Interspaced Short Palindromic Repeats (CRISPR) is being used to edit the genome and this is an efficient technology in comparison with other gene editing techniques. Mainly, CRISPR-Cas9 applications are being considered to edit the genome in human embryos. The objectives are to get a better understanding on how designer baby is created, study about the Cas9 mechanism and prevent inherited diseases in newborn babies. CRISPR-Cas9 can correct the genetic mutations in human embryos and could be used to treat or prevent the diseases like, Hypertrophic cardiomyopathy caused by Cardiac Myosin Binding Protein C (MYBPC3).

Keywords

CRISPR-Cas9, Genetic, Human embryo

Introduction

Designer babies can be created by a new technology used to design a baby who is not affected by various inherited diseases and reduce certain health conditions. The first designer's baby was made in the United States in 2000. When DNA coding of human embryos is changed, genes causing hereditary diseases can be eradicated or corrected before the birth of embryo. Many European countries use this technology whereas some Asian countries do not use because of some ethical issues. Only few techniques are used to edit the genomes. Homologous recombination was the earliest method that used to edit genomes. This type is limited because it is extremely inefficient in most cell types. In 1990, ZFN (Zinc Finger Nuclease) is the most established synthetic proteins that is used for gene targeting. Also, Transcription Activator-Like Effector Nuclease arrived into the genome editing in 2009. Now, CRISPR-Cas is the mainly used technology for genome editing. The CRISPR-Cas gene editing technology has been used in human embryos cultured *in vitro* to correct a mutation associated with a disease (Jiang, 2017).

Correction of MYBPC3 Gene Mutation In Human Embryo

This is one of the examples for the correction of gene mutation in human embryos. The *MYBPC3* gene mutation causes Hypertrophic Cardiomyopathy and it's a condition of inherited cardiac disease. It can be caused by different mutated genes including Cardiac Myosin Binding Protein C. The presence of mutant copy of MYBPC3 causes symptoms and it usually manifests as a heart failure. If one of the parents who had the mutant copy of the MYBPC3 gene, the couple's progenies have a 50% chance of inheriting it (Carrier, 2015).

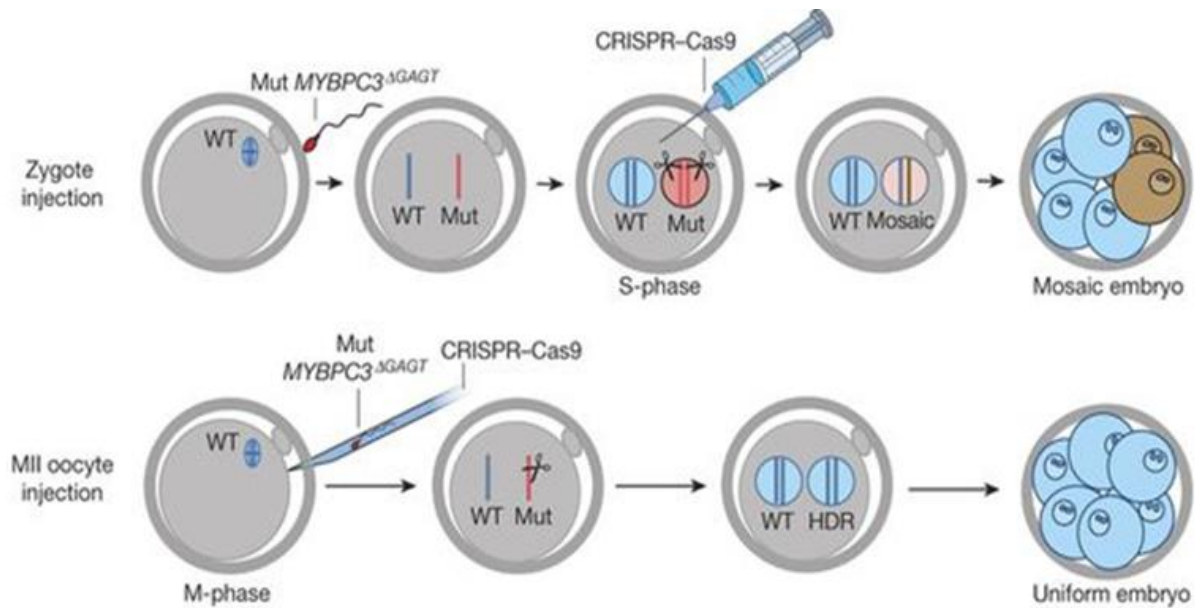


Figure I- Gene correction in S phase and M phase injected human embryo

Gene Correction In S Phase Injected Human Embryo

Focusing outcomes on human zygotes produced by fertilization of healthy donated oocytes with sperm from the patient heterozygous for the *MYBPC3* mutation. The direct introduction of Cas9 is more efficient than using a plasmid. Into the cytoplasm of pronuclear stage zygotes 18 hours after fertilization, injecting a mixture that include sgRNA, Cas9 protein and ssODN DNA, after adopted recombinant Cas9 protein microinjection. MII oocyte was fertilized by sperm from heterozygous patient and CRISPR-Cas9 was then injected into the zygote of the S phase. The embryos in 4-8 cell stage were collected for genetic analysis. However, the injection during S phase can be resulted the untargeted mutant embryo, mosaic embryo and HDR repaired embryo (Mo, O., 2015).

Gene Correction In M Phase Injected Human Embryo

During the fertilization if CRISPR-Cas9 was co-injected with sperm into M phase oocyte, by intracytoplasmic sperm injection (ICSI). It allows the genome editing to occur when the sperm still contains a single mutant copy. In addition, the prolonged exposure time to the MII cytoplasm could allow the degradation of CRISPR-Cas9 components before DNA replication, resulting in two or more mutant alleles. Finally, it produced a uniform embryo who contain only the repaired cells (Wiles, 2015).

Development and Cytogenetics Of Repaired Embryos

The effect of gene correction on preimplantation development can be examined by the cultured CRISPR-Cas9 injected embryos to blastocysts.

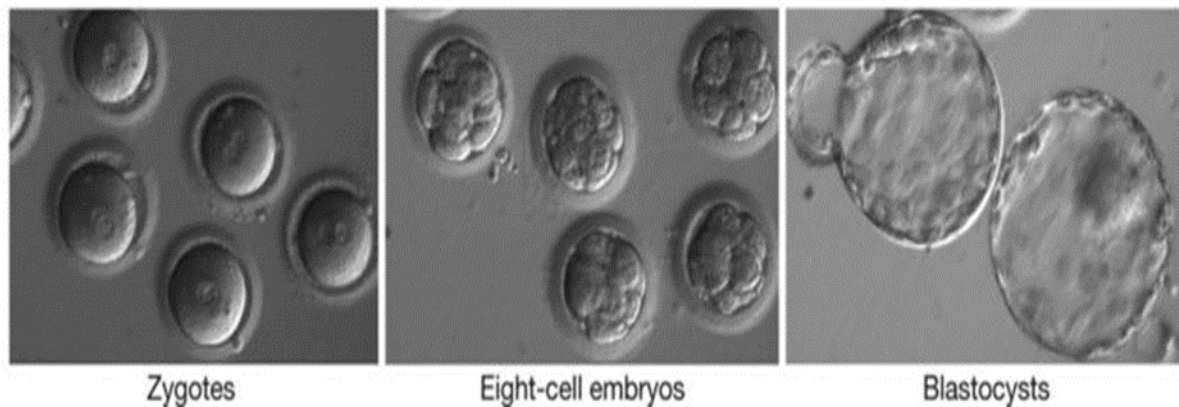


Figure II- The normal morphology of CRISPR-Cas9 injected pronuclear stage zygotes, eight cell embryos and blastocysts

Methodology

There were 49 articles and videos investigated for the preparation of review article.

Discussion

The technology that helps create designer babies is not 100% safe. At the moment, it is still in its experimental stage and there is much to be developed and tested. If the process of creating a design baby is not done correctly, it could result in accidental termination of the baby. There is a debate that says creating a designer babies can lead to a gap in society, where babies born on a regular basis will have a big difference compared to babies born as part of the designer baby series. Babies born as designer babies may look better, intelligent or even be less likely to get sick (Winblad, 2017) . Sometimes they may accidentally give rise to the new form of illness that we are not yet aware of.

Pros Of Designer Babies

- Can increase overall life expectancy – Because it discards most of the defective genes and only keeping healthy genes. As a result, the baby will grow up to be a healthier than the babies who may have both defective and healthy genes. Once the majority of the medical problems are taken care of and eliminated from the baby's genes, they will automatically enhance the baby's overall health the rate of life as well.
- Reduces chances of various genetic disorders – Examples include Alzheimer's, Down syndrome, Spinal muscular atrophy and Huntington's disease.
- Eliminate chances of diseases in future generations (Verlinsky, 2005)

Cons Of Designer Babies

- Not completely error free process
- They may accidentally give rise to the new forms of illnesses.
- Can create a gap in society (Verlinsky, 2005).

Conclusion

Designer babies are created by using CRISPR-Cas9 technique. Children can be designed without any genetic and inherited diseases that are painful for them. Also, designer babies are a potential cure only for genetic and inherited diseases. Assuming that parents want to design children with the most attractive and successful characteristics. It is not only a problem for social diversity but also from the biological diversity. However, by using this technology can reduce the risk of abortion and raised the birth rate as well.

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INFORMATION TECHNOLOGY

INTERNET USAGE AMONG THE UNDERGRADUATE STUDENTS IN EASTERN PROVINCE, SRI LANKA

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Abstract

Nowadays, the Internet is an essential thing among the students' life. In this descriptive research study, a sample of undergraduate students from different campuses of Eastern province was studied, to analyse the undergraduate's internet usage and to compare the usage between Government and Private sector students. A total of 247 students' data were collected and required statistical analyses were performed using SPSS software. The study results exposed that majority of the students need the internet to their lifestyle. 91.9% of students go online for their educational purpose. Students face many problems in using the internet because of internet slow, power failure and high rate. Therefore, the study recommends that both government and private colleges should provide required high-speed free connection and Government should concern to improve the current state of power in the country and to grant the lowest cost for the browsing.

Keywords: Academic, Campus, Internet, Students, Undergraduates

Introduction

The internet is generally used by students in several countries in their day to day life. Nowadays, it can be used anytime wherever you are with many devices. Therefore, Internet use has become a way of life for undergraduate students for their academic purpose (Bashir, S., Mahmood, K., and Shafique, F., 2008).

A descriptive cross-sectional study was carried out in different colleges of Eastern province to analyse the undergraduate's internet usage and to compare the usage between Government and Private sector students.

Methodology

The study was undertaken using stratified random sampling technique by chosen up samples from the respective stratum of the corresponding colleges South Eastern University of Sri Lanka, ICBT Campus Batticaloa and BCAS Campus Kalmunai. A total of 300 questionnaires were distributed among the students and in these, the usable questionnaires were 247. So the sample size was 247. This study has been carried out to analyse the undergraduate's internet usage and to compare the usage between Government and Private sector students. Also, descriptive test statistics were applied. And required statistical analysis was performed using SPSS software. Further, 5% of the significant level was used in this study.

This research study test the following hypotheses:

H_1 : There is a relationship between demographic variables and Important of the internet to Survival.

- H_2 : There is a relationship between demographic variables and Reasons for Internet using (Education, Entertainment, Communication, Update Yourself, Downloading, Shopping, Other reasons).
- H_3 : There is a relationship between demographic variables and Reasons for Internet use in academic.
- H_4 : There is a relationship between demographic variables and Internet usefulness in academic per suit.
- H_5 : There is a relationship between demographic variables and How much influence in academic.
- H_6 : There is a relationship between demographic variables and Training Source.
- H_7 : There is a relationship between demographic variables and How Long Use (years).
- H_8 : There is a relationship between demographic variables and Hour/ Day.
- H_9 : There is a relationship between demographic variables and Spend/ Month (in Rs.).
- H_{10} : There is a relationship between demographic variables and Place.
- H_{11} : There is a relationship between demographic variables and Email Service.
- H_{12} : There is a relationship between demographic variables and Sleep loss.
- H_{13} : There is a relationship between demographic variables and Just Few Minutes.
- H_{14} : There is a relationship between demographic variables and Affect rest time.

*Demographic variables: Gender, Age, Part-time work, Institute type, Course & Year of study.

Results and Discussion

The personal demographic profile of the students is shown in Table 1. Majority of respondents were females (51%), Aged at 22 years old. The results show that 39.7% of the Sinhala students and 39.3% of Muslim students participated in this study. 16.6% of the students were Hindus while only 4.5% was Christians. Most of them are studying at the Government campus. And, 44.1% of the respondents were physical science students, 28.7% of them were from biological sciences. 22.7% of students were in IT/ Computer Science field and 3.6% were in the engineering field. Additionally, the respondents were asked about their education level, 36.8% of the students were in the second year, 32.4% were in the final year while 30% of them were first-year students. Most of the students didn't do any part-time work and they are interested in sports, reading and playing.

Table 1. Demographic variable

Variables	Frequency	%			
Gender			Buddhism	98	39.7
Male	121	49.0	Muslim	97	39.3
Female	126	51.0	Hindu	41	16.6
Age*	Mode: 22 years		Christian	11	4.4
19 – 20 years	22	8.9	Institute Type*		
21 – 22 years	83	33.6	Government	180	72.9
23 – 25 years	129	52.2	Private	66	26.7
25 +	11	4.5	Course*		
Religion			Biological Science	71	28.7
			Physical Science	109	44.1

IT/ Computer Science	56	22.7
Management	1	0.4
Engineering	9	3.6
Year*		
1	74	30.0
2	91	36.8
Final	80	32.4
Part-time work*		

Via Internet	6	2.4
Other	34	13.8
No part-time work	204	82.6
Hobby***		
No Hobby	8	3.2
Read –Write	76	30.8
Sports	63	25.5
Art Paint	21	8.5
Other	121	41.0

Note: *N≠247 due to unmarked fields by respondents

***Multiple choice questions

Table 2 shows the usage of the Internet among undergraduate students. 98% of students need internet for their survival. The highest percentages for the sources of access are Smart Phone (88.3%) and laptop (59.5%). The highest percentage usage was for educational purposes (91.9%) (Bavakutty, M. and Salih, T.K.M., 1999), also using internet for Entertainment (66.8%) and downloading (57.9%) respectively. It shows that more social media and new technologies have provided space and applications of amusement to society as well as disguised kind of things for desirability to the society for using the internet and spent a lot of time. And also, 57.5% of students use the internet for communication purpose. 40.9% of students have been using the Internet for over 4 years. Most of them have been using around 2 hours per day as well as only 23.5% use less than one hour. The results indicate that the majority of respondents access the internet daily (Jagboro, K.O., 2003).

Table 2. Usage of the Internet

Variables	Frequency	%
Important to Survival*		
Yes	242	98.0
No	4	1.6
Devices***		
Smart Phone	218	88.3
Laptop	147	59.5
Tablet	21	8.5
PC	37	15.0
Other	3	1.2
Reason for Internet***		
Education	227	91.9
Entertainment	165	66.8
Communication	142	57.5

Update Your self	97	37.3
Downloading	147	57.9
Shopping	58	23.5
Other	26	10.5
How Long Use (years)*	Mode: 4.2 years	
< 1	7	2.8
1 – 2	63	25.5
3 – 4	70	28.3
> 4	101	40.9
Hour/ Day*	Mode: 1.8 hours	
< 1	58	23.5
1 – 3	111	44.9
4 – 6	36	14.6
>6	36	14.6

Note: *N≠247 due to unmarked fields by respondents

***Multiple choice questions

The Figure 1 represents the influence of internet in academic among private and government sector students and the private sector students use internet more for the assignment works. In Table 3, the majority of the students use the internet for the examination preparation (32.8%) and assignment works (25.5%). Furthermore, 62.3% of the students agreed that their academic performance has been improved by using the internet but 4.5% of them said that

their GPA has been declined because of internet usage. Most of the students have rated that internet usage in academic is average (71.3%) while only 4.9% of respondents rated it as low. Only IT/Computer science students use the internet at high level for their academic purposes (8.6%).

Figure 1. Reasons for Internet use in Academic

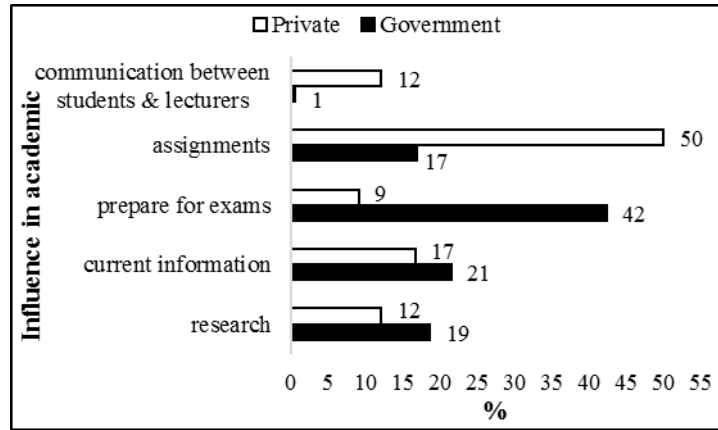


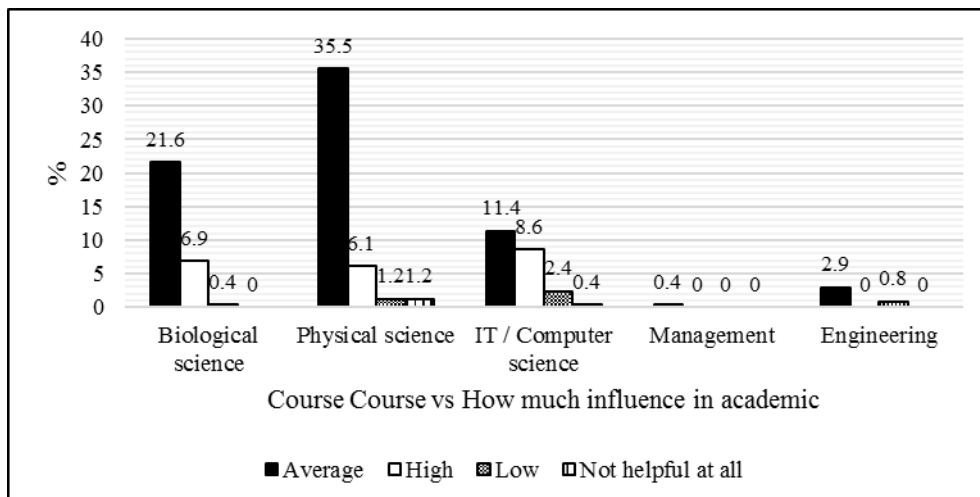
Table 3. Influence of Internet in Academic

Variables	Frequency	%	Useful in Academic*		
Reasons for Internet use*			GPA Improved	154	62.3
Research	42	17.0	GPA declined	11	4.5
Access to Information	49	19.8	None	72	29.1
Prepare for Exam	81	32.8	Rating of the Internet for academic pursuit*		
Assignments	63	25.5	Average	176	71.3
Communication between Lecturer and student	9	3.6	High	54	21.9
			Low	12	4.9
			None	4	1.6

Note: *N=247 due to unmarked fields by respondents

***Multiple choice questions

Figure 2. Course vs How much influence in academic



Students were asked about where they obtained talents to use the Internet. 58.3% of students specified that they've learned the capabilities by self-learning. The undergraduate students are generally attracted most with Dialog (51.4%) and Mobitel (46.6%). As well as they mostly use the internet in campuses (42.5%) and their home (37.2%). Students say that they face many problems in using the Internet but they mainly mentioned the low speed of Internet (89.5%) (Ibegwam, A., 2002). They also face the problem because of the power failure (17.8%) and high rate (17.8%) when using the internet. But 18.6% of students spend more than 1,500 rupees per month for the Internet and most of them spend around Rs.388 per month. Mostly they use the Google search engine for their browsing (96.4%) while only 13.8% of students use Yahoo (Search Engine Watch, 2007). 91.5% of students are using Gmail at the same time, no one is using Hotline as an e-mail service. Only 1.6% are using Yahoo. The students use the internet for working easily (71.7%).

Table 4. Access to the Internet

Variables	Frequency	%
Training Source*		
Self-Learn	144	58.3
From Friends	63	25.5
From Relatives	7	2.8
From Teacher	8	3.2
By Training Programme	6	2.4
Other	8	3.2
Internet Service Provider***		
Dialog	127	51.4
Mobitel	115	46.6
Airtel	44	17.8
Etisalat	14	5.7
Hutch	18	7.3
SLT	36	14.6
Other	11	4.5
Frequent Place*		
College	105	42.5
Home	92	37.2
Library	21	8.5
Cybercafé	2	0.8
Relative/ Friends	1	0.4
Other	20	8.1
Problems while use internet***		
Slow	221	89.5
Power Failure	44	17.8
Poor Computer Skills	16	6.5
High Rate	44	17.8
No Device	8	3.2
Spend/ Month (in Rs.)*	Mode: Rs.388	
< 500	97	39.3
500 – 1000	69	27.9
1000 – 1500	27	10.9
1500 – 2000	23	9.3
> 2000	23	9.3
Search Engine***		
Google	238	96.4
Yahoo	34	13.8
Ask	11	4.5
MSN	4	1.6
Other	24	9.7
Email Service*		
Gmail	226	91.5
Hotmail	0	0.0
Yahoo	4	1.6
Outlook	3	1.2
Other	6	2.4
Advantage***		
Easy of Work	177	71.7
Time Saving	124	50.2
Searching tool	131	53.0
Authenticity of Info	56	22.7
Earning	29	11.7
Other	36	14.6

Note: *N=247 due to unmarked fields by respondents

***Multiple choice questions

And Figures 3 and 4 explicit the comparison between the government and private sector students for the frequent internet usage place and cost for the internet usage per month. Private students use the Internet at their home than using in campuses and they spend over the 1000 rupees more than the government sector students.

Figure 3. Frequent use place

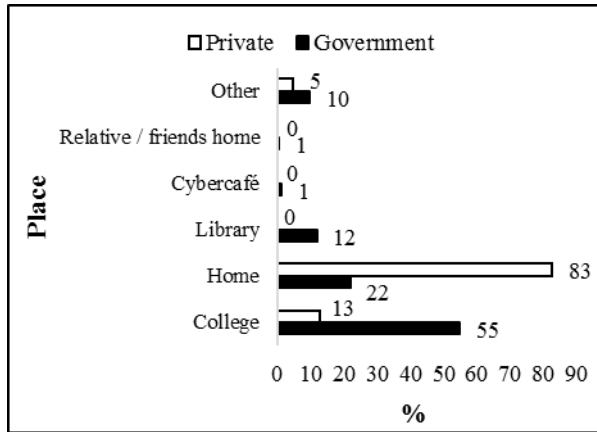
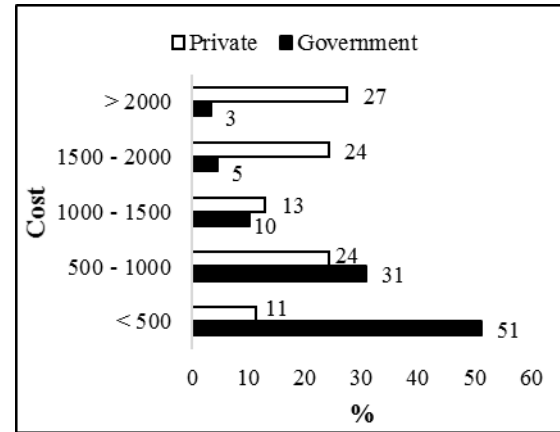
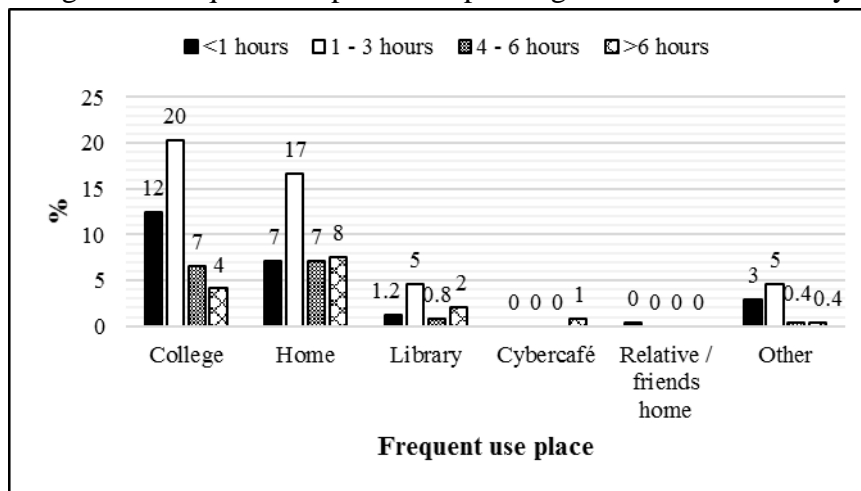


Figure 4. Spend per month



In Figure 5, about 20% of the students use Internet at their college for 1-3 hours per day and about 17% at their home.

Figure 5. Frequent use place vs. spending hours on Internet/day



At least of them says that they always lose sleep, they never find themselves saying just few more minutes when online and they strongly agree with the rest time is affected by the internet.

Figure 6. Sleep loss vs Just few minutes

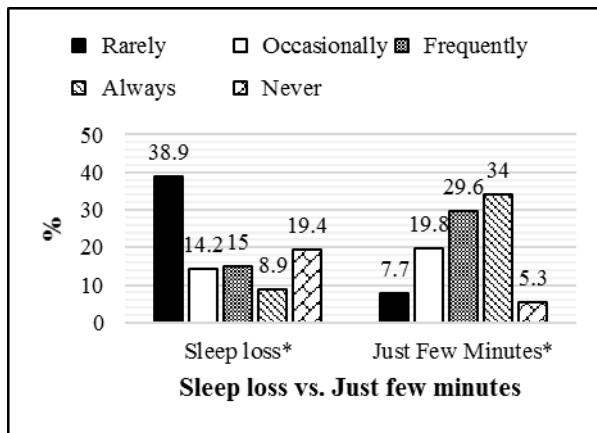
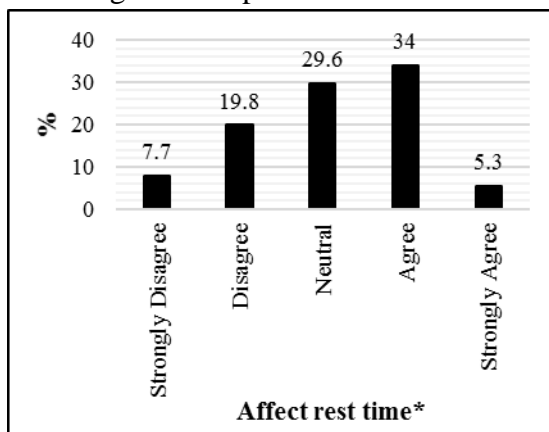


Figure 7. Impact of the Internet



Note: *N=247 due to unmarked fields by respondents

Table 5 shows the relationship between gender wise and communication, shopping, training source, how long use (years), hour/day, spend/month (in Rs.), place, sleep loss and affect rest time. And part-time work is significantly related to how long use (years), hour/ day and affect rest time. As well as, there is no relationship between institute type and education, entertainment, communication, update yourself, downloading, useful in academic and email service. But the course of study is significantly related with entertainment, communication, reasons for internet use in academic, rating of the internet for academic pursuit, training source, how long use (years), spend/month (in Rs.), place, sleep loss and just a few minutes. And the year of study is also considerably interrelated with education, reasons for internet use in academic, rating of the internet for academic pursuit, spend/month (in Rs.) and place.

Table 5. Relationship with demographic variables

Values	Gender	Age	Part-time work	Institute type	Course	Year
	χ^2 (P-value)	χ^2 (P-value)	χ^2 (P-value)	χ^2 (P-value)	χ^2 (P-value)	χ^2 (P-value)
Important to Survival	0.920 (0.337)	4.251 (0.236)	4.631 (0.099)	4.772 (0.029*)	8.177 (0.085)	4.251 (0.119)
Reasons for Internet Education	0.703 (0.402)	2.879 (0.411)	0.559 (0.756)	1.552 (0.213)	6.446 (0.168)	10.368 (0.006*)
Entertainment	0.344 (0.558)	8.083 (0.044*)	0.115 (0.944)	0.373 (0.542)	9.590 (0.048*)	1.111 (0.574)
Communication	6.062 (0.014*)	2.452 (0.484)	1.466 (0.481)	0.399 (0.528)	13.037 (0.011*)	1.576 (0.455)
Update Yourself	1.364 (0.243)	7.574 (0.056)	3.264 (0.196)	2.393 (0.122)	7.857 (0.097)	2.727 (0.256)
Downloading	0.060 (0.807)	4.330 (0.228)	1.189 (0.552)	1.292 (0.256)	7.091 (0.131)	3.084 (0.214)
Shopping	6.649 (0.010*)	1.738 (0.628)	3.205 (0.201)	6.360 (0.012*)	7.152 (0.128)	2.240 (0.326)
Other	6.748 (0.009*)	3.975 (0.264)	7.920 (0.019*)	3.548 (0.060)	7.125 (0.129)	2.994 (0.224)
Reasons for Internet use in academic	6.395 (0.172)	47.404 (0.000*)	9.891 (0.273)	55.327 (0.000*)	69.177 (0.000*)	23.850 (0.002*)
Useful in Academic	3.083 (0.214)	2.944 (0.816)	3.080 (0.544)	2.038 (0.361)	8.207 (0.414)	8.942 (0.063)
Rating of the Internet for academic pursuit	1.689 (0.639)	26.534 (0.002*)	12.324 (0.055)	17.154 (0.001*)	31.329 (0.002*)	20.743 (0.002*)
Training Source	20.510 (0.001*)	28.195 (0.020*)	2.302 (0.993)	22.959 (0.000*)	40.262 (0.005*)	17.971 (0.055)
How Long Use (years)	19.451 (0.000*)	19.078 (0.025*)	4.200 (0.650)	17.092 (0.001*)	22.258 (0.035*)	10.317 (0.112)

Hour/ Day	14.320 (0.003*)	15.142 (0.087)	20.716 (0.002*)	12.573 (0.006*)	16.353 (0.176)	2.811 (0.832)
Spend/ Month (in Rs.)	26.973 (0.000*)	50.057 (0.000*)	28.397 (0.000*)	64.493 (0.000*)	84.345 (0.000*)	22.168 (0.005*)
Place	16.782 (0.005*)	46.017 (0.000*)	0.930 (0.447)	73.537 (0.000*)	77.120 (0.000*)	36.893 (0.000*)
Email Service	3.996 (0.262)	16.733 (0.053)	10.413 (0.108)	2.695 (0.441)	9.709 (0.642)	4.263 (0.641)
Sleep loss	9.600 (0.048*)	16.616 (0.165)	8.537 (0.383)	20.902 (0.000*)	32.472 (0.009*)	5.812 (0.668)
Just Few Minutes	8.024 (0.091)	30.878 (0.002*)	14.307 (0.074)	12.657 (0.013*)	(0.014*)	11.852 (0.158)
Affect rest time	11.235 (0.024*)	13.096 (0.362)	17.265 (0.027*)	13.137 (0.011*)	18.656 (0.287)	13.248 (0.104)

Note: * fail to accept null hypothesis of there is no relationship at 5% level

Conclusions and Recommendations

Using the descriptive study, the undergraduate's internet usage and the comparison of the usage between Government and Private sector students were analysed. IT/Computer science students use Internet more. Students have problems using the Internet because of slow internet, power failure and high price. And they use the internet at home also like colleges that's why they spend over 1500 rupees per month. But there is no relationship between institute type and reasons for internet using except shopping, useful in academic and email service. Therefore, this study recommends that, campuses should provide required free high-speed Wi-Fi for the students' academic purpose and it should organize specialized training programmes regarding the awareness on the internet. As well as, the Government should show the interest in improving the current state of power in the country and it should review the cost of browsing favourably.

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**IMPACT ON “ICBT” KANDY CAMPUS WITH THE INTRODUCTION OF “ICBT”
KURUNEGALA CAMPUS (A GEOGRAPHICAL ANALYSIS)**

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Abstract

GIS (Geographical Information Systems) is a valuable tool, used in planning and management in education sector at different scales in different countries. International College of Business and Technology (ICBT) is one of the leading tertiary education providers in Sri Lanka consist of 8 local branches and 3 foreign branches. ICBT Kandy campus faced student registration downfall during year 2014-2016 based on number of students' enrollments for undergraduate programs. Initial attention was drawn to newly added member ICBT-Kurunegala campus and problem was related to location, transportation facilities in relation to the population of the study areas. The main objective of the study was to identify the impact of ICBT-Kurunegala to operations of ICBT Kandy, based on geographical factors, using statistics of students' registrations during year 2014–2016. Geographical analysis was carried out using ArcGIS extensions. Statistical analysis was done using R/ R- studio software. In a conclusion, there was no significant geographical impact of ICBT-Kurunegala on ICBT-Kandy campus on student registration during year 2014-2016. ICBT-Kandy showed very broad range of hometown coverage (0 – 272.33 km). Further, ICBT-Kandy performance was significantly ($p < 0.05$) higher than the performance of ICBT-Kurunegala in the areas of total number of registered students, student density distribution. Even though, the ICBT-Kurunegala is in geographically beneficial area, in facility accessibility, it has not been taken the full advantage of it.

Key words

Geographical analysis, ICBT Campus, Kandy, Kurunegala

Introduction

An information system that collect, process, stores and present geo-spatial information based on a standard geo coordinate system can be simply identified as a Geographical Information System (GIS). GIS analysis allows the study of real world situations by applying different tools, methods, and scenarios. The advancement in the field of geographical information systems (GIS) had contributed greatly to several studies dealing with measures of spatial access to educational facilities and resources. A number of studies have demonstrated mapping the distribution of facilities and analyzing their distribution to show whether they are clustered, dispersed or randomly distributed as well as to make out the facilities serving the people of the area (Aliyu *et al.*, 2013; Kerski, J. J. 2003.). Hite (2008) showed that the application of GIS in school mapping is a term used in educational planning and management, which covers a wide range of educational planning and management concerns related to resource allocation, efficient delivery of services and improvement in efficient learning.

International College of Business and Technology (ICBT) Kandy campus faced performance downfall during year 2014-2016 based on number of students' enrollments for various undergraduate programs. Initial attention was drawn to newly added member ICBT-Kurunegala campus and problem was related to location, transportation facilities in relation to the population of the study areas. The main objective of the study was to identify the impact of ICBT-Kurunegala to operations of ICBT Kandy, on geographical factors, using statistics of students' registrations during year 2014–2016. Furthermore, specific objectives were to determine the impact of ICBT Kurunegala on ICBT Kandy in total student registration, student density distribution based on Districts and Divisional Secretariats and to identify the geospatial variation of students based on the air distance to hometown of the students enrolled. Moreover, it is to determine the closest ICBT campus facility using network analysis.

Methodology

Independent variables (number of registered student based on Districts and Divisional Secretariats, distance to the branch from students home towns, student density distribution respective to their home towns, and road network in the respective city) were considered for geographical analysis and statistical analysis. Primary data were collected from student information system of ICBT Kandy and Kurunegala and those data were exposed to data filtering, cleansing and conversion process. Secondary data (spatial data, existing maps, GPS data, demographic and population data) collected from official web source of Survey Department of Sri Lanka. Multiple ring buffering, overlays, proximity, shortest path, append, digitizing, dissolving, development of the shape files as well as intersections assisted in the analysis were used to determine geographical impact. Further, various access route distances to the facilities were demined. Moreover, traffic analysis was made on 2 selected roads in each selected city (Kandy and Kurunegala), which provide direct access to selected ICBT campus and based on those data traffic flow maps were constructed. All the geographical analysis was carried out using ArcGIS extensions and Statistical analysis as done using R/ R-studio software. In the process of accomplishment of data processing considerable amount of intermediate results oriented files are generated as seen on the conceptual model of the research (Figure 1).

Results

Total number of registered students in ICBT-Kandy was significantly ($p < 0.05$) higher than the total number of students registered in ICBT-Kurunegala. Home towns coverage from Kandy was significantly ($p < 0.05$) higher than the ICBT-Kurunegala and the coverage was 0 km to 272. 33 km (Figure 2). Multiple buffer analysis provided evidences, that the performances of both Kandy and Kurunegala branches focused in to one small geography though student's dispersion scattered in many far distance areas and student density from far distances are comparatively low when close proximity areas are concerned. (Figure 3, Figure 4).

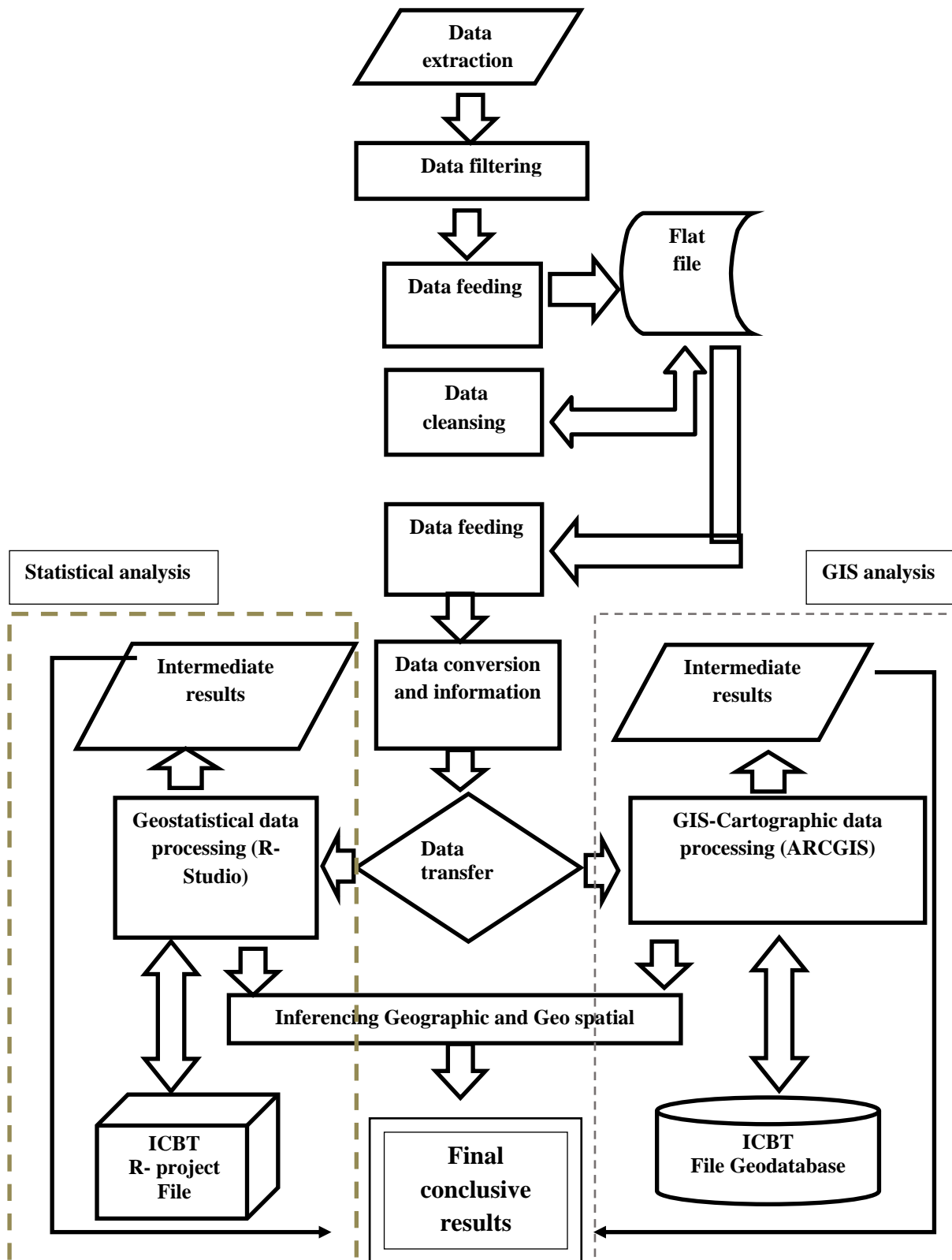


Figure 1 Conceptual Model of the Research

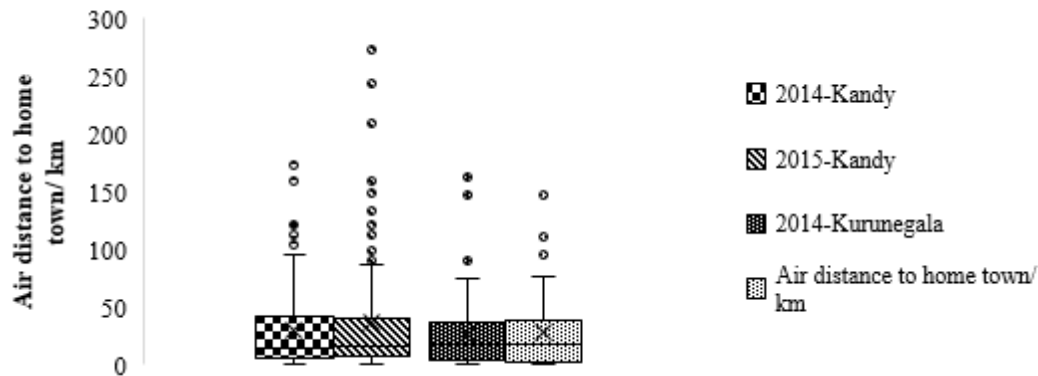


Figure 2: Distribution of Air Distance to Home Towns of registered Students in ICBT Kandy and Kurunegala campuses during the Years of 2014 - 2015

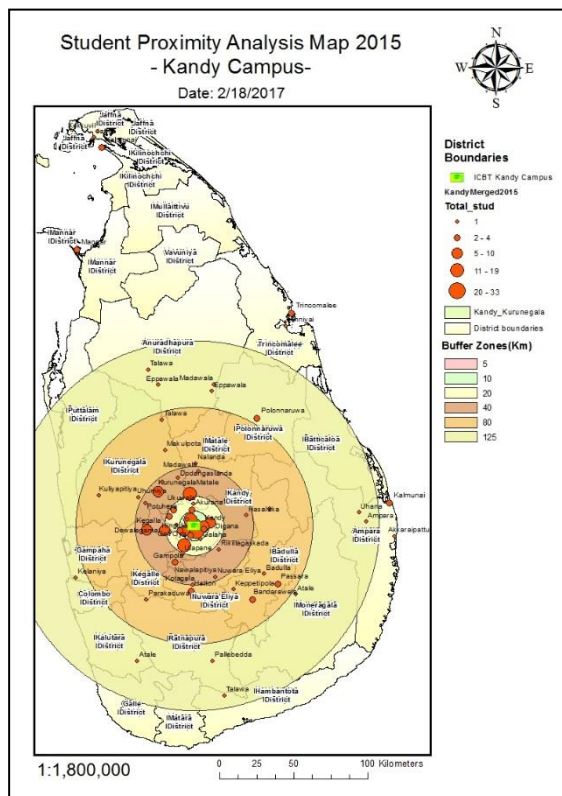


Figure 3: Student Proximity Analysis Map 2015- Kandy campus

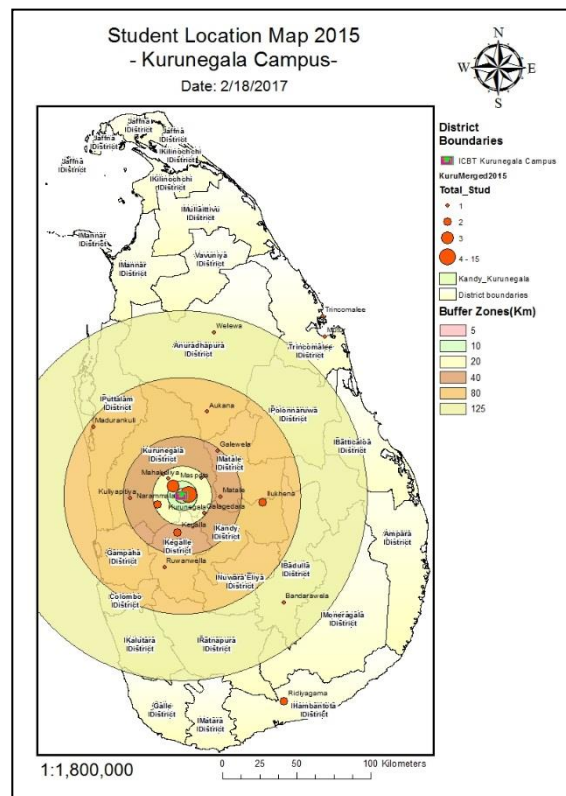


Figure 4: Student Proximity Analysis Map 2015- Kurunegala campus

ICBT Kandy performed well during 2014 – 2016 compared to the ICBT Kurunegala . ICBT Kandy campus with respect to the total number of registered students Also, it covered all 9 Province and the 18 Districts out of 25 Districts of Sri Lanka. On the other hand, Kurunegala campus covered the 10 Districts, where the total number of registered students also less in number with respect to Kandy. However, in both campuses, none of the student were registered from 7 Districts, such as Kilinochchi, Mullative, Vavuniya, Batticaloa, Kaluthara, Matara and Galle.

Closest Institute (Shortest path) analysis showed that the closest campus for most of student was the Kurunegala rather than Kandy. However, in contrast to that most of students were registered in ICBT Kandy compared to ICBT Kurunegala (Figure 5, Figure 6). Therefore, in the field of performance ICBT-Kurunegala could not generate a significant impact on ICBT-Kandy. Among selected 4 roads in Kandy and Kurunegala the highest percentage traffic length was shown by the Peradeniya bridge to ICBT Kandy road as shown in and figure 7 and it was significant ($p < 0.05$) with respect to the percentage traffic flow of Pileekada Junction to ICBT Kurunegala as shown in figure 8.

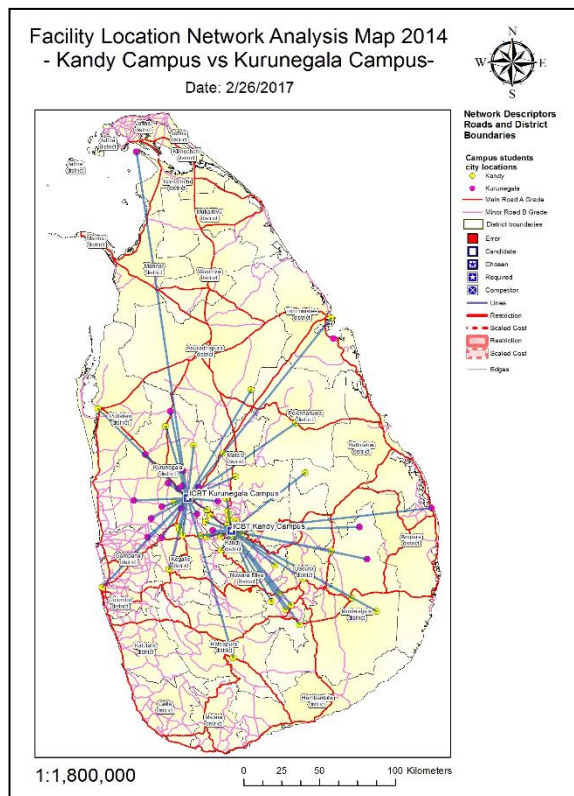


Figure 5: Closest ICBT Facility Location, Network Analysis Map for Year 2014, Kandy vs Kurunegala campus.

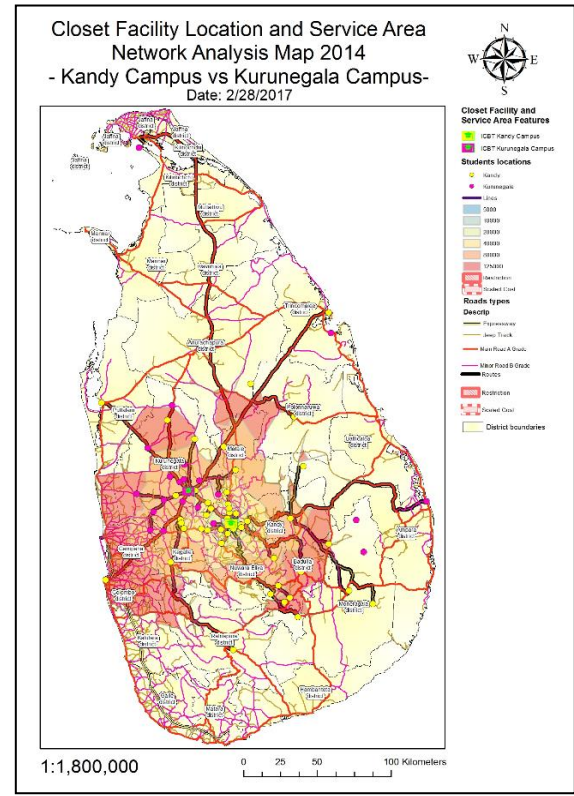


Figure 6: Closest ICBT Facility Location, Road Network Analysis, Map for Year 2014, Kandy vs Kurunegala campus.

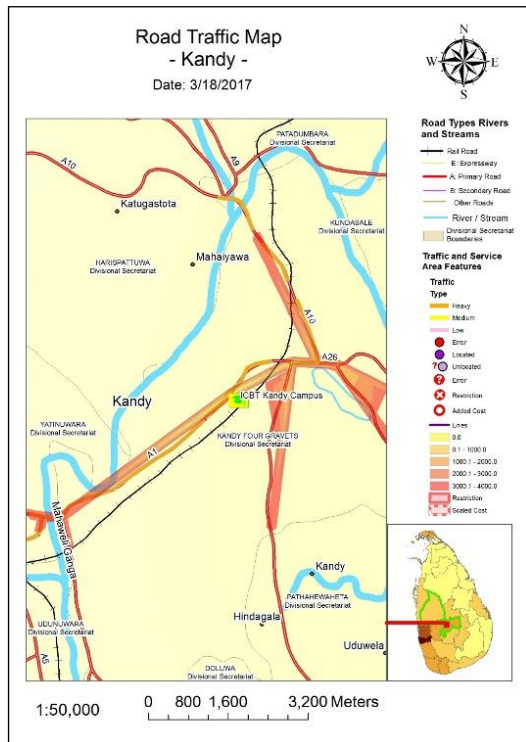


Figure 7: Traffic Flow Map of Kandy in 2017

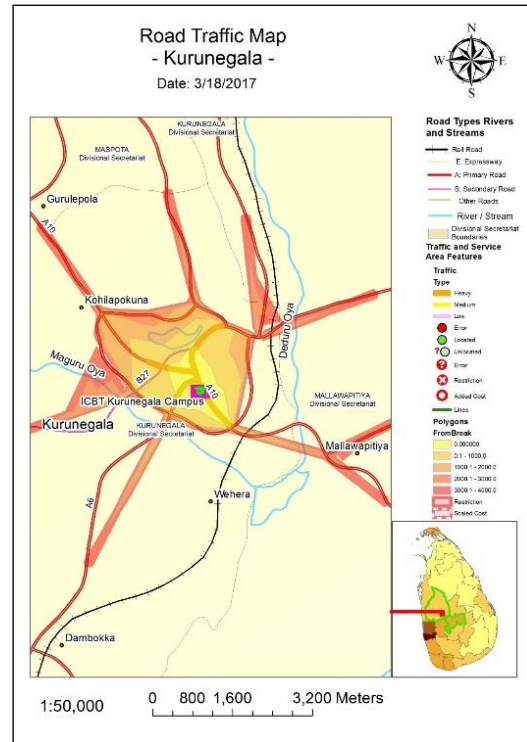


Figure 8: Traffic Flow Map of Kurunegala in 2017

Discussion

Based on geographical parameters, Kandy branch was able to secure its leading Districts compared to ICBT-Kurunegala based on students from their home towns. It is highly justifiable that ICBT-Kandy operations were capable of attracting students from very broad area compared to ICBT-Kurunegala since every time those maps illustrate more students' dispersion exist with Kandy branch compared to ICBT-Kurunegala. When it compared with Kandy branch on geographical interpolated results illustrations, it is imperative to declare that the ICBT-Kandy performances are far better compared to ICBT-Kurunegala.

Conclusions and Recommendations

There was no significant geographical impact of ICBT-Kurunegala campus on ICBT-Kandy campus on student registration during year 2014-2016. ICBT-Kandy showed very broad range of home town coverage (0 – 272.33 km). Further, ICBT-Kandy performance was significantly ($p < 0.05$) higher than the performance of ICBT-Kurunegala in the areas of total number of registered students, student density distribution. Even though, the ICBT-Kurunegala is in geographically beneficial area, in facility accessibility, it has not been taken the full advantage of it. According to traffic flow maps, it concluded that, traffic congestion around ICBT Kandy campus and ICBT Kurunegala campus, did not effect on student registration 2014 - 2016.

As recommendations, it is important to consider many factors involved in performance fluctuations in organizations such as demographic, sociographic, geographic and competitive private education providing organizations etc. Therefore, in order to achieve high precision and reliability in a research, it should be conducted by covering broader subject areas based

on research variables. Since the research was concentrated on one targeted campus to Kandy, that is Kurunegala campus so that much better results to achieve it is very much required to consider other campuses of the network as well. Since the research findings clearly indicate that there are no direct relationships exist in operation of Kurunegala campus to Kandy campus operations based on number of students' registrations, the ICBT Kandy campus need to find other possible reasons that cause decrease in number of students for undergraduate programs that result in downgrading performances during 2014 to 2016-time period.

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THE SUITABILITY OF WASTE MANAGEMENT INFORMATION SYSTEM FOR SRI LANKA

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Abstract

Currently, Sri Lankan Municipals and other waste management Organizations are using less technology to manage the waste, but people want to advance with the new technologies that are being invented. The waste management disposal that relates with provisions which are made under the National Environment Act (1981) and Public Nuisance ordinance for the last 20 years.

So, a proper waste management information system can be used to categorize the waste and produce waste power and do Recycling, composting and reduce the spreading of biogases etc. Through a WMIS, municipal councils can handover the collected waste for companies who produce waste power and recycling by purchasing a waste. The research study looks at how it can involve in the waste management and the importance of having a proper waste management information system to the Municipals and what people think of it.

Keywords

WMIS- Waste Management Information System, MCA- Municipal Collection Authority, 3Rs- Reduce, Reuse, Recycle, NGOs- Non-Governmental Organization, MSW-Municipal Solid Waste

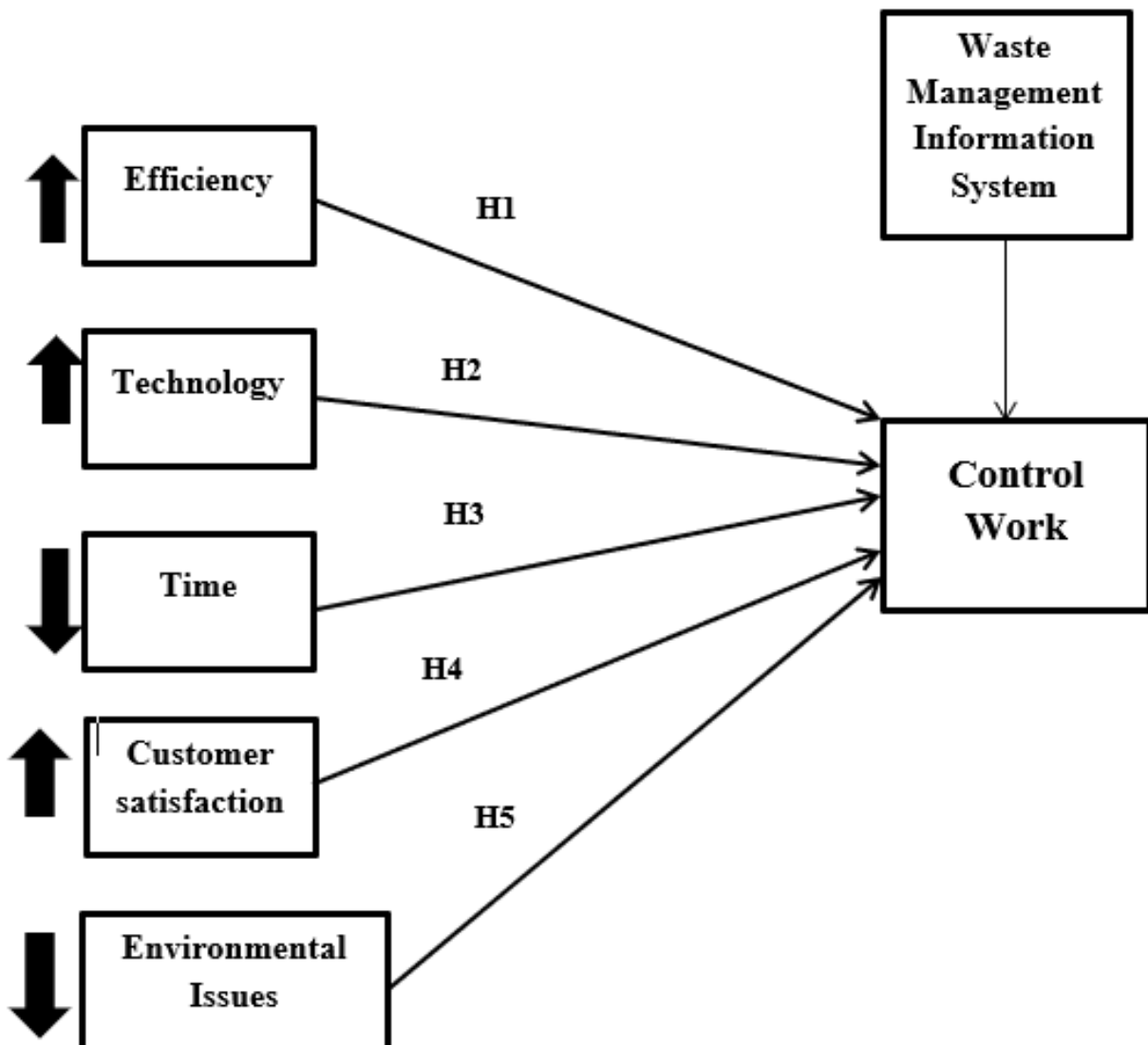
Introduction

The waste management Information systems, leads to an effective waste management. It provides information that is needed to manage Municipal councils and other waste management organizations efficiently and effectively. A waste management information system includes the process that municipal council going to provide, and it helps to waste administration and revenues management for the waste registers. The Waste Management information system reports are used to handling for other transport, waste collecting and waste power etc. The main features are Enterprise management, Security management, Revenue management, Customer Management, Waste collection planning and control, waste record management integration and Analytics.

Methodology

The research was undertaken in Colombo District and the sample size is 80. This quantitative research distributed by using random sampling method. According to the research topic identified variables had cover through the questionnaires that designed. The data gathering methods helps to get ideas from staff members' and urban area living people. The identified level for analyzing part is 95% (0.05) level of confidence. This research is going to conduct with the people age between 18 to 70 years by using both male and female participants.

Figure 17. Theoretical model

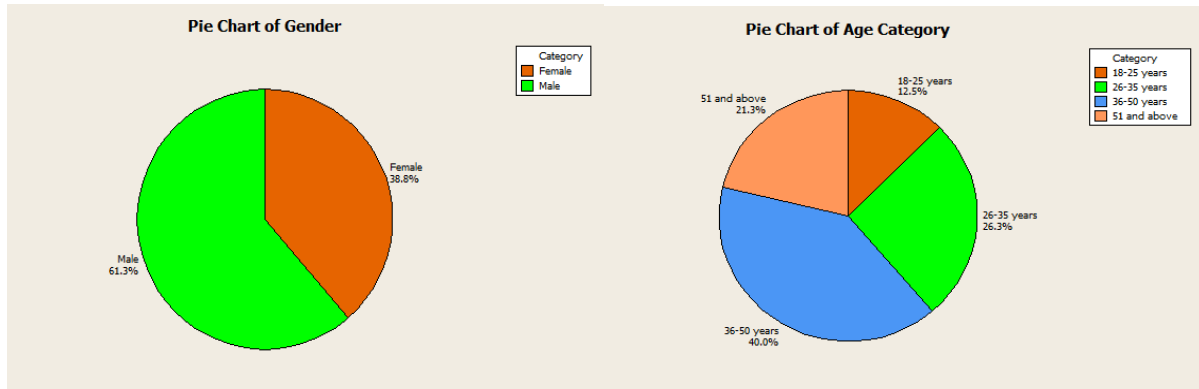


Results and discussion

Gender & age category

The bellow First pie chart has shown the collected data according to the gender groups and age category. The first pie chart has categorized as Female responses and Male Responses orange color area has shown the female responses and light green area shows the Male responses area. There are 38.8 % of female responses and 61.3 % Male responses.

Figure 2. Pie charts of Gender and Category

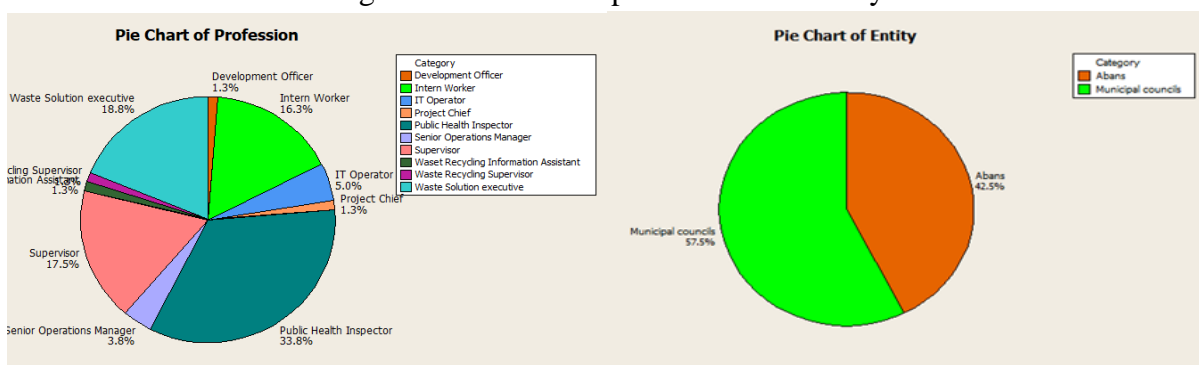


According to the second pie chart dark brown area has shown the age category 18- 25 years and there are 12.5 % responses. The Green color area has shown the age category 26- 35 years and there are 26.3 % responses according to that age category. In blue color area has shown the 36- 50 age category people and there are 40.0 % of responders. Finally, the 51 years and above (21.3%) age category has represented in light pink theme. So, age category 36- 50 has taken the highest responses and age category 18- 25 has taken minimum responses.

Professions and entity

According to the pie chart of Municipal council and Abans environmental services employees' professions categorization has shown similar percentage (%) in Development officer and Project chief profession as 1.3% also the waste recycling information assistant and waste recycling supervisor has shown 1.3 % profession participants for the questionnaires. The light purple colored area represented senior operations manager as 3.8% and there are 5.0 % IT Operators plus there are 16.3% intern workers that who represented in light green area. The participated supervisors are 17.5 % and they represented light pink area. There are 18.8% of waste solution executives that who represented in light blue area. Finally, there are 33.8 % public health Inspectors in dark blue area.

Figure 3. Pie chart of profession and Entity



The above chart has shown a data collecting relevant entity regarding to the Municipal councils and Abans Environmental services in Colombo district. The light green section represented the Municipal council representors and Brown color section has represented the Abans responses. There are 57.5 % of Municipal council's responses had participate for the questionnaire and 42.5% of Abans responses also already participated. Municipal councils people get high percentage according to the relevant Entity also Abans participants get minimum percentage.

Descriptive statistics

The analyzed table given below shows the summary of the data that according to the variables and it contain all the Independent and dependent variables. The data has categorized according to the Mean, Standard Deviation, Q1, Q3 and Median.

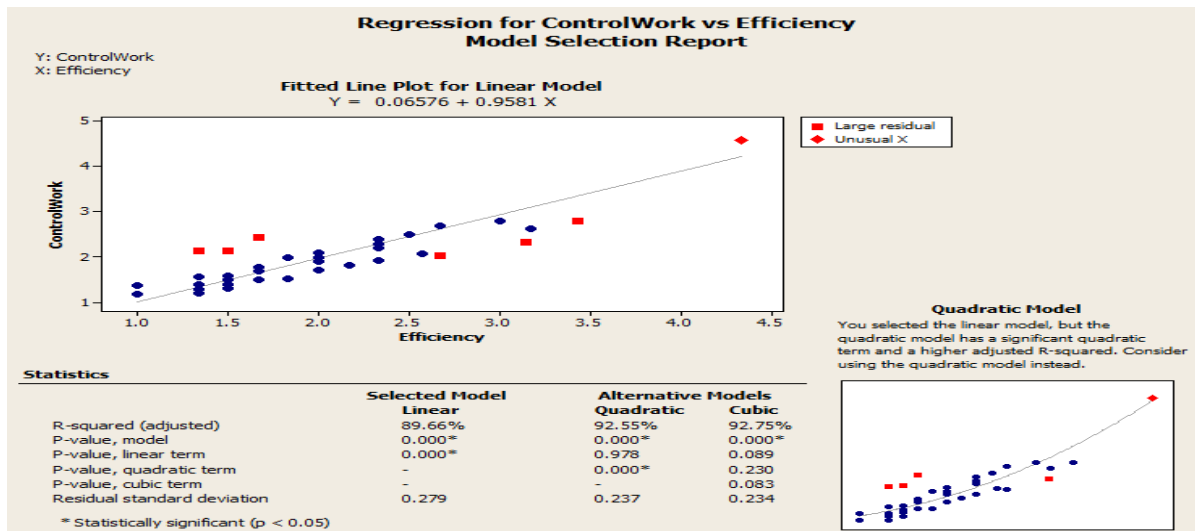
Table 1. Descriptive statistics

Variable	Mean	Standard Deviation	Q1	Median	Q3	Mode
Efficiency	2.0330	0.8577	1.5000	1.6667	2.3333	1.5
Technology	1.981	1.061	1.250	1.750	2.438	1.25
Time	2.0330	0.8577	1.5000	1.6667	2.3333	1.5
Customer Satisfaction	2.0071	0.8900	1.4167	1.6875	2.4063	1.375
Environment Issues	2.0158	0.8617	1.4167	1.6944	2.3472	1.41667
Control Work	2.0158	0.8672	1.4063	1.6979	2.3300	1.40625

Hypothesis testing

Hypothesis 01

Figure 4. Regression for Control work vs Efficiency



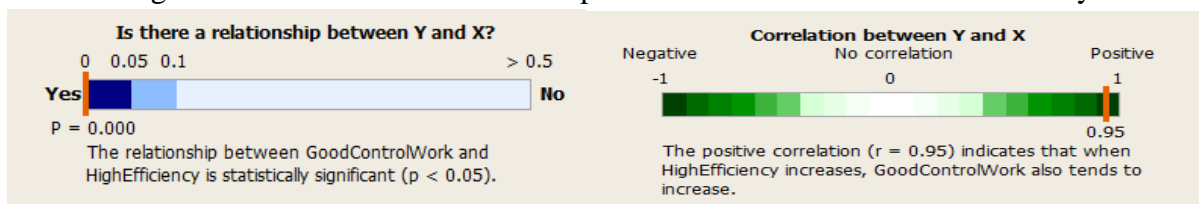
Above fitted line plot diagram shown the Efficiency with Control work and the independent variable “Efficiency” as X axis and dependent variable “Control work” as Y axis. The fitted equation for this linear model shown the relationship between Y and X,

$$Y = 0.06576 + 0.9581 X$$

H1A: There is a statistically significant relationship between efficiency and Control Work because of the WMIS.

H1o: There is no statistically significant relationship between efficiency and Control Work because of the WMIS.

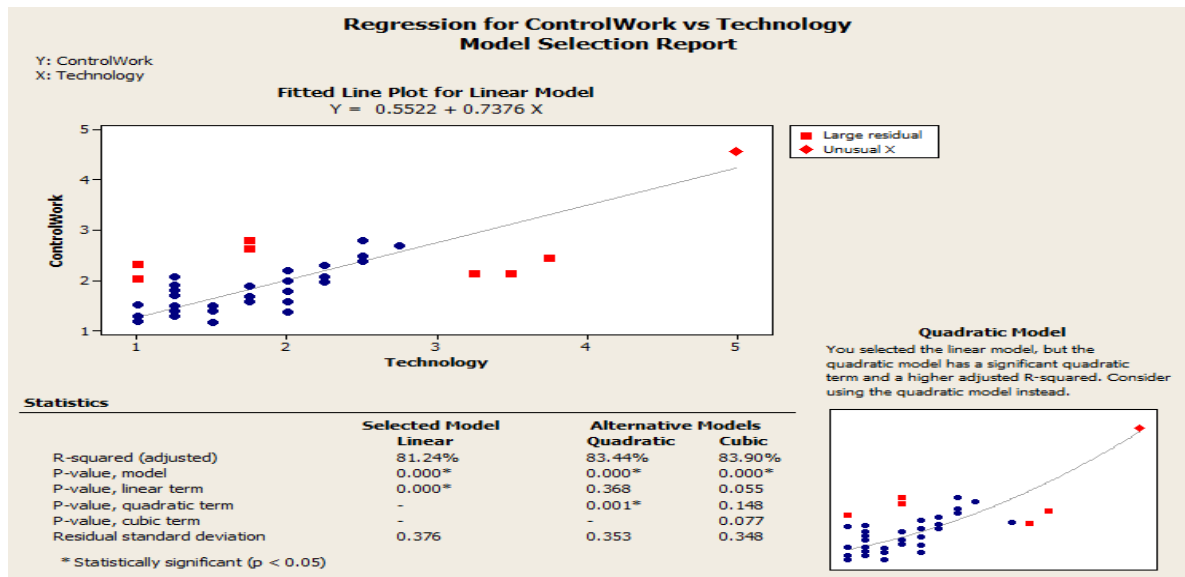
Figure 5. Correlation & Relationship between Control Work and Efficiency



This diagram shown the relationship between Y= Efficiency and X= Control Work. Therefore, the relationship between control work and efficiency is statistically significant. In above diagram, Efficiency and control work has positive correlation (0.95) and results are Statistically Significant. So, the result indicates when high Efficiency of WMIS increases, Good control work of WMIS is also tends to increase.

Hypothesis 02

Figure 6. Regression for Control work vs Technology



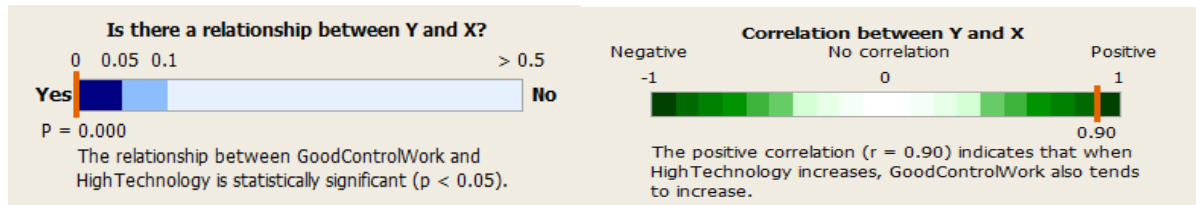
Above fitted line plot diagram shown the Technology with Control work and the independent variable “Technology” as X axis and dependent variable “Control work” as Y axis. The fitted equation for this linear model shown the relationship between Y and X,

$$Y = 0.5522 + 0.7376 X$$

H2A: There is a statistically significant relationship between Technology and Control Work because of the WMIS.

H2o: There is no statistically significant relationship between Technology and Control Work because of the WMIS.

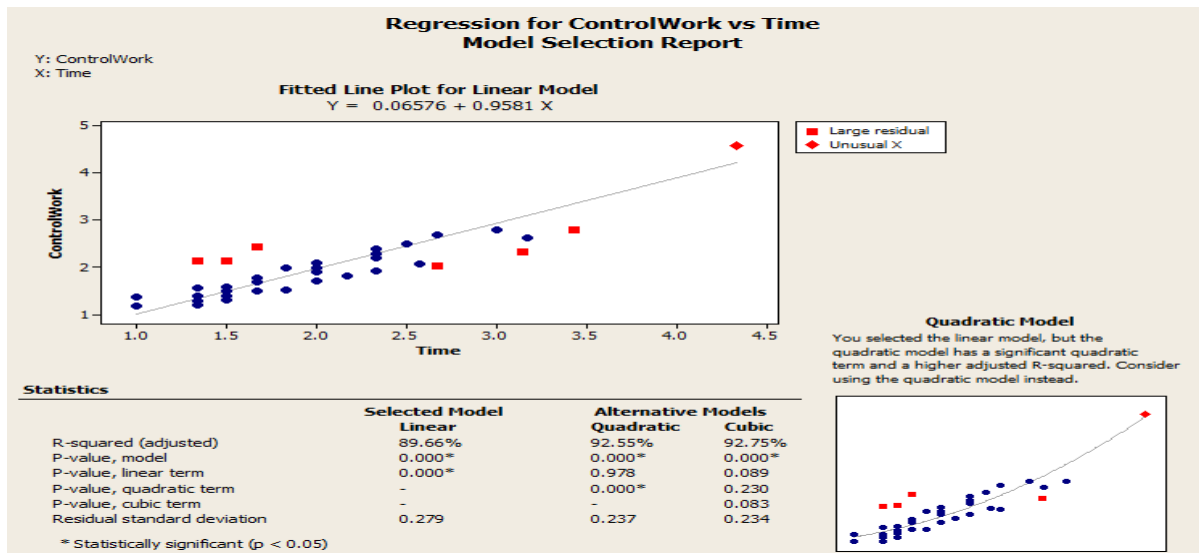
Figure 7. Correlation & Relationship between Control Work and Technology



This diagram shown the relationship between Y= Technology and X= Control Work. Therefore, the relationship between control work and Technology is statistically significant. In above diagram, Technology and control work has positive correlation (0.90) and results are Statistically Significant. So, the result indicates when High Technology of WMIS increases, Good control work of WMIS is also tends to increase.

Hypothesis 03

Figure 8. Regression for Control work vs Time



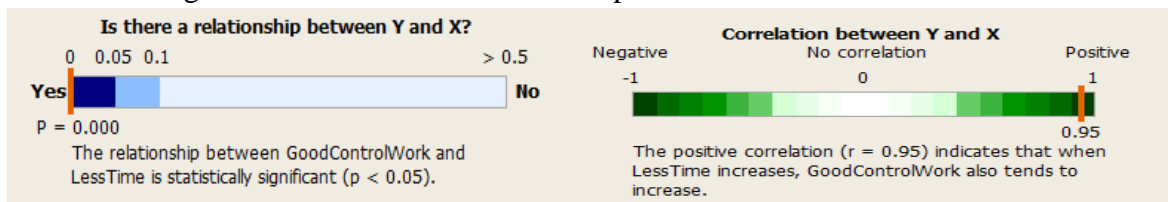
Above fitted line plot diagram shown the Time with Control work and the independent variable “Time” as X axis and dependent variable “Control work” as Y axis. The fitted equation for this linear model shown the relationship between Y and X,

$$Y = 0.06576 + 0.9581 X$$

H3A: There is a statistically significant relationship between time and Control work because of the WMIS.

H3o: There is no statistically significant relationship between time and Control work because of the WMIS.

Figure 9. Correlation & Relationship between Control Work and Time

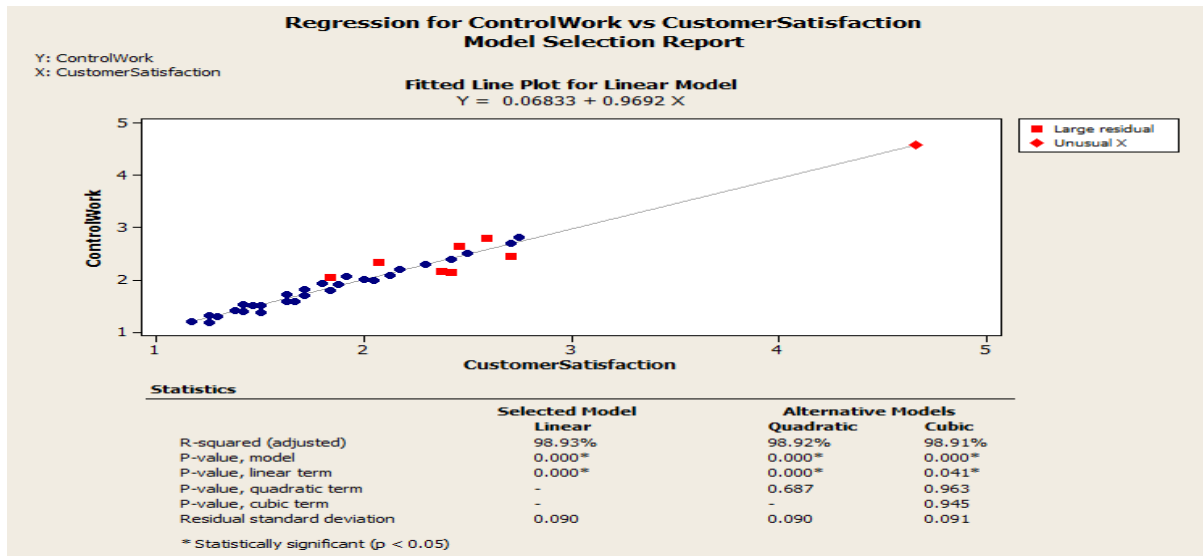


This diagram shown the relationship between Y= Time and X= Control Work. Therefore, the relationship between control work and Time is statistically significant.

In above diagram, Time and control work has positive correlation (0.95) and results are Statistically Significant. So, the result indicates when Less Time of WMIS increases, Good control work of WMIS is also tends to increase.

Hypothesis 04

Figure 10. Regression for Control work vs Customer Satisfaction



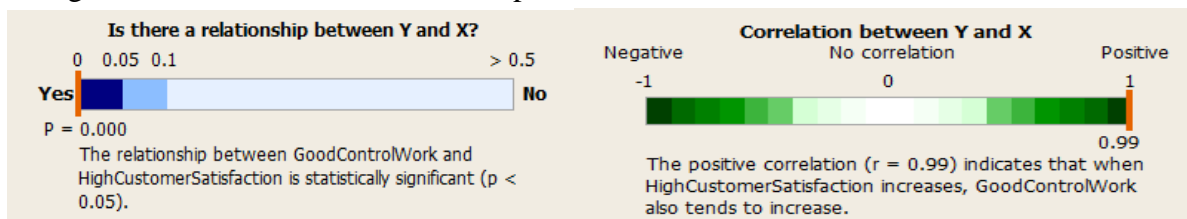
Above fitted line plot diagram shown the Customer Satisfaction with Control work and the independent variable “Customer Satisfaction” as X axis and dependent variable “Control work” as Y axis. The fitted equation for this linear model shown the relationship between Y and X,

$$Y = 0.06833 + 0.9692 X$$

H4_A: There is a statistically significant relationship between customer satisfaction and Control Work because of the WMIS.

H4_o: There is no statistically significant relationship between customer satisfaction and control work because of the WMIS.

Figure 11. Correlation & Relationship between Control Work and Customer Satisfaction

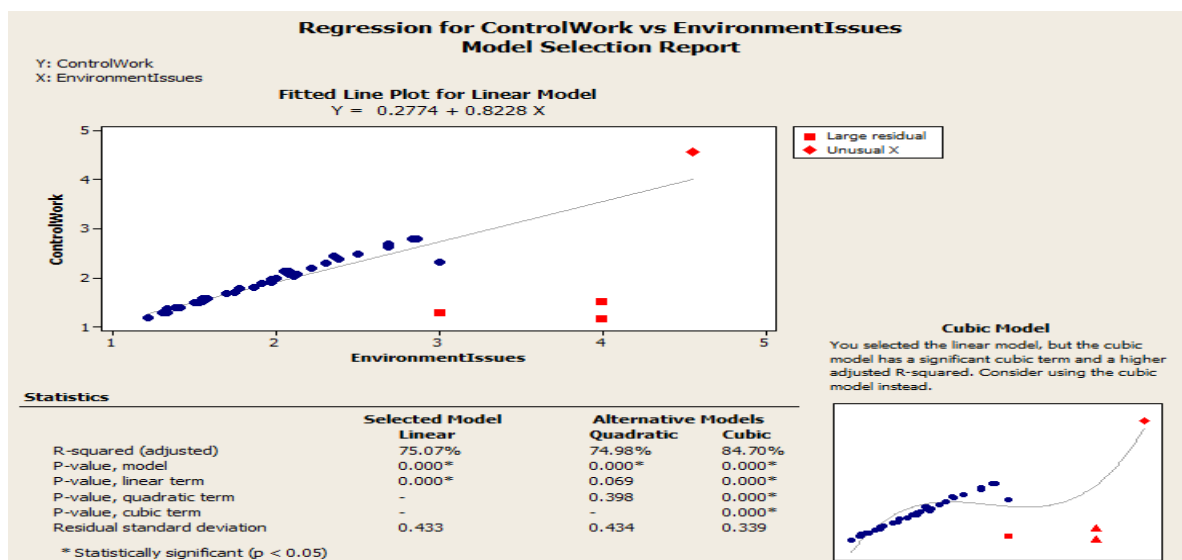


This diagram shown the relationship between Y= Customer Satisfaction and X= Control Work. Therefore, the relationship between control work and Customer Satisfaction is statistically significant.

In above diagram Customer Satisfaction and control work has positive correlation (0.99) and results are Statistically Significant. So, the result indicates when High Customer Satisfaction of WMIS increases, control work of WMIS is also tends to increase.

Hypothesis 05

Figure 12. Regression for Control work vs Environmental Issues



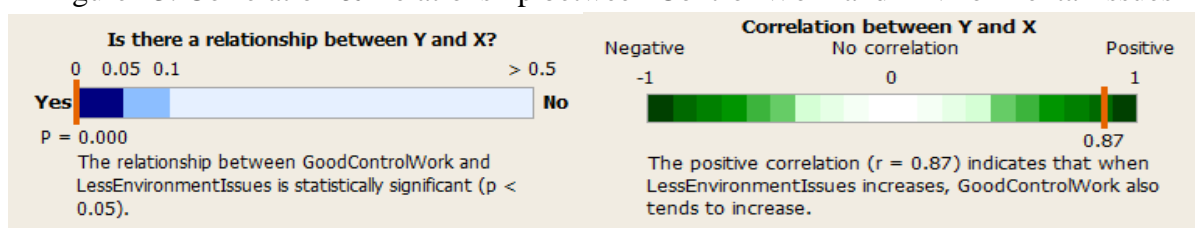
Above fitted line plot diagram shown the Environmental Issues with Control work and the independent variable “Environmental Issues” as X axis and dependent variable “Control work” as Y axis. The fitted equation for this linear model shown the relationship between Y and X,

$$Y = 0.5522 + 0.7376 X$$

H5A: There is a statistically significant relationship between Environment Issues and Control work because of the WMIS.

H5o: There is no statistically significant relationship between Environment Issues and Control work because of the WMIS.

Figure 13. Correlation & Relationship between Control Work and Environmental Issues



This diagram shown the relationship between Y= Environmental Issues and X= Control Work. Therefore, the relationship between control work and Environmental Issues is statistically significant.

In above diagram Environmental Issues and control work has positive correlation (0.87) and results are Statistically Significant. So, the result indicates when Less Environmental Issues of WMIS increases, control work of WMIS is also tends to increase.

Conclusions and recommendations

This waste management information system survey results shows that all the independent variables proved that it has positive correlation (0.95) and results are Statistically Significant. Through the statistical results we can identify all the objectives get proved and that means a waste management information system is suitable for Sri Lanka according to the respondent’s ideas and data that they provided.

The Colombo district municipal councils already have waste scheduling So, other districts also need to handle waste collecting schedule. Due to Driver ideas, having GPS technology is

recommended because it can save the time. To use this kind of a method, employees need to be trained and specially truck drivers need to be trained if they got a chance to use GPS technology. Currently waste categorizing promoted in Colombo area, so other districts also need to be collect waste by categorizing and Municipals can update data through the websites.

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EFFECTIVENESS OF USING HIGH TECH DRONE TECHNOLOGY IN WILD ANIMAL CONSERVATION

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Abstract

This study is carried out to identify the problems faced by department of wild life due to the lack of technology and to identify the effectiveness of using drones in conserving wild animals. Currently in Sri Lankan context drones have taken their place in the market and has turned the industries upside down but when it comes to conservation of wild life this Technology is still Greek to them.

In Sri Lanka wild animals are hunted for different body parts of them and are hunted for meat by poachers. These animals are one of the main foreign attraction of the country. In 2016 there were 279 elephant deaths and in 2017 there were around 700- 1000 leopards living in Sri Lanka most of them are now dead. Larger number of wild animals are caught to animal traps but wild life is not possible to track them and free them. Also due to deforestation animals are starving in the jungles hence they are more likely to come into cities in search of foods, especially elephants. so when this happens its wild life department duty to chase them back into cities. For this they use tranquilizer guns, fire crackers, and fire and tend to shoot them rubber bullets. This happens more often. Hence it takes lot of their time to chase them down and also incur a larger cost to the government. But implementing this drone system will help to overcome this issue because animals are scared of the sound emitting from drone and also it takes a little time to identify the location of the animal when comparing with the current methods.

Moreover, wild life department is in charge of monitoring illegal farming activities in the wild forests, especially weed farmers. Because these farmers destroy the forests and habitats of the animals forcing them to leave their living areas. for this they wild life department get the help of air force and uses helicopters to scout the area also wild life officers do the ground scouting monthly to monitor these activities but this system is ineffective because of the cost and unavailability of reliable information but using a drone would help them in many ways during this process not only that and also drone will help ground units in the process of capturing and raiding these illegal weed farms.

So due to this problem it would be better to come up with drone technology to address these issues. Therefore, the current technics of the wild life department should be identified and the new system should be introduced presenting the pros and cons. (Walkthroughindia.com, 2018).

Key Words -: Wild life Department, Animal, Drone Technology

Introduction

Sri Lankan wild elephants, leopards, sloth bear, grizzled giant squirrel and monkey such as purple faced langur, toque macaque and some unique birds are some of them. (Walkthroughindia.com, 2018)

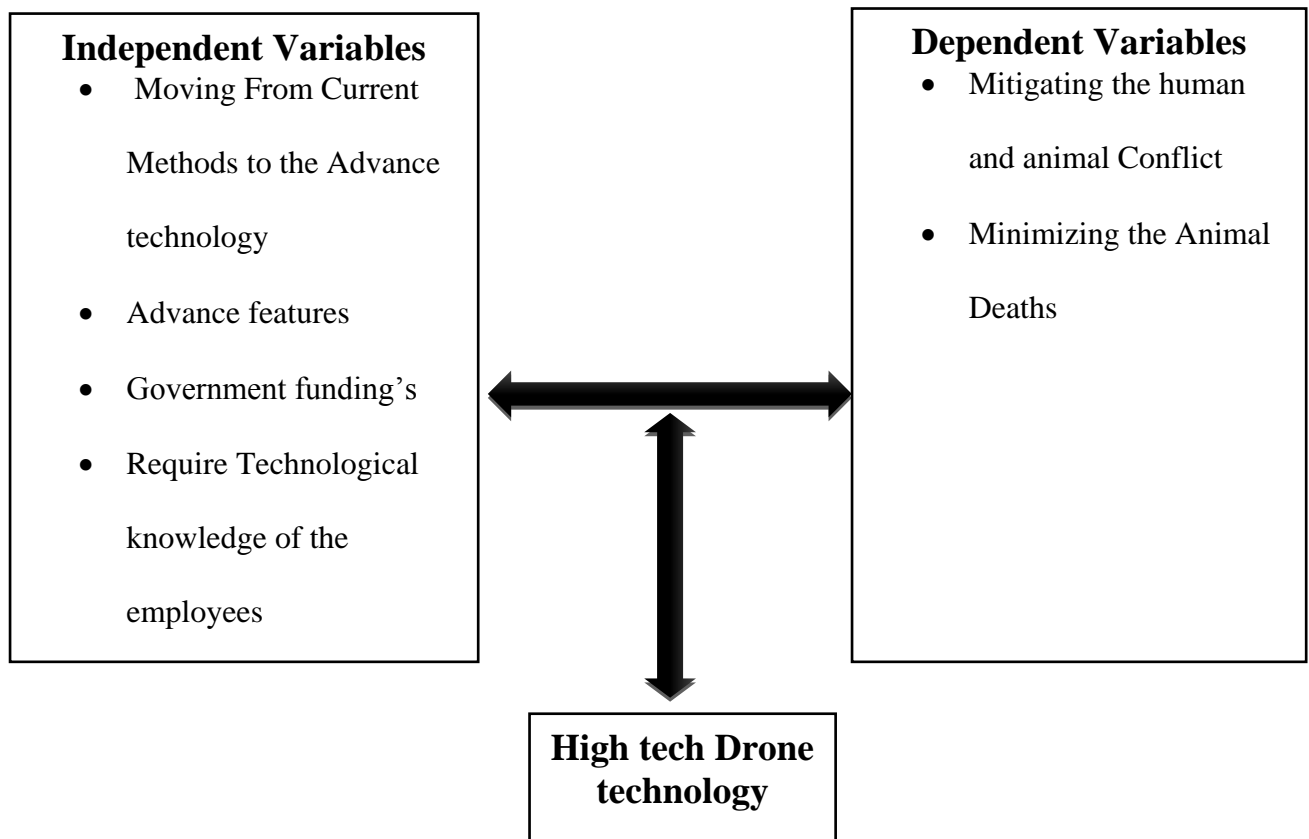
Also, according to the wild life protection act in 2009 number 22 if any one kills any wild animals, destroy their habitats or destroy their eggs they can be charged with strict actions. According to the law, if any person kills any animal in an unnecessary cruel manner he shall be punished with fines, which may extend to an imprisonment.

Here in this project the wild life department will be using high tech drones to capture animals by tranquilizer them, to monitor unusual activities in national parks, capture poachers, to provide air support to ground units and find animals those who are trapped into hunting traps. The project will be started up with a single falcon 8 plus drone. This drone can withstand extreme weather conditions this enables the wild life authorities to conduct missions even in extreme weather conditions. For an example according to the Intel website it says they have done a research on arctic Polar bears using falcon 8 plus drone in extreme cold weather. (Intel, 2018)

Methodology

My Research is Quantitative research. I had to use Primary and Secondary data collection methods to gathering data such as questionnaires, interviews with Wild life Officers, literature reviews, Paper Articles and Internet. Target population will be the people those who are working at national wild life authority in Sri Lanka, ex-employees, lawyers and drone specialists. And 80 Questionnaires were distributed wild life officers who were selected randomly.

Conceptual Framework



Hypothesis

Hypothesis 1

H0 – Moving from current methods to the advance technology cannot be mitigating the human and animal conflict

H1 – Moving from current methods to the advance technology can be mitigating the human and animal conflict

Hypothesis 2

H0 – Moving from current methods to the advance technology cannot be minimizing the animal deaths

H1 – Moving from current methods to the advance technology can be minimizing the animal deaths

Hypothesis 3

H0 – Advance features of High Tech Drone cannot be used to mitigate the human and animal conflict

H1 – Advance features of High Tech Drone can be used to mitigate the human and animal conflict

Hypothesis 4

H0 – Advance features of High Tech Drone cannot be used to minimizing the animal deaths

H1 – Advance features of High Tech Drone can be used to minimizing the animal deaths

Hypothesis 5

H0 – Government funding's of High Tech Drone will not help to mitigate the human and animal conflict

H1 – Government funding's of High Tech Drone will help to mitigate the human and animal conflict

Hypothesis 6

H0 – Government funding's of High Tech Drone will not help to minimizing the animal deaths

H1 – Government funding's of High Tech Drone will help to minimizing the animal deaths

Hypothesis 7

H0 – Technological knowledge of the employees when using High Tech Drone will not help to mitigate the human and animal conflict

H1 – Technological knowledge of the employees when using High Tech Drone will help to mitigate the human and animal conflict

Hypothesis 8

H0 – Technological knowledge of the employees when using High Tech Drone will not help to minimizing the animal deaths

H1 – Technological knowledge of the employees when using High Tech Drone will help to minimizing the animal deaths

Data Analysis and Hypothesis Testing

STATISTICAL DATA ANALYSIS

Analysis of Age Category in Participants

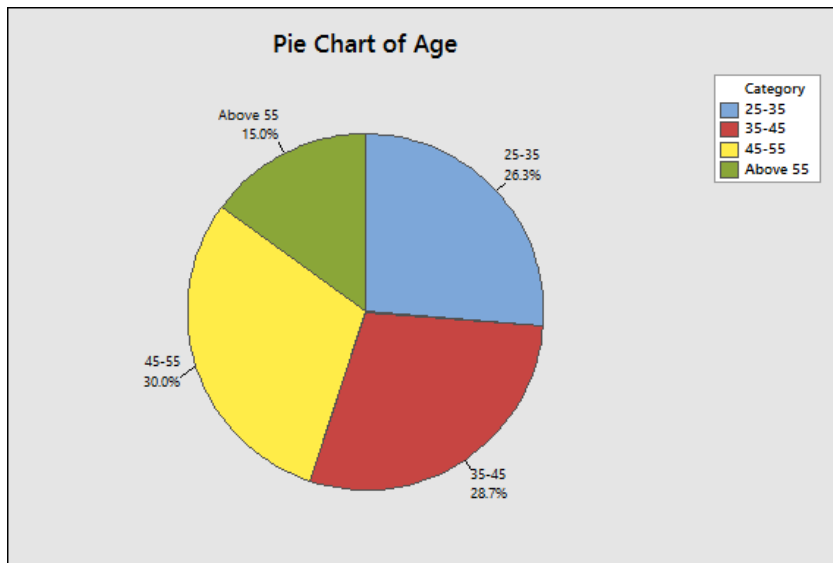


Figure 18 Age category in participants

Blue color (25-35) shows 26.3% participants, red color (35-45) shows 28.7% participants, yellow color (45-55) shows 30.0% participants and finally green color (Above 55) shows 15.0% participants.

Analysis of Gender Category in Participants

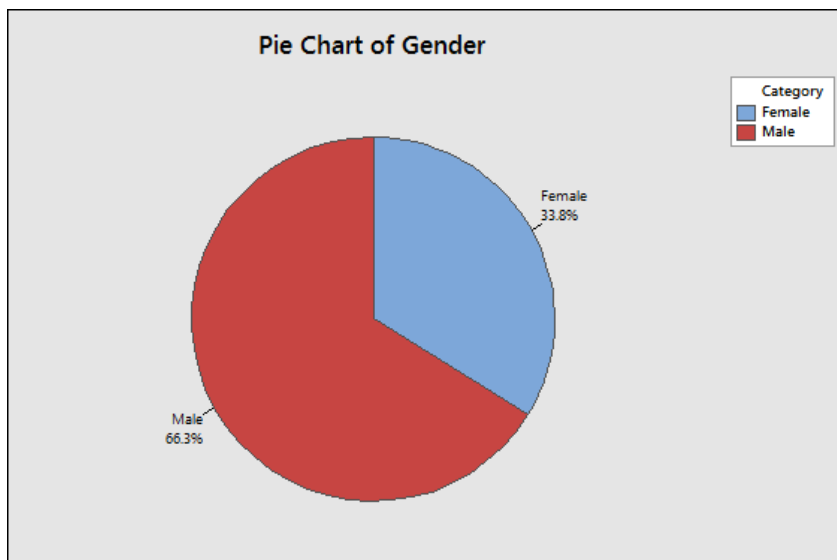


Figure 19 Gender category in participants

Red color shows the male participants and blue color shows the female participants.

Regression Analysis

Regression analysis

Hypothesis 1

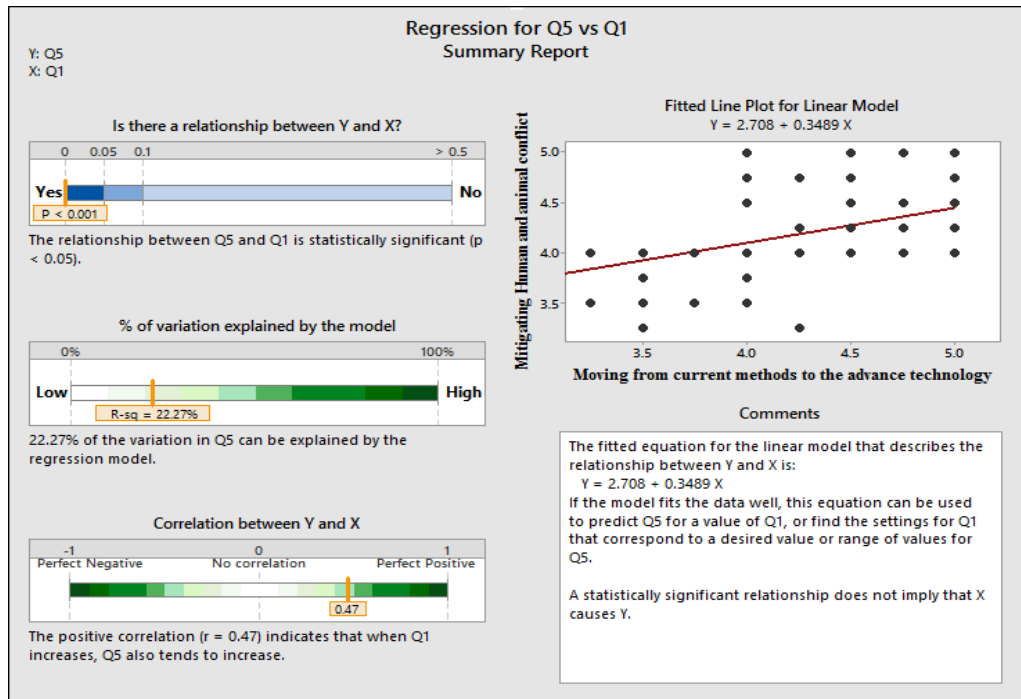


Figure 20 Moving from current methods to the advance technology and Mitigating the Human and animal conflict

Hypothesis 2

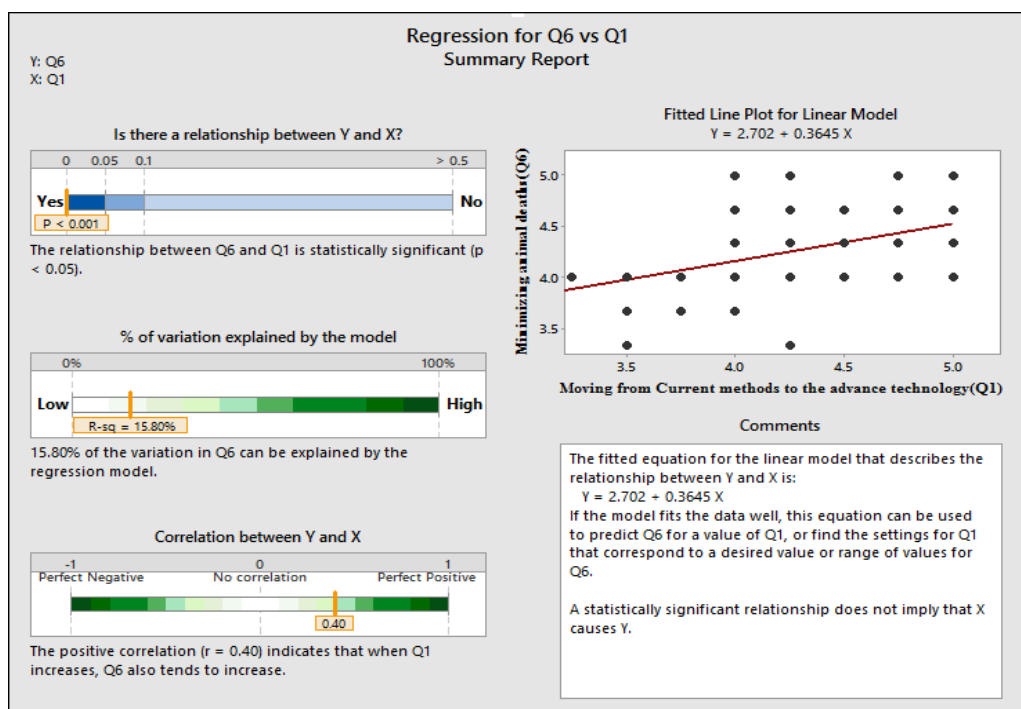


Figure 21 Moving from current methods to the advance technology and Minimizing animal deaths

Hypothesis 3

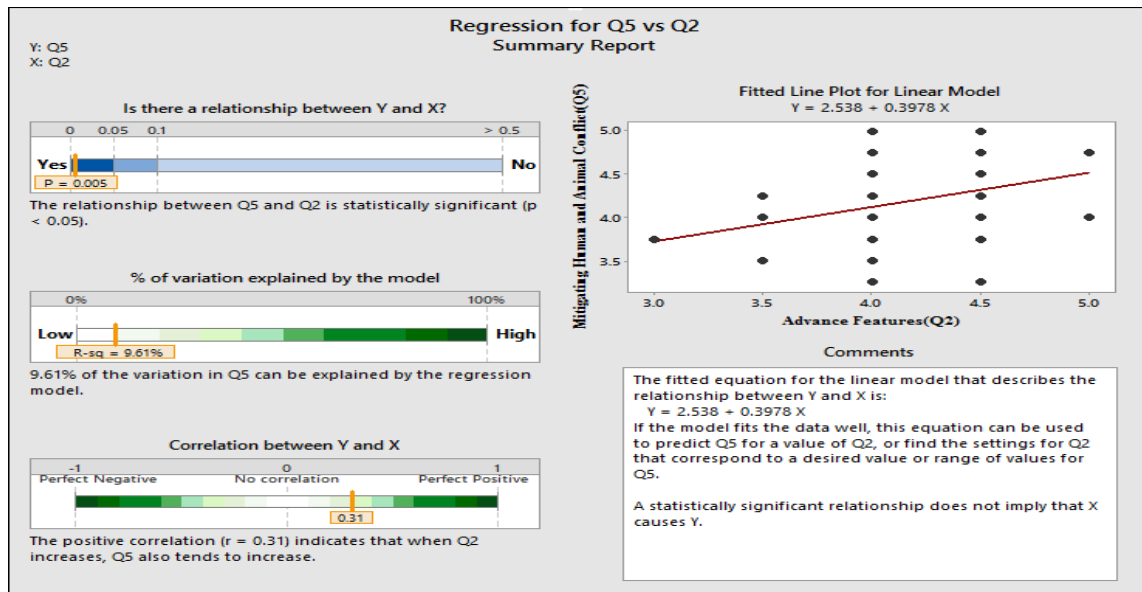


Figure 22 Advance Features and Mitigating the human and animal conflict

Hypothesis 4

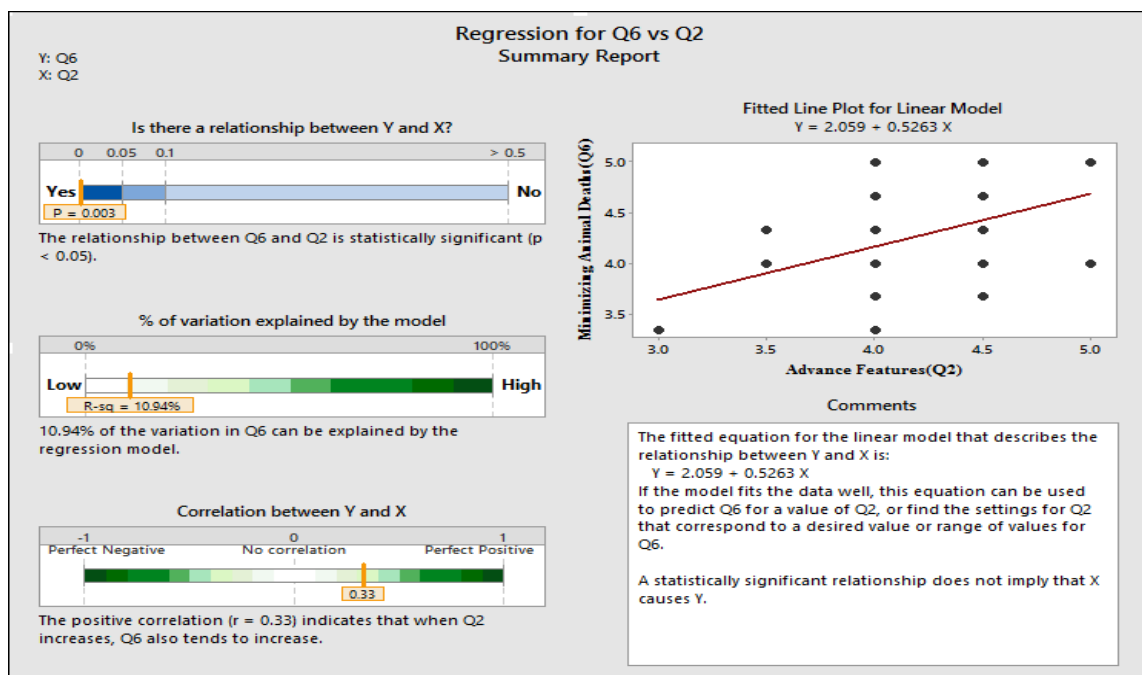


Figure 23 Advance features and Minimizing animal deaths

Hypothesis 5

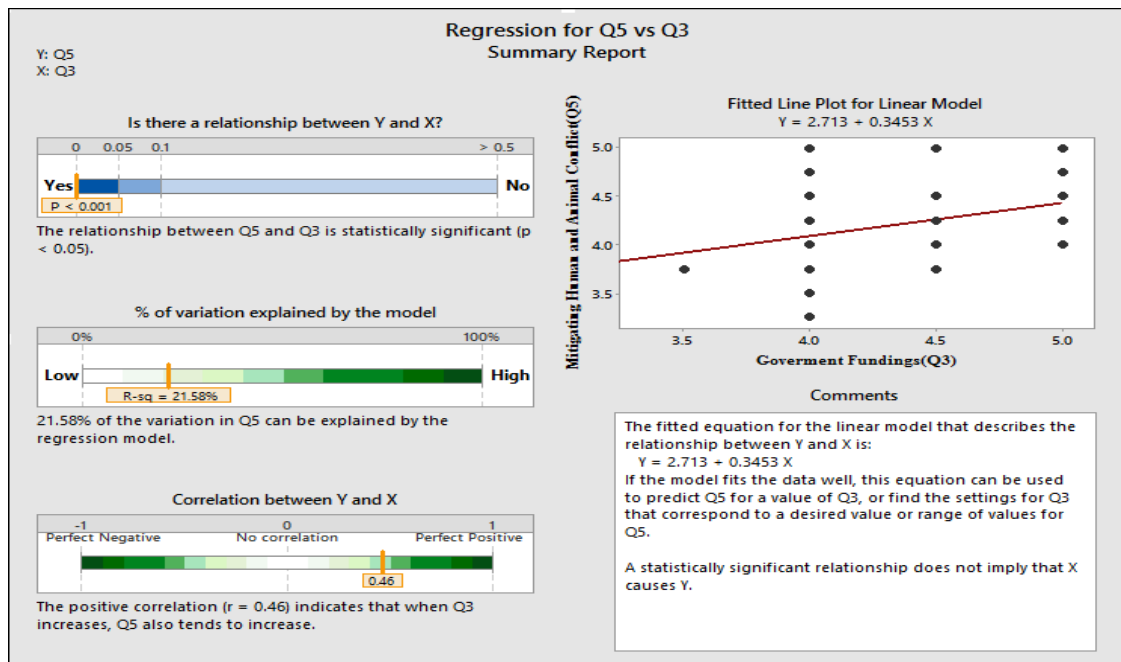


Figure 24 Government Funding's and mitigating the human and animal conflict

Hypothesis 6

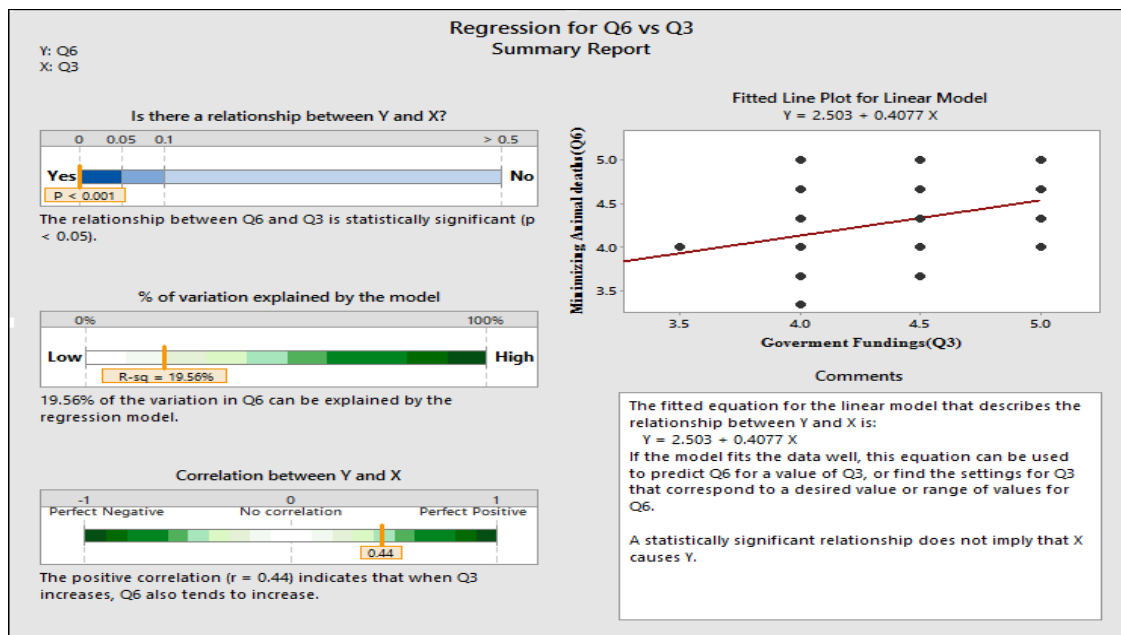


Figure 25 Government Funding's and Minimizing animal deaths

Hypothesis 7

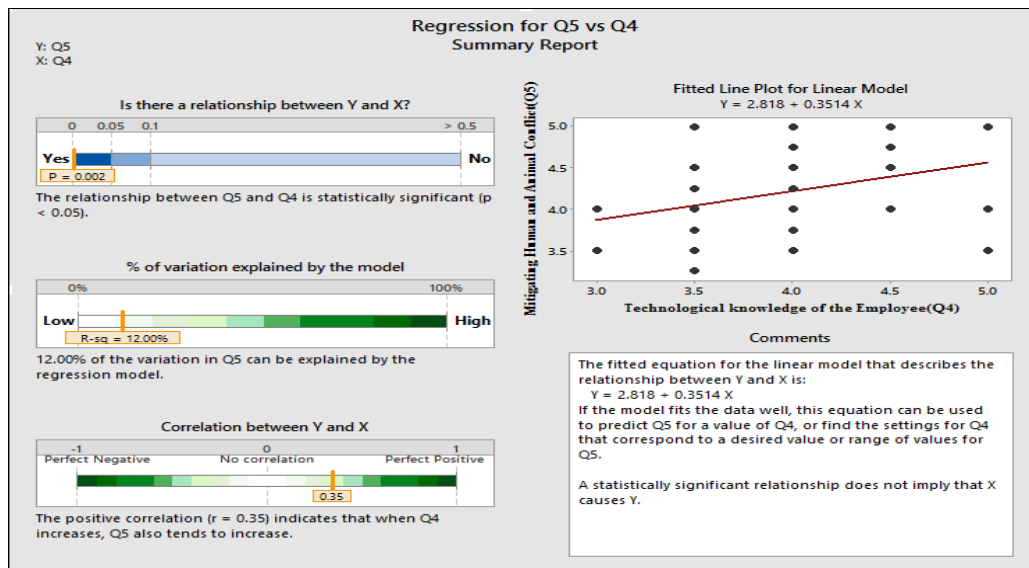


Figure 26 Technological knowledge of the employee and mitigating the human and animal conflict

Hypothesis 8

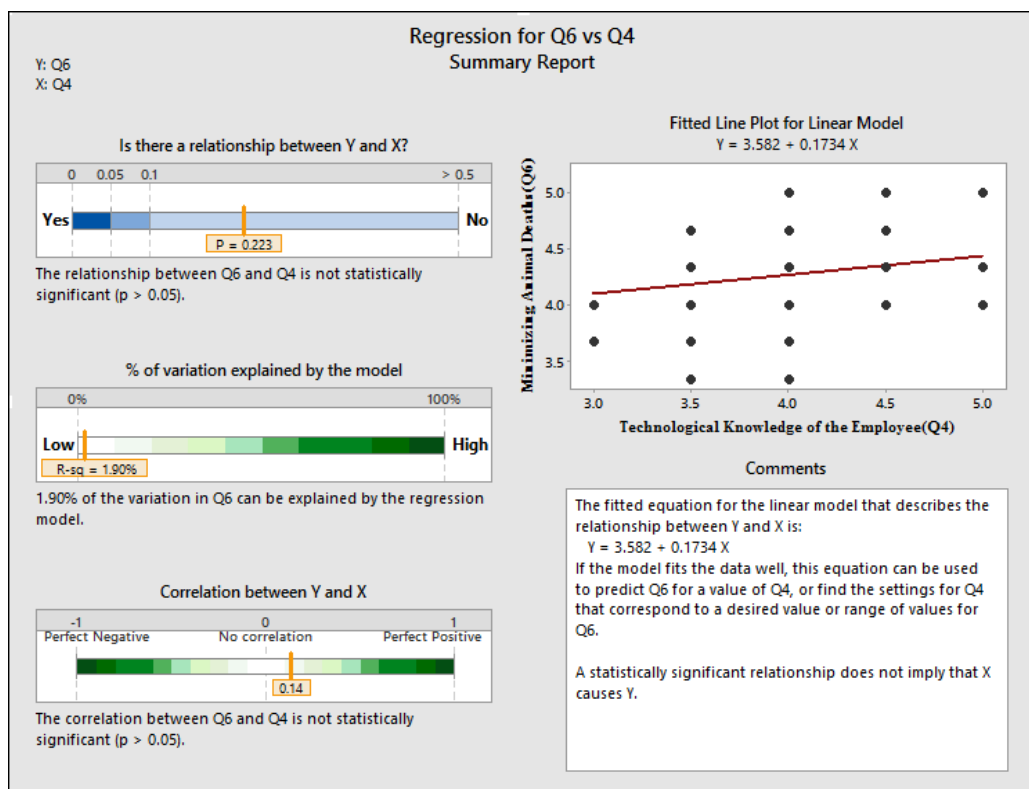


Figure 27 Technological knowledge of the employee and minimizing animal deaths

Variable	Regression	P value	Correlation	Result
1. Moving from current methods to the advance technology and	Positive	0.001	0.47	Moving from current methods to the advance technology can be

mitigating human and animal conflict				mitigating the human and animal conflict
2. Moving from current methods to the advance technology and minimizing animal deaths	Positive	0.001	0.40	Moving from current methods to the advance technology can be minimizing the animal deaths
3. Advance Features and Mitigating Human and animal conflict	Positive	0.005	0.31	Advance features of High Tech Drone can be used to mitigate the human and animal conflict
4. Advance Features and Minimizing Animal Deaths	Positive	0.003	0.33	Advance features of High Tech Drone can be used to minimizing the animal deaths
5. Government Funding and Mitigating Human and Animal Conflict	Positive	0.001	0.46	Government funding's of High Tech Drone will help to mitigate the human and animal conflict
6. Government Funding's and Minimizing Animal Deaths	Positive	0.001	0.44	Government funding's of High Tech Drone will help to minimizing the animal deaths
7. Technological Knowledge of the employee and Mitigating Human and Animal Conflict	Positive	0.002	0.35	Technological knowledge of the employees when using High Tech Drone will help to mitigate the human and animal conflict
8. Technological Knowledge of the employee and Minimizing Animal Deaths	Negative	0.223	0.14	Technological knowledge of the employees when using High Tech Drone will not help to minimizing the animal deaths

Table IX - Final outputs of the regression analysis

According to the above results interpreted in the above analysis, Four Independent variables and Two Dependent Variables were used. Independent are Moving from current methods to the advance technology, Advance Features, Government Funding's and Technological

knowledge of the employee. Dependent variables are Mitigating Human and Animal Conflict and Minimizing Animal deaths. Each variable was tested and checked out whether there was a relationship between the selected independent and dependent variables.

Conclusion

They were to identify the current wild animal conservation technics, identify why these technics are ineffective, identify what problems wild life department face in terms of protecting wild animals and their habitats and finally to identify the a solution , which is introducing a drone. This particular study was conducted to identify the effectiveness of using high tech drone technology in wild animal conservation.

Some of their methods in protecting wild animals are old school and out dated. Few of the methods are using electric fences to prevent animals from coming to cities, using fire and fire crackers to chase away animals, daily scouting to look for injured animals, illegal farmers and poachers. These methods are costly and time consuming hence it is ideal to use a high tech drone to overcome day today problems that are occurred in the process of protecting wild animals and their habitats.

Wildlife department has used electric fences to prevent animals from visiting the villages and this leads to conflicts between animals and humans. But still animals and human conflicts has not reduced instead it keeps on rising every day because animals have evolved over time, especially elephants. Elephants destroy electric fences by dropping tree logs and branches on to them. Also wildlife department uses fire crackers to chase away animals and villagers uses fire and some dangerous methods to keep animals away from the domesticated areas but still they keep on coming but instead of using these primitive methods, advance methods will be much more effective such as using a drone it is easy to identify the animal and their location. Therefore without been late they can take preventive actions to chase these animals away to mitigate conflicts. Wild life department is unable to monitor Illegal activities as they are happening in larger scales and does not get to know live news from their search teams. They can only act based on the news they get from villagers and team mates working on camp sites. But using this high tech drone they can easily track down poachers. They only have to fly it once and a huge area could be easily scanned hence in the long term animal's deaths could be reduced.

Advance features such as sound releasing system to scare off animals would be helpful in mitigating animal and human conflicts. As suggested by the wild life officer it would be ideal to use a bee hum sound or elephants language. These sounds could be programmed to the drone system and can be played when and where needed.

Moreover when discussing with wild life officers it was able to gather more information on the areas where the drone will be useful. According to them, there are many illegal farmers producing weeds inside the forest. These activities are highly illegal and wild life department should monitor these activities. Currently these activities are monitored monthly during their scouting and these fields are identified based on the information gathered through villagers. Instead using a drone it will be much effective. Drone will also provide live video transmission to ground units during capturing processes of these illegal farmers.

Recommendations

- During if an elephant visit a city, drone could fly there and play this sound which tells the animal to “go” in their particular language.
- They should be sent to other countries where these methods are widely used in wild life conservation. Wild life officers have less knowledge on handling these high tech equipment. Even the people those who thinks this is useless could be included in these foreign trainings to make over their minds and change their perception.
- Especially those who are depending on tourists industry could be encouraged because their ultimate motive is earning profit.in case if there no animals for foreigners to watch then there will be no income for those type of businesses hence they would invest money on these project.

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SUITABILITY OF USING DECISION SUPPORT SYSTEMS IN HEALTHCARE IN SRI LANKA

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Abstract

Healthcare arena is one of most valuable aspects of a country. Even in Sri Lanka, healthcare sector plays a major role. The government has a responsibility for health of their citizens. Therefore, currently the health sector is being developed with new technologies. Although some new technologies have introduced to the healthcare sector, still there are some problems in this field. Therefore, the purpose of this research is to identify the suitability of using Decision Support Systems in healthcare sector in Sri Lanka. Thus, 80 doctors were randomly participated to answer the required questionnaires from both private and government sector hospitals. And the collected data were statistically analyzed using software such as Minitab 18 and SPSS. After analyzing the data, final result recommends that it is suitable to use Healthcare Decision Support Systems

Keywords: Decision Support Systems (DSS), Healthcare, Doctors

Introduction

Any country should consider about having a proper healthcare and ensuring entire community is protected from infectious diseases, chronic diseases, arising accidents and emergencies. Decision Support Systems (DSS) in healthcare are computerized applications which designed to diagnosis analyzing by using a series of complex algorithms with the aid of entire medical history of patients, current symptoms and other necessary data. Currently the Health Minister is planning to digitalize over 300 hospitals by 2019, which was set up as far back as 2009 by identifying the internal issues of the healthcare sector in Sri Lanka. (Aloysius, 2017) Even though the health sector of Sri Lanka is being developed with the several technologies combined with Information Technology (IT), still problems are occurred in this field. They provide a health service which is able to cover all the regions of country with the united of national, provincial general, district and divisional, base hospitals and primary medical care units. Through the digitalization, they expect to improve the quality and the efficiency of the healthcare in beneficial ways.

The Sri Lankan government must manage the health of a large population all over the country. Though the several technologies are covered to a certain level in urban area hospitals, still the manual processes are being used in rural area government hospitals. Therefore, these hospitals are suffering from lack of necessary technologies and facilities to diagnose accurately and treat patients. When the doctors are failed to identify the condition of the patient and these hospitals don't have the technology to identify it, they transfer the patient for another hospital. If the condition of the patient is critical, he might be dead, while transferring.

According to an article of The Sunday Leader newspaper, a 19 years old younger boy was died due to medical misconducted by the doctors of the national hospital (Raisa Wickrematunge, 2010). Incidents like this can happen if doctors do not give their fully

contribution, when the patients are treated for the wrong conditions because of the failure diagnosis analysis or delayed treatments or no treatments at all.

Another important goal of the healthcare sector is early cancer detection. Even though diagnosis analysis is done by expert radiologists, there is the possibility of human errors, such as,

1. Interobserver error is the different number of variations between the results analyzed by two or more doctors examining the same reports.
2. Intra-observer error is known as the differences between interpretations of a doctor's observations of the same report at different times.

In Sri Lanka, Healthcare DSSs are still not more popular among people. Even the doctors are unaware of the technical knowledge of using this system properly.

Through this research I would mainly discuss about the suitability of using Decision Support System in healthcare in Sri Lanka and how it will help to have a better health management.

Methodology

Quantitative method is followed in order to conduct my research. In quantitative method, data are produced numerically and analyzed using statistical and mathematical methods. Also, it is necessary to have clearly designed research questions to conduct the research. Therefore, I had to use structured data gathering methods such as questionnaires, online surveys, interviews with healthcare professionals, literature reviews and articles through internet. Target population of this research mainly covers health professionals of Sri Lankan healthcare sector, such as doctors in private sector and government sector. Thus, 80 questionnaires were distributed to doctors who were selected randomly. The gathered data were analyzed through the Minitab 18 version. Data have been represented numerically and graphically using pie charts and histograms.

Theoretical framework

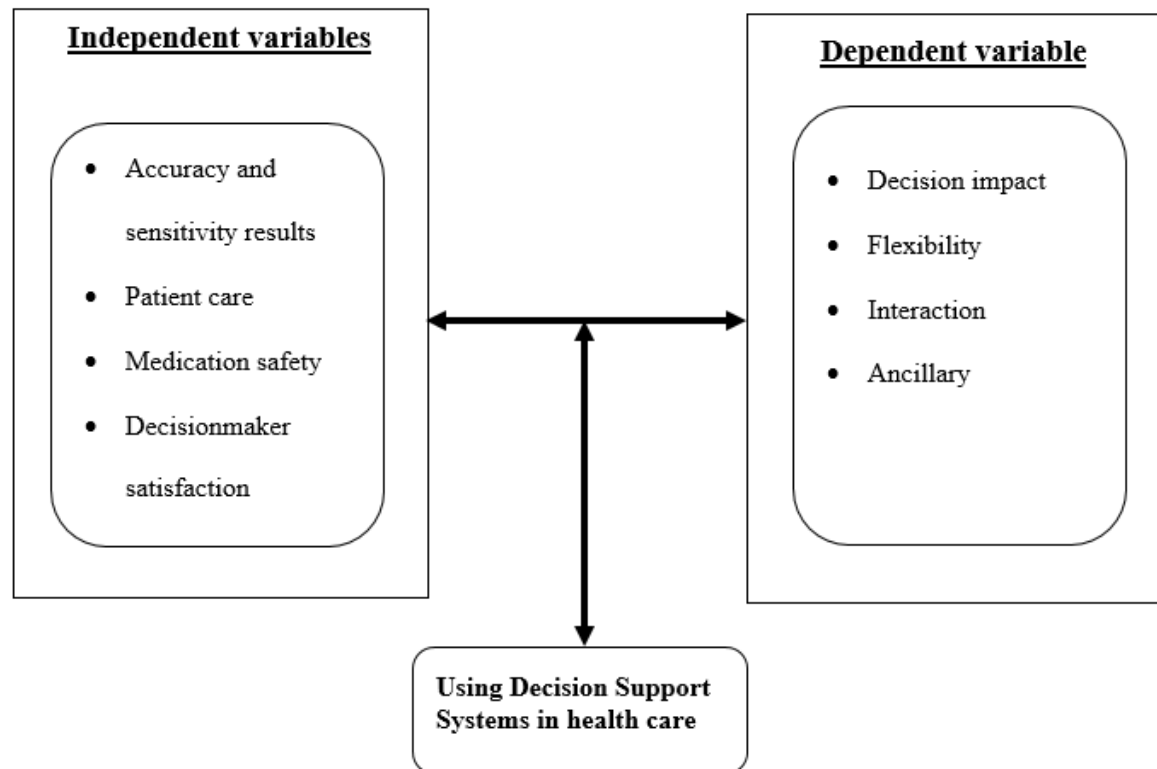


Figure XXVIII - Theoretical framework

Results and discussion

Analysis of the gender of the respondents

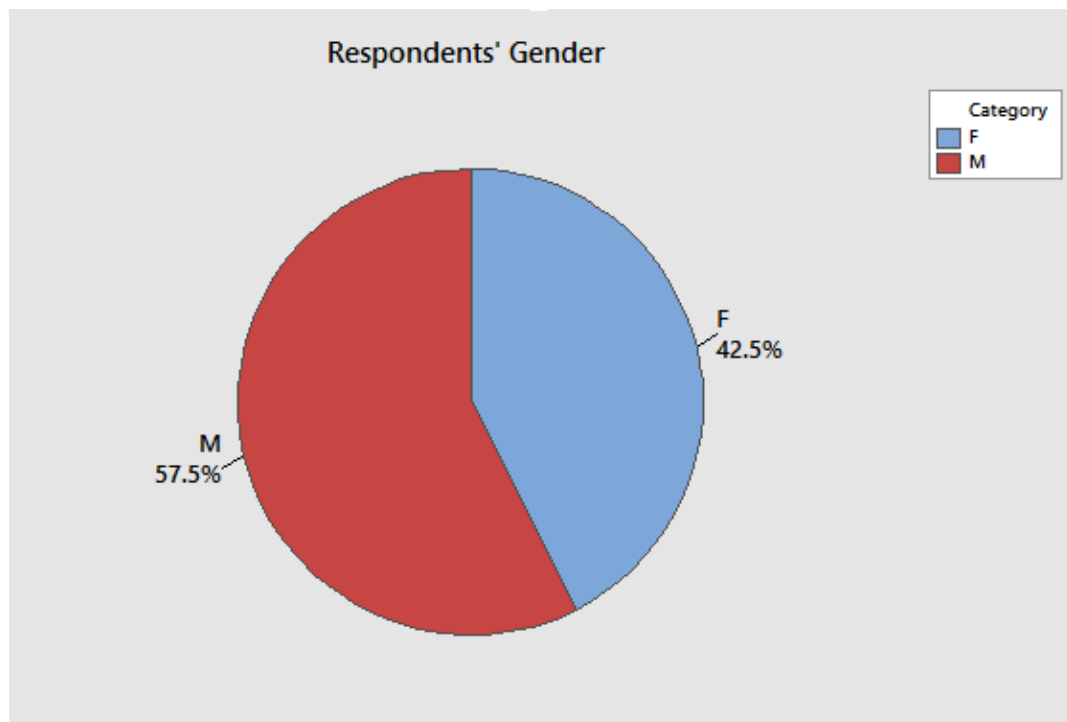


Figure XXIX - Pie chart of gender

According to the above pie chart the main responder of the conducted survey is the doctor. Therefore, when it divided according to the gender, out of all eighty participants, 57.5% were Male and the other rest of 42.5% were Females.

Analysis of Respondents' Age Category

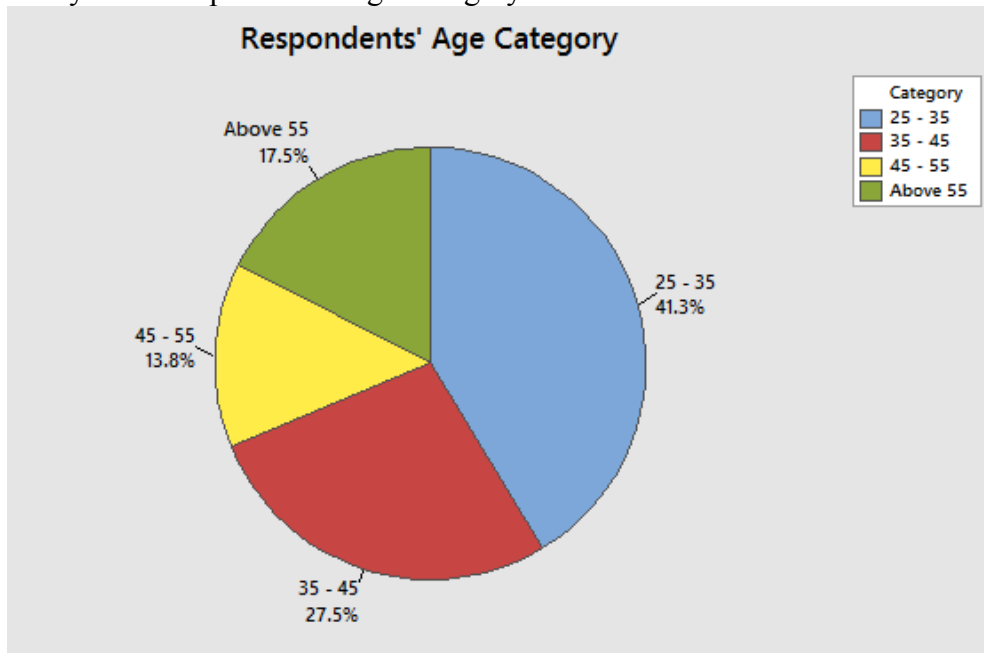
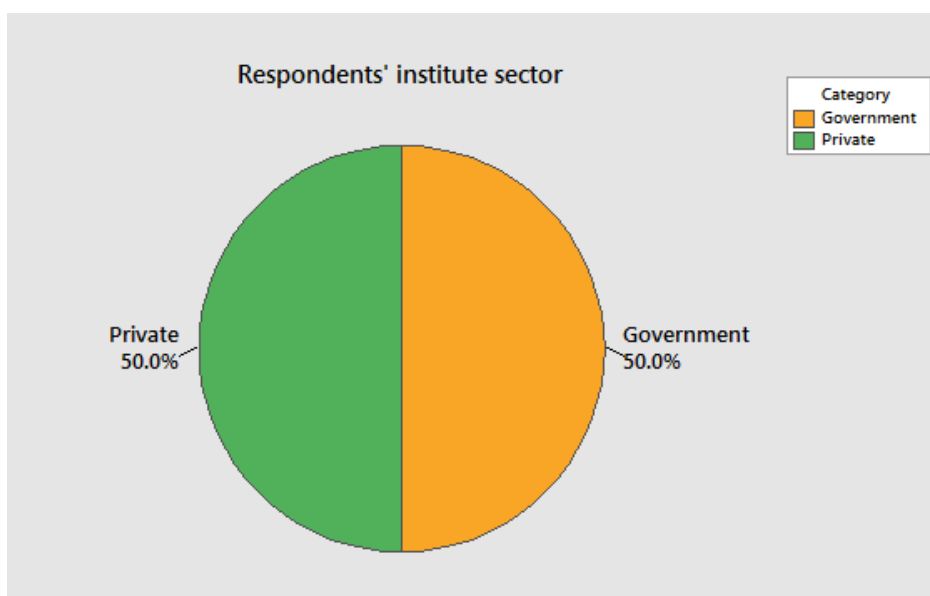


Figure XXX - Pie chart of Age category

This above pie chart was drawn to show the age category of respondents. Mainly out of all eighty respondents 41.3% have answered the questionnaires as the doctors between age 25 – 35 years. There are 27.5% of doctors who are between age 35 – 45 years and the 13.8% are doctors between the age category of 45 – 55 years. The rest of 17.5% doctors are above 55 years who are considered as well experienced doctors.

Sectors of data collection



Figure

XXXI - Sectors of data collection

According to this, data were collected through the private and government sector equally since the private sector doctor involvement is stated as 50% and the government sector involvement is showed as 50%.

Regression analysis

Variable	Regression	P value	Correlation	Result
Accuracy and sensitivity results of computer based DSS and the Decision impact in healthcare	Positive	0.001	0.68	Accuracy and sensitivity results of computer based DSS positively effect on Decision Impact in healthcare
Patient care of computer based DSS and Decision impact in healthcare	Positive	0.001	0.52	Patient care of computer based DSS positively effects on Decision Impact in healthcare
Medication safety of computer based DSS and Decision impact in healthcare	Positive	0.001	0.42	Medication safety of computer based DSS positively effects on Decision Impact in healthcare
Decision maker satisfaction of computer based DSS and Decision Impact in healthcare	Positive	0.001	0.56	Decision maker satisfaction of computer based DSS positively effects on Decision Impact in healthcare
Accuracy and sensitivity results of computer based DSS and the Flexibility in healthcare	Positive	0.001	0.61	Accuracy and sensitivity results of computer based DSS positively effects on Flexibility in healthcare
Patient care of computer based DSS and Flexibility in Healthcare	Positive	0.001	0.66	Patient care of computer based DSS positively effects on Flexibility in healthcare
Medication safety of computer based DSS and Flexibility in Healthcare	Positive	0.001	0.52	Medication safety of computer based DSS positively effects on Flexibility in healthcare
Decision Maker Satisfaction of computer based DSS and Flexibility in Healthcare	Positive	0.001	0.54	Decision Maker Satisfaction of computer based DSS positively effects on Flexibility in

				healthcare
Accuracy and sensitivity results of computer based DSS and Interaction in Healthcare	Positive	0.001	0.44	Accuracy and sensitivity results of computer based DSS positively effects on Flexibility in healthcare
Patient care of computer based DSS and Interaction in Healthcare	Positive	0.016	0.27	Patient care of computer based DSS positively effects on Interaction in healthcare
Medication safety of computer based DSS and Interaction in Healthcare	Positive	0.001	0.48	Medication safety of computer based DSS positively effects on Interaction in healthcare
Decision maker satisfaction of computer based DSS and Interaction in Healthcare	Positive	0.013	0.28	Decision maker satisfaction of computer based DSS positively effects on Interaction in healthcare
Accuracy and sensitivity results of computer based DSS and Ancillary in Healthcare	Positive	0.007	0.30	Accuracy and sensitivity results of computer based DSS positively effects on Ancillary in healthcare
Patient care of computer based DSS and Ancillary in Healthcare	Positive	0.011	0.28	Patient care of computer based DSS positively effects on Ancillary in healthcare
Medication safety of computer based DSS and Ancillary in Healthcare	Positive	0.002	0.34	Medication safety of computer based DSS positively effects on Ancillary in healthcare
Decision Maker Satisfaction of computer based DSS and Ancillary in Healthcare	Positive	0.008	0.29	Decision Maker Satisfaction of computer based DSS positively effects on Ancillary in healthcare

Table X - Final outputs of the regression analysis

According to the above results interpreted in the above analysis, four dependent variables and four independent variables were used. Independent variables were come up from Decision Support Systems in healthcare as accuracy and sensitivity results, patient care, medication safety and decision maker satisfaction. Dependent variables were identified from the healthcare as decision impact, flexibility, interaction and ancillary in healthcare. Each variable was tested and checked out whether there was a relationship between the selected independent and dependent variables. By considering the outputs of each testing, it is

concluded that when the four independent variables are increased, the dependent variables are also increased with that. Therefore, it is necessary to have these four independent variables in DSS to provide a better health service and implementing Decision Support Systems in healthcare would increase the efficiency of these.

Conclusion and recommendations

As the first step, current problems in healthcare in Sri Lanka, medical misconducts and deaths due to those were identified. Through that it was decided to conduct a research to check the suitability of using Decision Support Systems in healthcare in Sri Lanka. Moreover, lack of technologies and facilities in hospitals, unawareness of new technologies in healthcare, diagnosis failures were identified as current problems in healthcare arena. According to the all findings it is clear that, medication safety, patient care, accurate results and doctor involvement should be there to provide an efficient healthcare service to the public and these factors support to increase the decision impact, flexibility, interaction and ancillary in healthcare. Doctors have agreed that Information Systems are really helpful for them but without a doctor involvement these systems are not succeeded, and they accept that the system can provide a clear prescription according to the doctors' needs. Therefore, Decision Support Systems are suitable to use in hospitals in Sri Lanka to diagnosis analysis, medical report analysis, recommend treatments and handle patient data with the doctor involvement.

Doctors recommendations in using Decision Support Systems

- DSSs can be used to predict diagnosis. But the accurate diagnosis analysis cannot be done without a doctor.
- These systems are better for surgeries to analyze the reports.
- Information Systems are really helpful for doctors, but without a doctor involvement these systems are not succeeded.
- Doctors accept that the system can provide a clear prescription according to the doctors' needs.
- The outputs of the system should be always controlled by the doctors according to the patient's mentality at the moment and these systems are just computerized systems and should not use to replace the human brains.

Future recommendations

- Allowing patients to access DSSs according to their needs as to see their testing reports, recommended treatments, prescriptions and their patient information and patients do not have the authorization to change, delete or modify the data.
- Developing a Mobile Application for DSSs to improve the flexibility of using the system.
- Conducting a research which covers all the areas in Sri Lanka, including rural and remote area hospitals to figure out the suitability of implementing this system in hospitals.

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SUITABILITY OF SMART CARD BASED SOLUTION FOR FUEL STATIONS IN SRI LANKA

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Abstract

Fuel stations are very important for a country as well as the entire world as the main resource which is needed to activate vehicles is fuel. This research helps to discover an advanced technology than the current system which is a smart card based solution for fuel stations in Sri Lanka to overcome the identified drawbacks which are time consumption, Human errors, Security issues, Data verification issues, 24/7 service unavailability and Man-power of the current system. By doing this research study, the effectiveness of smart card based solution towards customer satisfaction in fuel stations will be identified. Literature surveys and Interviews were done and questionnaires were distributed to a sample size of 100 respondents from fuel station employees, fuel station owners, fuel consumers etc. The collected data was analyzed using SPSS and Minitab to prove the hypothesis created. Finally, it concluded that a smart card based fuel card system is suitable for fuel stations in Sri Lanka.

Keywords: Data verification, Fuel stations, Human errors, Man-power, Security issues, Smart Cards, Time consumption, 24/7 service unavailability.

Introduction

Fuel stations have a long history which started with a storage barrel, plunger, hand lever and an upright faucet lever and then gradually increased the technology into a manual fuel pumping system. This research will mainly focus on, investigating the suitability of smart card based solution for fuel stations in Sri Lanka by identifying the drawbacks in the current system and thereafter researcher will Study and analyze the current system and process of the fuel stations in Sri Lanka through information gathering techniques, Identify the drawbacks of the current system and how it affects the organization and customers, Identify if there are any IT based solutions to solve the identified drawbacks, Select the most suitable solution by comparing and contrasting the identified IT solutions and finally will Propose the selected solution with features and functions to overcome the problems identified. When considering the current fueling system in Sri Lanka, the main problem is that the fueling process consumes a lot of time where the customer has to wait for a long time to get their vehicles refilled. Thereafter, at the end of the day the owner faces many problems regarding the accuracy of the income when the total income is calculated. And also much time is consumed when dealing with cash while paying the balance to the customer. It is also difficult to verify the amount of fuel pumped within a single pumping process and the transactions of a customer. And also all the fuel stations in Sri Lanka are not open 24/7.

Methodology

This research consists of accurate data collections with the help of secondary data collection methods such Journal articles, Newspapers, websites and Reports for the background studying on the selected topic and Questionnaires were distributed to gather data as people are busy with their day today activities and Observations, Interviews and Pilot surveys were

done for further collection of confidential, accurate and massive amounts of data. This research study consists both quantitative and qualitative data and the sampling method used will be random sampling method as the data will be gathered by a particular sample which has an equal probability of being chosen to answer the questionnaires. Thereafter the gathered data from primary and secondary data collections will be represented using proper charts, graphs and tables with the help of software such as Rstudio, Minitab and SPSS.. Further, these data will be statistically represented using mode, median, mean, standard deviation and hypothesis.

Conceptual Framework

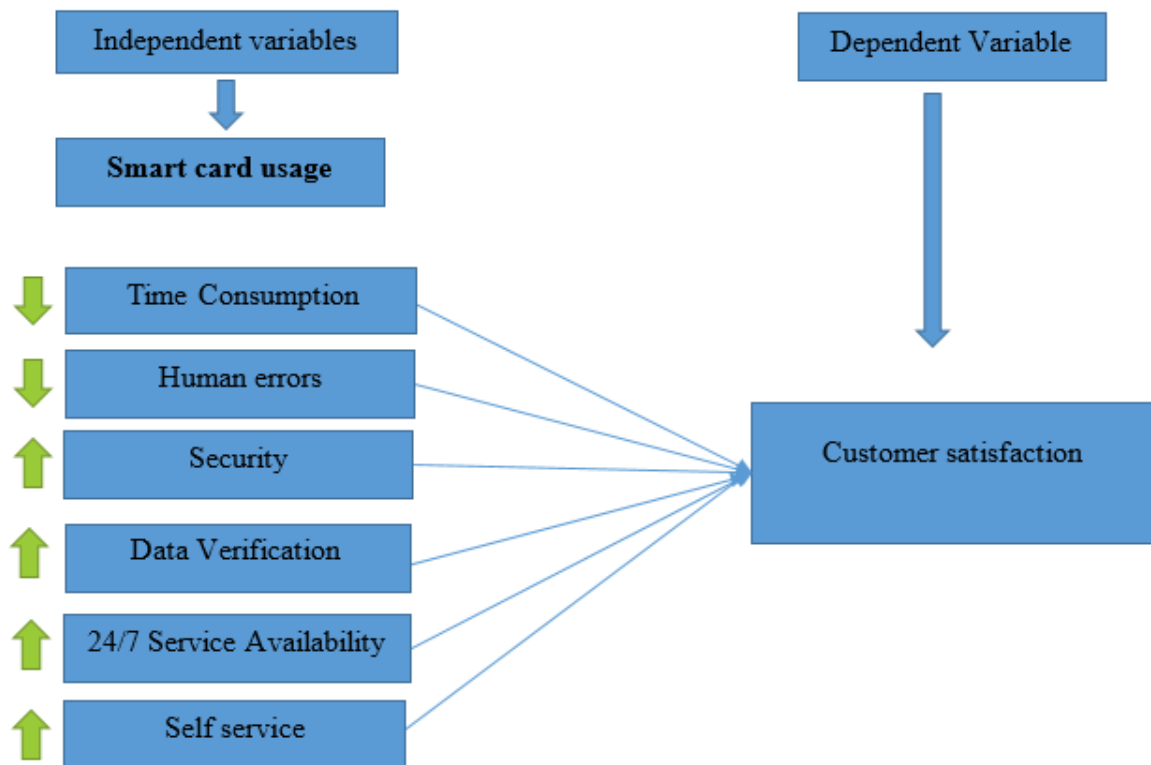


Figure I - conceptual framework

Results and discussion

Distribution of the Gender

Gender	Frequency	Percentage
Female	20	20%
Male	80	80%
Total	100	100%

Table I - Distribution of the Gender

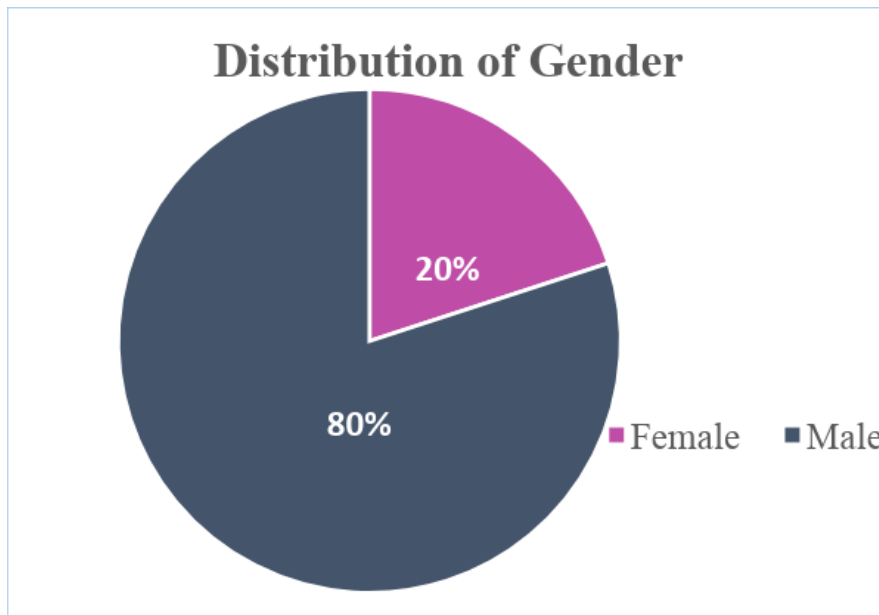


Figure II-Distribution of the Gender

The above chart shows the distribution of gender and proves that from the sample of 100 respondents, 80% were male and 20% of the respondents were female. Therefore, it concludes that the number of male respondents were greater than the female respondents.

Distribution of Age

Age	Frequency	Percentage
18 – 25	62	62%
25 – 35	19	19%
35 – 45	10	10%
Above 45	9	9%
Total	100	100%

Table II-Distribution of Age

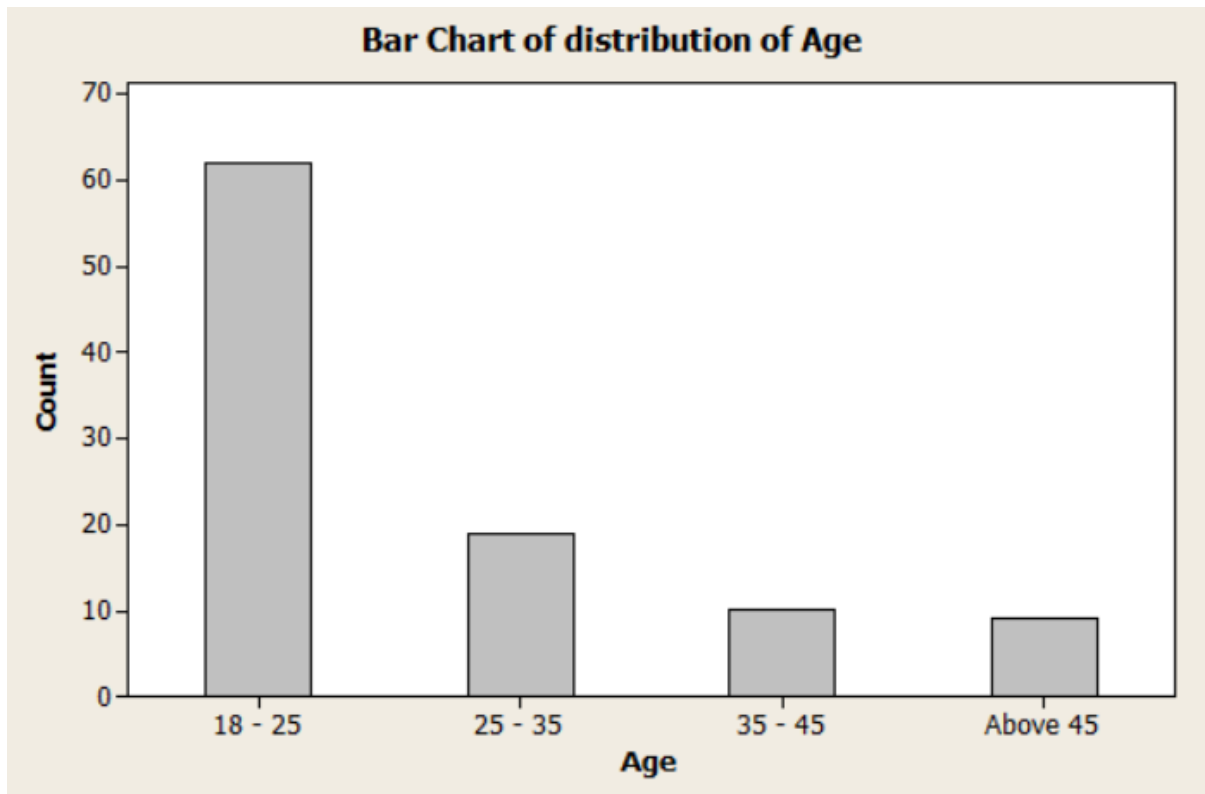


Figure III-Distribution of Age

When the distribution of age is taken into consideration, 62% of the respondents were aged 18 – 25 years, 19% of the respondents were aged 25 – 35 years, 10% were from respondents aged 35 – 45 years whereas the other 9% were aged above 45 years. The highest number of respondents were aged between 18 – 25 years and the lowest number of respondents were aged above 45 which was 9% and the second lowest number of respondents were much similar to the lowest number of respondents where the respondents were aged 35 – 45 years which was 10%.

Employment status

Employment Status	Frequency	Percentage
Employed	69	69%
Non-Employed	31	31%
Total	100	100%

Table III-Employment status

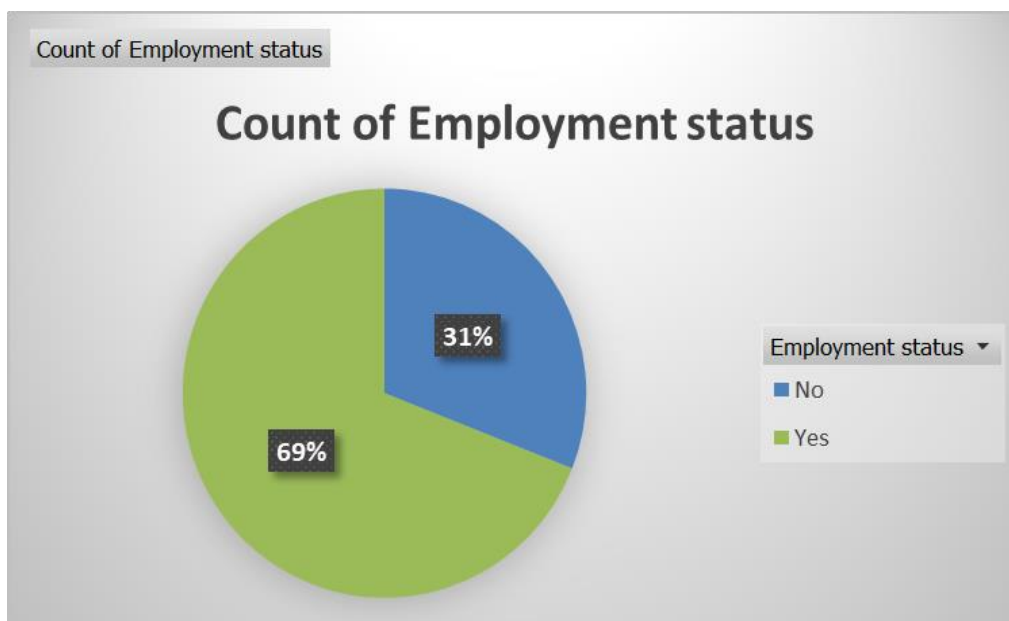


Figure IV- Employment status

When considering the employment status of the respondents 69% of them were employed and 31% were unemployed where the participation of employed respondents was greater than the number of unemployed respondents.

Use / Own a Vehicle

Use / Own a vehicle	Frequency	Percentage
Yes	82	82%
No	18	18%
Total	100	100%

Table IV- Use/ own a vehicle

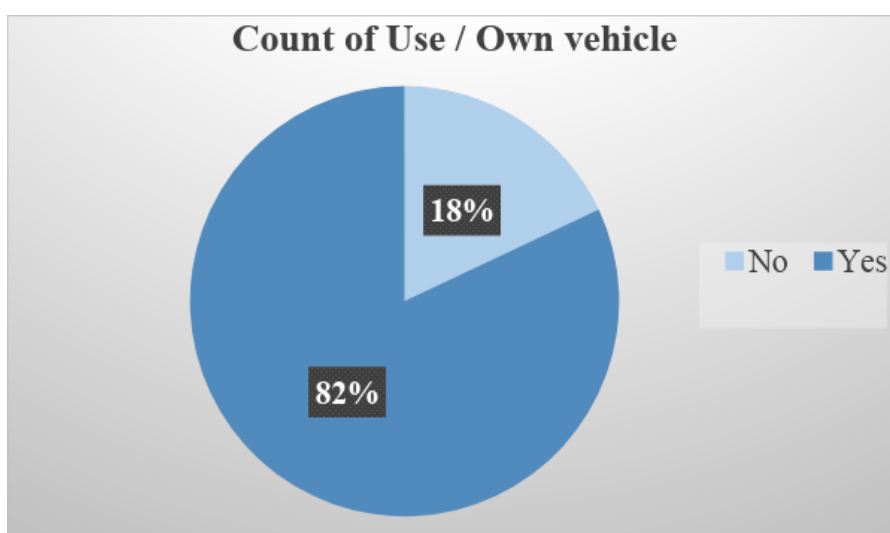


Figure V- Use/ own a vehicle

The respondents who used or had owned a vehicle were 82% and the rest of the 18% did not own or use a vehicle which concludes that there was a higher number of respondents who owned or used a vehicle by themselves.

Use of fuel stations

Use of fuel stations	Frequency	Percentage
Less than 1 year	32	32%
1 – 2 years	20	20%
3 – 5 years	16	16%
More than 5 years	32	32%
Total	100	100%

Table V- Use of fuel stations

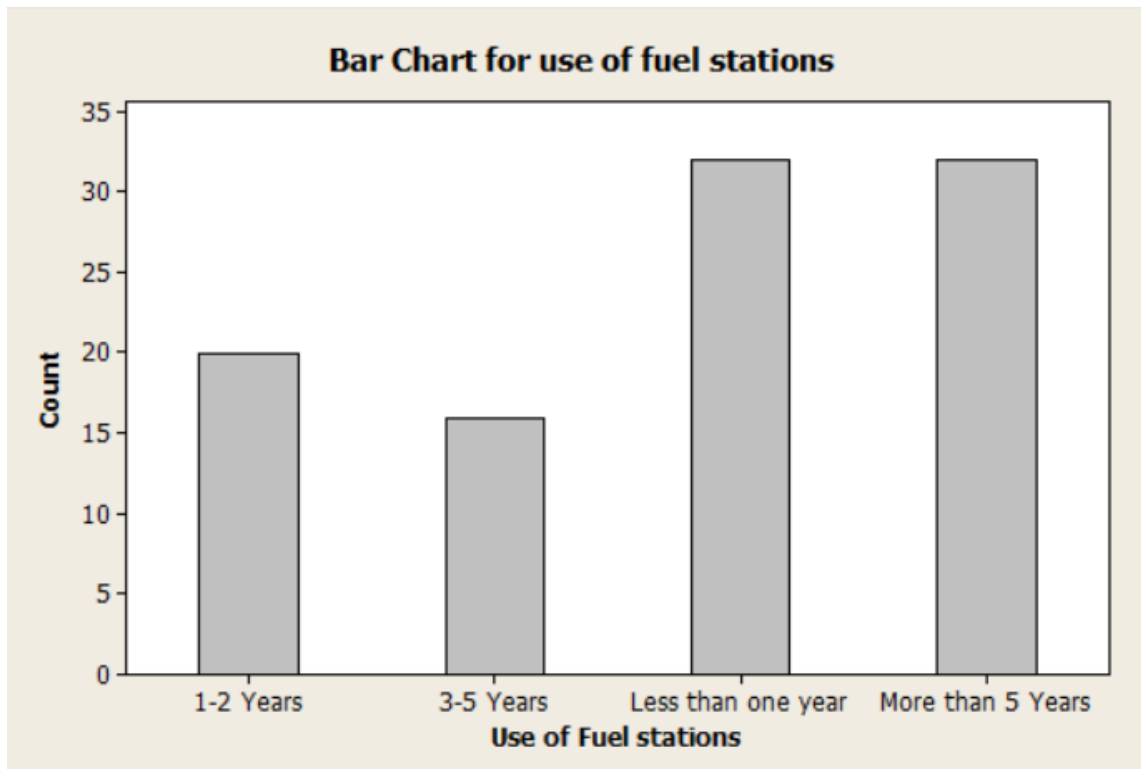


Figure VI- Use of fuel stations

When focusing on the number of respondents who are using fuel stations, 32% were using a fuel station for more than 5 years and similarly another 32% were using fuel stations in a duration less than 1 year. 20% were using fuel stations for 1 – 2 years and the rest of the 16% were using fuel stations for 3 – 5 years. In conclusion, it is proved that the highest number of respondents were using fuel stations for more than 5 years and well as less than 1 year.

Findings / Regression analysis

Variable	Regression	P value	Correlation	Result
Relationship between Time consumption in fueling process and customer satisfaction	Negative	0.000	-0.47	There is enough statistical evidence to prove that time consumption effects negatively on customer satisfaction.
Relationship between human errors in fueling process and customer satisfaction	Negative	0.000	-0.47	There is enough statistical evidence to prove that Human errors affect negatively on customer satisfaction
Relationship between Security of the fueling system and customer satisfaction	Positive	0.000	0.55	There is enough statistical evidence to prove that security affects positively on customer satisfaction
Relationship between data verification in fueling system and customer satisfaction	Positive	0.000	0.50	There is enough statistical evidence to prove that Data verification affects positively on customer satisfaction
Relationship between 24/7 service availability and customer satisfaction	Positive	0.000	0.62	There is enough statistical evidence to prove that 24/7 service availability effects positively on customer satisfaction
Relationship between Self-Service in fueling process and customer satisfaction	Positive	0.000	0.47	There is enough statistical evidence to prove that self-service affects positively on customer satisfaction

Table VI - Regression analysis findings

Hypothesis were created to prove or disprove the predictions made and the findings were as follows,

H₀	There is no relationship between high time consumption in fueling process and customer satisfaction	Rejected
H₁	There is a relationship between high time consumption in fueling process and customer satisfaction	Accepted

H₀	There is no relationship between human errors in fueling process and customer satisfaction	Rejected
H₁	There is a relationship between human errors in fueling process and customer satisfaction	Accepted

H₀	There is no relationship between security of the fueling system and customer satisfaction	Rejected
H₁	There is a relationship between security of the fueling system and customer satisfaction	Accepted

H₀	There is no relationship between data verification in fueling system and customer satisfaction	Rejected
H₁	There is a relationship between data verification in fueling system and customer satisfaction	Accepted

H₀	There is no relationship between 24/7 service availability and customer satisfaction	Rejected
H₁	There is a relationship between 24/7 service availability and customer satisfaction	Accepted

H₀	There is no relationship between self-service in fueling process and customer satisfaction	Rejected
H₁	There is a relationship between self-service in fueling process and customer satisfaction	Accepted

Conclusion and Recommendations

According to the data analysis and their outputs author was able to conclude that there is a relationship between high time consumption, human errors, data verification, security, 24/7 service availability and self- service on customers' satisfaction.

In order to overcome the problems in the current fueling system, author suggested smart card based solutions such as visa cards, Credit cards, and other ATM cards and chip based cards but then while doing more investigation the most suitable smart card based solution was "Fuel Cards" which were made for fuel stations itself and it can help to overcome these identified problems. There are both pros' and con's in this solution but when compared with other smart card based solutions this is the most suitable out of them due to the below reasons.

- Consumes less time as a single swap will conclude the fuel transaction.
- Low threat to human errors as the entire process and record handling is done using technology.
- Helps to secure the transactions from frauds and errors and is accessible from any fuel station as a centralized database is provided to all fuel stations.
- User friendly.
- Allows data verification as it helps to predefine the fuel type, specific vehicle, timing, consumption, transaction value and also the place of purchase and optimize on the fleet management.
- 24/7 service is available as the entire process can be done by the customer at any hour.
- Gives an end for high administration/employee cost as the entire process is done as a self-service so "Pump-your-own-fuel" concept is used.

The above mentioned advantages will help to overcome these problems identified.

Recommendations

- Give customers the function to recharge their fuel cards and check their fuel pumping and transaction details through a mobile application which will save paperwork.
- Do Proper cost and budgetary analysis in order to know the feasibility.
- Proper devices must be taken to use the smart cards like NFC based cards.
- A centralized database system can be made to allow fuel stations to share same data within fuel stations so that the customer can check their details at any fuel station within Sri Lanka.
- Rather than using the billing system it is better if it could be enhanced to a SMS alert system.
- Allocate an amount for fueling and confine the fuel expenditure to this value for a specific period then monitor the expenditure usage for future planning.

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DESKTOP APPLICATION TO LEARN & PREDICT AMERICAN SIGN LANGUAGE – FINGER SPELLING ALPHABET

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Abstract

Ability of hearing and speech impaired people normally underprivileged of communicating with normal people. In the same time people who have the ability to hear and speak, have difficulties in understanding special skilled people because differently abled society only can communicate through sign languages. The aim of this project is to bridge this gap of communication between these 2 communities without training the differently abled community to learn other languages. The basic objective of this project is to build a system to educate and predict the American Sign Language (ASL) basics for normal people in the easiest method, so they can communicate with differently abled community through signs. A tutorial which is created with the system educates the user where Artificial Intelligence (AI) predicts the signs shown or provided by user through a webcam. After processing the image system provided output as English alphabetic letter / number.

Keywords

AI, ASL, CNN, TensorFlow

Introduction

Majority of the people around the world has the ability to hear and speak. In day-to-day life, they use the mode of verbal communication to communicate with one another. In the meantime, there are few people who don't have the ability to speak and hear and they communicate by sign languages within and out of their community, because most of the people around them (even the normal people) can at least understand these signs. It is impossible for the people who lack the capability of hearing and speaking to live their day to day life by moving only with in their community and not with the other normal people.

So when it comes to communicating with the normal people whom are out of the differently abled community, it is hard for such normal person to express their ideas and thoughts, because they are not used to these sign languages and they will find difficult to understand even the basic signs. It is impossible to accompany by a translators' every time and especially during an emergency situation.

This communication issue between these 2 communities is demanding a speedy solution. Therefore, a solution should be provided to normal people to understand these signs. Since the technology has developed rapidly over the years, a basic solution is provided through this desktop application using artificial intelligence concepts and image processing. ASL is used here as the domain language, because ASL is one of the highly and commonly used sign language all around the world and most of the time only one hand is required.

So the objectives of this system as follows;

- Users should be able to learn and predict the ASL signs themselves
- As the output, Artificial intelligence system should show the related English letter / Number for the gesture image user providing.
- Through this system, communication between two communities will be established

By the given solution even normal people get the ability to

- To learn ASL basics from home without visiting the special skilled schools or people who teach these languages.
- Easily evaluate the signs they learned through the prediction function of this system with the help the AI.
- Enable error free communication with hearing and speech impaired person, since both the learning and verification of ASL signs can be done using this system.

Related Researches

Few researches have been working on this issue in past. Most of those were based on kinetic motion reactive gloves. The system was able to identify 14 gestures out of 26 after only one or two examples of each gesture. (Lee and Xu, 1996).

These gloves have few disadvantages which make it a complicated system.

- These gloves must be recalibrated for each user
- No free movement due to wire connections.
- Some image processor require color bands to identify finger-tips and
- It's expensive.

According to Rahim et al (n.d) another system built by Bangladeshi students, named as “Intelligence Sign Language Verification System” using image processing, clustering and neural network to predict Bengali Sign Language (BSL)

According to Keni et al (2013) developed a system called “Sign Language Recognition System” based on image processing and algorithms. A very similar system developed by Marie in 2017, where the author used Google’s Inception V3 model which was a Convolutional Neural Network (CNN) for classification. In this system he trained it using TensorFlow. But this system was trained to only identify ASL letters from A to Z, no numbers. According to literature reviews stated above and research conducted it was cleared that CNN can be the best technique that can be used for this system.

Methodology

Convolutional Neural Network (CNN)

CNN used as the AI and It has two parts as trainer and predictor. CNN is a class of feed forward deep learning Artificial Neural Network (ANN) that has been extremely succeeded in processing images and videos.

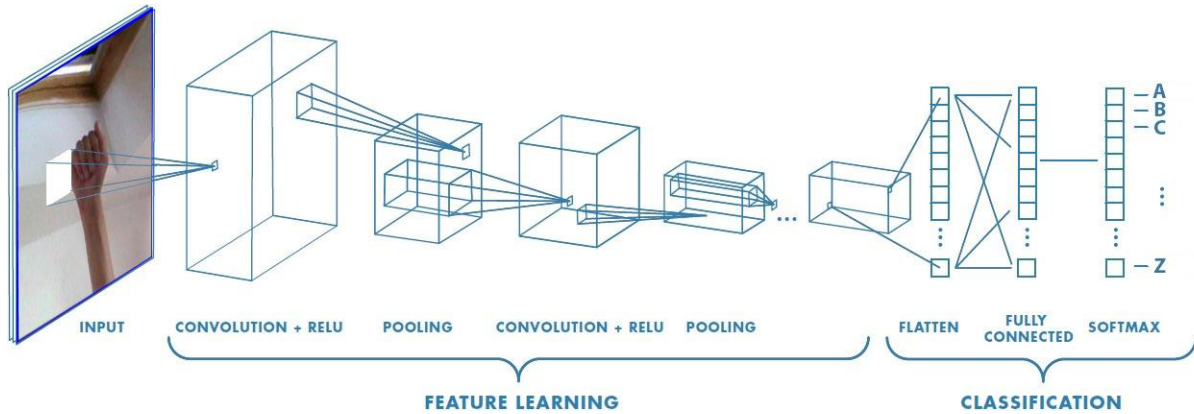


Figure 32 - Structure of a CNN

During the training, the convolution layer identifies pixel values of the input image and by using filters it detects the features of this image and computes the feature map. The ReLU activation function, converts minus values into nearest positive values. The pooling layer (max pooling), converts the output of the convolution layer into a single output by reducing the properties and number of parameters, taking the highest positive value from previous layer.

After certain amount of convolution and pooling layers, it comes to fully connected layer. Each neuron in a layer receives input from all the neurons in the previous layer. The output of this layer computed by matrix multiplication followed by bias offset. Finally, softmax activation function (used to get multiple predictions) in the output layer of the fully connected layer which outputs the possible predictions with scores between 0 and 1. For this project the CNN trained from scratch with the help of AWS server to get more processing power.

The second part, the predictor runs in the desktop application where CNN predictor linked with the desktop application then the desktop application linked with the PHP API and centralized database. This produces the estimation based on the trained model or classifier by matching it with the input. The output is done using softmax function. Here the CNN is developed using Python 3, Keras and TensorFlow libraries. In the end the desktop application interaction tested and converted to .exe format and uploaded to server to be downloaded from asllearning.info web site by any registered end user.

Dataset

The data set was prepared by taking pictures of the ASL sign using a web cam by myself. The data set contained 4950 images of 33 classes. The images representing the ASL signs for numbers “1” to “9” and “A” to “Y” and letters “J” and “Z” were excluded from this due to limitations. 80% of the dataset was used for training and the 20% used for the validation of the final training process.

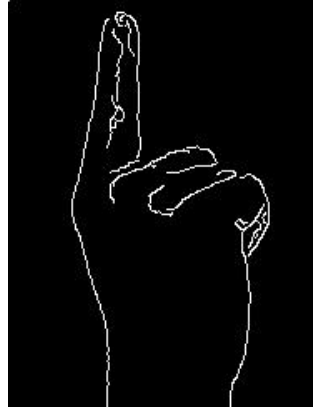


Figure 33 - "Edge" image

In the same time the images were converted in to “edge” images during the preprocessing stage as shown above. The entire dataset was containing “edge” images because it is easy for the CNN to read and learn the “edge” images than normal RGB images. It was found that the accuracy is very high when using “edge” images than RGB images. Even during the prediction stage the image was converted into “edge” image internally before passing to predictor.

Results

Training



At the end of the training of the CNN **Validation accuracy = 1.000 (100%)** was achieved as shown below.










```
ubuntu@ip-172-31-33-239: ~/keras-cnn
Epoch 48/50
250/250 [=====] - 73s 293ms/step - loss: 0.2097 - categorical_accuracy: 0.9315 - val_loss: 1.0931e-04 - val_categorical_accuracy: 1.0000
Epoch 49/50
250/250 [=====] - 73s 294ms/step - loss: 0.2167 - categorical_accuracy: 0.9305 - val_loss: 2.9308e-04 - val_categorical_accuracy: 1.0000
Epoch 50/50
250/250 [=====] - 73s 292ms/step - loss: 0.2113 - categorical_accuracy: 0.9295 - val_loss: 6.2549e-05 - val_categorical_accuracy: 1.0000
(tensorflow p36) ubuntu@ip-172-31-33-239:~/keras-cnn$
```











Figure 3 - Training the CNN using AWS EC2 Server

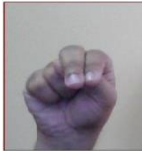
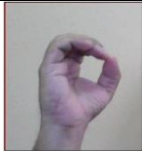

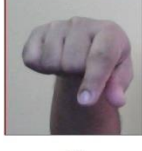
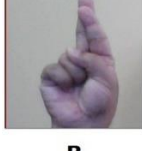





Prediction

Following is the result of the predictor evaluation (Letters “J” and “Z” excluded due to limitations).

Prediction	Correct? (Yes / No)	Correct Answer (If No)
 1	Yes	-
 2	Yes	-

 3	Yes	-
 4	Yes	-
 5	Yes	-
 6	Yes	-
 7	Yes	-
 8	Yes	-
 9	Yes	-
 A	Yes	-
 B	Yes	-

 C	Yes	-
 D	Yes	-
 E	Yes	-
 F	Yes	-
 G	Yes	-
 X	No	H
 8	No	I
 K	Yes	-
 L	Yes	-
 M	Yes	-

 N	Yes	-
 O	Yes	-
 P	Yes	-
 P	No	Q
 R	Yes	-
 E	No	S
 E	No	T
 U	Yes	-
 V	Yes	-
 W	Yes	-

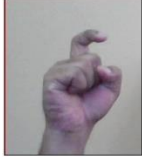

 x	Yes	-
 s	No	Y

Table 1 - AI Predictor Evaluation

According to this evaluation shown above, the predictor also predicted **27 classes successfully** out of 33 trained classes. So the accuracy rate is averagely around **81%**. So evaluation of the solution is successful.

Discussion

During the prediction the ASL signs for numbers “1” to “9” and English letters “A” to “Y” (Letters “J” and “Z” excluded due to limitations) were used for prediction. Out of these 33 classes the predictor did predict 27 classes successfully. Letters “H”, “I”, “Q”, “S”, “T” and “Y” were not predicted correctly. So according to this the accuracy rate is averagely around **81%**. So evaluation of the solution is successful.

The result above proved that the CNN can provide a high accuracy level in machine learning and the can provide solution for this communication issue than any of the studies conducted and solutions provided by others under the topic “*related researches*”. But the accuracy level of this CNN is 81% and it can be increased up to 94% by using Google Inception V3 or V4 models in future.

Conclusion and Recommendations

As mentioned above, this system was built as the first step of enabling smooth communication between differently abled community and normal people. The basic objective of this is to introduce ASL learning and predicting application as the unbiased common teacher or translator to identify ASL - Finger Spelling Alphabet from “A” to “Z” and “1” to “9” through images. The successful demonstration of this system and the results proves the accuracy and efficiency of the CNN. So this system has achieved **81% of accuracy** within a short period of time with limited classes and resources in prediction and has the ability of providing the knowledge to user about ASL basics, I would like to conclude by saying that this desktop application provides a successful solution for the problem in hand.

The future enhancements would be improving the user interfaces, performance, accuracy and compatibility for operating systems other than Microsoft Windows.

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SOCIAL SCIENCES

**THE RELATIONSHIP BETWEEN SELF ESTEEM AND LIFE SATISFACTION
AMONG UNDERGRADUATES AT ICBT, SRI LANKA**

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Abstract: The aim of the present study was to assess the relationship between self esteem and life satisfaction among undergraduates at International College of Business and Technology. One hundred participants (sex ratio of 1:1) with an age group of 19-27 years completed the Rosenberg Self Esteem Scale (1965) and the Satisfaction With Life Scale (1985). Data was analysed using descriptive tools, Pearson Correlation Coefficient and an independent samples t-test. Results suggested that there is a significant positive correlation between self esteem and life satisfaction ($r = 0.589$, $p < 0.01$). Furthermore, female undergraduates possessed a higher level of self esteem (t-test value = 2.248, $p < 0.05$) and life satisfaction (t test value = 3. 647, $p < 0.01$) in comparison to their male counterparts. The findings of the study comply with the predicted outcome and hence, can be considered as a stable foundation for future research in Sri Lanka.

Keywords: Self Esteem, Life Satisfaction, Correlation, Gender

Introduction

The field of psychology has introduced many approaches to enhance human well-being. Many people tend to connect psychology only with dysfunction and illness and therefore, have little or no knowledge about what it offers to healthy individuals. Therefore, in recent years, many studies have explored the topic of self-esteem and life satisfaction of individuals. These are essential factors in the lives of individuals based on the effects they have on the productivity, social interaction and health of a person in the society (Bauer, McAdams & Pals, 2008).

This study explores self-esteem and its relation to life satisfaction. The focus group of the research will be undergraduate students at International College of Business and Psychology (hereafter referred to as ICBT) in Sri Lanka. The study aims to prove two hypotheses. The research will be a significant contribution to the existing literature; specially, since Sri Lanka lacks extensive research on these variables. The purposes of the study are to assess the link between self-esteem and life satisfaction and to compare gender differences in the result.

Different researchers have defined and explained the concept of self-esteem and life satisfaction of individuals (SheldonNeetu et al., 2010). Self esteem, as defined by Sedikides and Gress (2003, as cited in Sharma & Agarwala, 2015) is an individual's perception about his or her own self-worth, feelings of self respect and confidence, and the negative and/ or positive views about one's self. On the other hand, life satisfaction is the perceived happiness an individual has from a global viewpoint of life. Various studies show that the satisfaction of students with life is dependent on multiple variables (Paula & Campbell, 2002).

According to past studies, a positive connection has been identified between self-esteem and life satisfaction. Some researchers such as Diener and Diener (1995) suggest that comprehensive self-esteem may be a subgroup of life satisfaction. This study showed that young adults who were considered to possess great, average, and short lifespan satisfaction experienced equivalent stages of self-esteem. Therefore, self-esteem and life satisfaction are related based on various studies. For instance, a survey conducted by Kong and You (2013) among the late adolescents showed that self-esteem provided a link between social sustenance and life satisfaction. However, there exist few studies that focus on the relationship between life satisfaction and self-esteem for emerging adults. Therefore, the results of the present study will provide more information on the issue.

Many findings denote that females are more satisfied with life in comparison to their male counterparts (Chui & Wong, 2016; Kong, Wang & Zhao, 2014). Furthermore, studies show that men view themselves as independent, achievement and goal oriented and competitive in comparison to women (Lima, 2011). Women, on the other hand, have a higher likelihood to define themselves as outgoing, dependent and less confident (Lima, 2011). These differences in the description show that people males and females do not gain life satisfaction from the same sources. Many studies conducted to measure the life satisfaction of men and women show that women obtain high intensities of contentment than males (Vohs, Baumeister, & Ciarocco, 2005). However, Lebanese men obtained a significantly higher mean score on happiness and mental health than their female counterparts (Abdel-Khalek, 2015). The conflicting findings in the studies make it difficult to come up with conclusions associated with the topic.

Cultural factors have a strong influence on the self-esteem of an individual in their experience. Sri Lanka is a part of South Asia and shares the same cultural beliefs and practices with only a few minimal differences. In the recent past, there have been numerous studies on self-esteem of undergraduates from the region (Tkach & Lyubomirsky, 2006). The reviews have explored the affiliation between the expressive intelligence and the levels of anxiety (Rogers et al., 2012). However, the studies that focus on the association between self-esteem and life satisfaction among the students are scarce. Sri Lanka is a rapidly developing country in the South Asian region, and its population can be estimated to be about 21 million (Tkach & Lyubomirsky, 2006). The state has various colleges and universities with a considerable number of students. Compared to other countries in the region, Sri Lanka has a higher level of literacy and number of students enrolling for undergraduate programs (D'Souza & Moore, 2017). Therefore, higher education institutions such as these are an essential setting for promoting health among young adults in the country.

Therefore, the present study aims at determining the relationship between self-esteem and life satisfaction and whether the association differs between male and female students. The research will contribute to the body of knowledge that is in existence on the topic.

Methodology

The study followed a quantitative survey design where the researcher collected numerical data using the Rosenberg Self Esteem Scale (1965) and Satisfaction With Life Scale (1985) to test the correlation between self esteem and life satisfaction. The following hypotheses were tested in the study:

- Hypothesis 1: There is a strong positive correlation between self esteem and life satisfaction among undergraduates at ICBT.
- Hypothesis 2: Female undergraduates have a higher level of self esteem and are more satisfied with life.

The sample of 100 participants (sex ratio 1:1) was recruited from ICBT. The course followed by the participants and the year of study were not considered. Data was collected during the course of 3 days. Participants were gathered to the study areas of ICBT where they were given the envelopes containing the two questionnaires after they have had read the information sheet and signed the consent form. Since the total items in both questionnaires were only 15, the participants were able to complete the items under 15 minutes and handover personally to the researcher at the same time. Completed questionnaires were stored in a locked cupboard and were accessible only to the researcher. Participants were given 5 days to withdraw data after which the questionnaires were taken out to commence analysis.

Results and Discussion

Results suggested a significant positive correlation between self-esteem and life satisfaction among undergraduate students at ICBT ($r = 0.589$, $p < 0.01$). The significant positive correlation could be explained through many studies which indicate that the young adults often report relishing their lives and being positive about the future (Kernis, & Paradise, 2002). Moreover, self-esteem and life satisfaction are positively related as it is associated with the emotional function and happiness (Lyubomirsky et al.2006; Moreno et al.2009). Therefore, based on the data analysis, undergraduates at ICBT can be regarded as maintaining a substantial level of self esteem and thus, are generally satisfied with life at the current point in life. Unlike state universities where students of different financial backgrounds attend, majority of the students attending private universities such as ICBT are financially supported by their parents or are in a position to concentrate solely on their studies. This in turn gives these students the required time and support to achieve their goals which eventually leads to a higher self esteem.

Furthermore, female students possess a higher level of self-esteem (t-test value = 2.248, $p < 0.05$) and are more satisfied with life (t test value = 3. 647, $p < 0.01$) as compared to their male counterparts. This outcome too complies with previous findings which also denoted that females are more satisfied with life in comparison to their male counterparts (Chui & Wong, 2016; Kong, Wang & Zhao, 2014). Many studies found that women obtain high intensities of contentment than males (Vohs, Baumeister, & Ciarocco, 2005). This result can be explained with a number of reasons in the Sri Lankan context. Firstly, it could be suggested that females in the target age group have already achieved their goals or are in the process of achieving them; secondly, majority of the females tend to have the ability to control themselves in their

field of action and further follow the rules that were put in place in order to achieve the set goals; and thirdly, compared to other Asian countries, Sri Lanka strives to maintain gender equality in all aspects of life, and females are given equal opportunity to engage in education and realize their goals on par with their male counterparts (Herath, 2015). This unique element can be a contributing factor to the pre-existing tendency for females to be more satisfied with life.

Conclusions and Recommendations

The research findings demonstrated a strong positive relationship between self-esteem and life satisfaction among undergraduate students at ICBT. Furthermore, results indicated that female undergraduates have a higher level of self esteem and thus, are more satisfied with life.

However, it is recommended that extensive future research on the two variables is a necessity in Sri Lanka. The target group should be expanded to represent students of all types of higher education institutions in Sri Lanka such as state and private universities, technical colleges, vocational training institutes etc. Furthermore, factors which affect an individual's sense of worth and life satisfaction such as financial stability and employment, marital status, course of study, social relationships should also be incorporated into future studies. Finally, continuous research with due recognition given to these recommendations is essential in order to maintain a comprehensive picture of the well-being of the society.

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THE EFFECT OF EMOTIONAL INTELLIGENCE ON MARITAL SATISFCTION IN MALDIVIANS

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Abstract

Objectives: This study examined (i) the relationship between emotional intelligence and marital satisfaction, (ii) the association between overall marital satisfaction and the subscales of emotional intelligence, (iii) the gender differences in the two studied variables and their respective subscales. **Method:** In this quantitative study, with a correlational comparative research design, 75 males and 75 females aged between 20-40 years, with a minimum marital duration of 2 years were selected. **Results:** A significant relationship between emotional intelligence and marital satisfaction was found ($r=.427$, $p < .001$). Overall marital satisfaction was significantly correlated with all subscales of emotional intelligence. Women scored higher in overall emotional intelligence ($t=3.097$, $p = .002$), and in its 3 subscales. No significant gender difference was found for overall marital satisfaction ($t = .557$, $p = .578$, ns), however, women also scored higher in its subscales.

Key words: Emotional Intelligence, Gender, Maldives, Marital Satisfaction

The universality of marriage extends to various societies and eras, in varied forms. Marital satisfaction is understood to be rooted in a cognitive basis, in which a subjective experience is brought about from the disparity between the outcome desired by the partners for the relationship and the perception of reality (Esmaili, Mohammadi, & Hakami, 2016). Examining the optimal conditions under which this is most likely to be achieved is crucial. The United Nations reported that in 2002, Maldives held the highest divorce rate in the world with 10.97 divorces per 1,000 inhabitants per year and made it into the Guinness World Records. Furthermore, extremely limited research is conducted on the fundamental issues that leads to divorce and insufficient efforts are put in to strengthening marital quality. In order to study how marital satisfaction can be attained, one must retreat to the most basic element of human behaviour, i.e. emotions. In 1990, Salovey and Mayer conceived the term “emotional intelligence”. Later, the ability model of emotional intelligence was developed, which entails the capacity to perceive, manage, facilitate and understand emotions in order to facilitate thought processes (Mayer & Salovey, 1997).

The current study hypothesized the presence of 1) a significant, positive relationship between emotional intelligence and marital satisfaction, 2) significant, positive correlations between overall marital satisfaction and the subscales of emotional intelligence, which are perception, utilization, management of self-related and other’s emotions, 3) significant gender differences in overall emotional intelligence and its (said) subscales, and 4) significant gender differences in overall marital satisfaction and its subscales, marital satisfaction and idealistic distortion.

Methodology

As a quantitative study, a correlational design and a comparative design was adopted. Purposive sampling technique was used to select a sample of 75 men and 75 women of Maldivian nationality, aged between 20-40 years, with a minimum marital duration of two years.

Apart from a demographic questionnaire, Schutte Emotional Intelligence Scale (SEIS) (Schutte et al., 1998), was used to measure emotional intelligence. This scale is based on the model of emotional intelligence developed by Salovey and Mayer in 1990 and consists of 33 items, divided into four subscales. ENRICH (evaluation and nurturing relationship issued, communication and happiness) Marital Satisfaction Scale (EMS) (Fowers & Olson, 1993) was used to measure marital satisfaction which contains 15 items divided into two subscales.

Procedure

An advert along with a URL of a Google Form was posted on social media platforms, namely Facebook and Twitter introducing the purpose of the study. The URL directed them to an information sheet which contained background and objectives of the study, eligibility requirements, participant rights and other crucial information. Followingly, a consent form was presented where an informed decision to partake in the study was required for the participant to proceed to the questionnaires.

Results and Discussion

- 1) The findings of the Pearson product-moment correlation coefficient (two-tailed) test indicated that the relationship between emotional intelligence and marital satisfaction was positive and significant, ($r(148) = .427, p < .001$).

This finding was in line with a large body of research findings (Batool, & Khalid, 2012; Eze, 2018; Lavalekar et al., 2010).

- 2) The four subscales of emotional intelligence (perception, utilization, and management of own and others emotions) were significantly and positively correlated with overall marital satisfaction.

Table 1

Pearson Product Moment Correlation Coefficient to Investigate the Correlations Between Overall Marital Satisfaction and the Four Subscales of Emotional Intelligence

		ENRICH marital scale	Perception of emotions	Managing own emotions	Managing others emotions	Utilization of emotions
	Pearson Correlation	1	.278**	.487**	.338**	.373**
ENRICH marital scale	Sig (2-tailed)		.001	.000	.000	.000
	N	150	150	150	150	150

Note. N= Sample size. ** $p < .01$.

Numerous studies from previous literature replicated this finding (Batool, & Khalid, 2012; Lavalekar et al., 2010; Mary MJ, & Adhikari, 2012).

- 3) Independent t-tests found that women scored significantly higher in overall emotional intelligence.

Table ٧

Results of t-test and Descriptive Statistics for Gender Differences in Overall Emotional Intelligence

	Sex						95% CI of difference		t	df	p-value
	Female			Male			Lower	Upper			
	M	SD	N	M	SD	N					
Emotional intelligence	127.69	16.58	75	118.81	18.48	75	3.21	14.54	3.09	148	.002**

Note. M= Mean. SD= Standard deviation. N=Sample size. CI= Confidence interval. t= t value. df= degrees of freedom. p-value= sig (2-tailed) value. Equal variances assumed. **p < .05.

This finding was largely demonstrated in previous literature (Ilyas & Habib, 2014; Naghavi, & Redzuan, 2011; Soleymani, & Akram, 2009). The gender disparity in emotional intelligence can be further understood through three fundamental factors, genetics, neuroscience and socialization.

Table ٨

Results of t-test and Descriptive Statistics for Gender Differences in Subscales of Emotional Intelligence

	Sex						95% CI of difference		t	Df	p-value
	Female			Male			Lower	Upper			
	M	SD	N	M	SD	N					
Perception of emotions	36.45	5.68	75	32.67	6.93	75	1.74	5.83	3.65	142.49	.000**
Managing own emotions	35.40	5.92	75	34.32	5.69	75	-.79	2.95	1.13	148	.257
Managing other's emotions	32.00	4.35	75	29.55	4.93	75	.95	3.95	3.23	148	.002**
Utilization of emotions	23.84	3.74	75	22.28	3.75	75	.35	2.77	2.54	148	.012**

Note. M= Mean. SD= Standard deviation. N=Sample size. CI= Confidence interval. t= t value. df= degrees of freedom. p-value= sig (2-tailed) value. Equal variances were assumed for all variables except perception of emotions. **p < .05.

Moreover, women also scored higher in three of the four subscales of emotional intelligence (perception, utilization and management of others emotions). No gender differences were found for the subscale of managing own emotions. Some previous studies demonstrate gender differences in all four scales of emotional intelligence, for instance, a study by Cabello and colleagues (2016). However, their methodology vastly differed from that of the

current study, which could explain the disparity between both results. For instance, they had a sample of 12,198 Spanish individuals, aged between 17 to 76 years old. The culture specificity significantly reduces generalizability due to the absence of cross-cultural validity.

- 4) An independent samples T test revealed that there was no significant gender difference in overall marital satisfaction.

Table 4

Results of t-test and Descriptive Statistics for Gender Differences in Overall Marital Satisfaction

	Sex						95% CI of difference			df	p-value
	Female			Male			Lower	Upper	T		
	M	SD	N	M	SD	N					
ENRICH Marital Scale	48.70	11.70	75	47.66	11.21	75	-2.65	4.74	.55	148	.578

Note. M= Mean. SD= Standard deviation. N=Sample size. CI= Confidence interval. t= t value. df= degrees of freedom. p-value= sig (2-tailed) value. Equal variances assumed. **p < .05.

However, a previous study by Fowers (1991) suggest that there is a significant gender difference in overall marital satisfaction, with men scoring higher. This discrepancy could be explained by the significantly large sample size, as relatively minor differences can generate statistically significant results in larger sample sizes (Fowers, 1991).

In the current study, T tests also demonstrated that women reported higher scores than men in both of the subscales of marital satisfaction (marital satisfaction and idealistic distortion).

Table 5

Results of t-test and Descriptive Statistics for Gender Differences in Subscales of Marital Satisfaction

	Sex						95% CI of difference		T	df	p-value
	Female			Male			Lower	Upper			
	M	SD	N	M	SD	N					
Marital Satisfaction	37.48	7.29	75	35.13	6.70	75	.08	4.60	2.05	148	.042**
Idealistic Distortion	19.04	4.08	75	16.63	4.38	75	1.04	3.78	3.48	148	.001**

Note. M= Mean. SD= Standard deviation. N=Sample size. CI= Confidence interval. t= t value. df= degrees of freedom. p-value= sig (2-tailed) value. Equal variances were assumed for all variables.

**p < .05.

However, this finding is opposed by previous literature (Rostami, Ghazinour, Nygren & Richter, 2014; Fowers, 1991). Originally, the notion that men derive greater benefits from marriage than women arose from the gender role hypothesis in the 1970's (Gove, 1972). In current Maldivian households, employment of both genders, increasing balance of gender roles and equal educational opportunities could contribute to the empowerment of women, increasing their marital satisfaction.

Women scored significantly higher in the idealistic distortion scale, which may indicate that Maldivian women have a higher tendency to have distorted appraisals of their marriage in the direction of socially desirability. An ideal husband and a successful marriage are widely believed as socially desirable concepts in collectivist cultures. Research also shows that masculinity is negatively correlated with social desirability (Sutton & Farrall, 2005). This could contribute to the high idealistic distortion scores.

Conclusion

Successful marriages are indeed the bedrock of functional societies. According to the Statistical Yearbook of Maldives (2018), the number of divorces amount to more than half of the number of marriages recorded, consecutively for the past seven years. Awareness about emotional intelligence and its role in marital satisfaction could be spread by developing pre-marriage education and counselling sessions specially focused on its concept and application. Moreover, the inclusion of emotional intelligence into the education system is recommended so that children from a young age is familiarized with it.

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**COMPARISON OF PREVALENCE RATES OF DEPRESSION, ANXIETY AND
STRESS AMONG MALES OF SEXUAL MINORITIES AND HETEROSEXUAL
MALES IN SRI LANKA**

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Abstract

Depression, anxiety and stress have been extensively studied in Sri Lanka across varying populations. Sexual minorities are vulnerable to such conditions due to the discrimination and stigma they face. However, mental health conditions of sexual minorities and the disparities of prevalence between sexual minority and heterosexual individuals have seldom been studied.

The present study investigated the prevalence of depression, anxiety and stress symptoms among heterosexual males and sexual minority males, and how these rates compared between the two groups. Additionally, the study aimed to investigate the perceived determinants of mental health by heterosexual and sexual minority males.

The Depression Anxiety and Stress Scale- 21, Patient Health Questionnaire and Perceived Stress Scale were employed to assess the prevalence rates of depression, anxiety and stress among 197 heterosexual males and 191 sexual minority males. Semi-structured interviews gathered qualitative data from each target group regarding the perceived determinants of mental health.

The results indicated that sexual minority males had significantly higher prevalence rates of depression, anxiety and stress symptoms compared to heterosexual males. Further, the differences in perceived determinants of mental health showed that harassment and lack of social acceptance were prominent themes for sexual minority males.

Keywords

Anxiety, Depression, Stress, Sexual minorities

Introduction

Millions of people around the world are affected by mental health problems. It is estimated that 151 million people suffer from depression, 26 million from schizophrenia and 125 million from alcohol use disorders, while 844 thousand lives are lost due to suicide (WHO, 2010). Such a high prevalence of mental health problems has caused a significant burden not only on the individual but society as well (Pratt & Brody, 2008).

Sexual minorities have been found to be a vulnerable population to develop depression and anxiety and suffer from stress, and are more likely than heterosexuals to experience major depression and anxiety disorders (Gilman, Cochran, Mays, Highes, Ostrow& Kessler, 2001; Cochran, Sullivan & Mays, 2003). Sexual minorities refers to individuals who have any sexual experiences that are not exclusively heterosexual, including fantasy, attraction, behaviour and/or a sexual identity that is not heterosexual (Blakemore, Berenbaum&Liben, 2009). Sexual minorities encompass homosexual (i.e. Lesbian women and Gay men), Bisexual and Transgender (LGBT) individuals.

Prevention and intervention of mental health issues and resulting dysfunction requires accurate identification and understanding of such problems. The extent to which mental health disorders are prevalent in sexual minority populations and their correlates have been documented in many countries (White, Barnaby, Swaby&Sandfort, 2010), yet such information is not available in the Sri Lankan context. This dearth of information can have negative implications on mental health professionals' knowledge and understanding of problems faced by these groups, the manner in which intervention takes place, and the importance given in training of mental health professionals regarding sexual minority issues.

This research will be invaluable in bridging that gap, and initiating a more tailored, culturally congruent approach to mental health services offered to these groups. The focus on males of sexual minority groups was selected for this study because it has been found that males are at higher risk of discrimination (Sirin et al., 2004; Gross et al., 1988), and psychopathology than their female counterparts (Mayer et al., 2008).

Objective of the study

The main objective of this study is to determine and compare prevalence of depression, anxiety and stress; and identify perceived determinants of mental health among sexual minorities and heterosexual males in the Sri Lanka. The study focuses on the following research questions:

- 1) What are the prevalence rates of depression, anxiety and stress symptoms among sexual minority males in Sri Lanka?
- 2) What are the prevalence rates of depression, anxiety and stress symptoms among heterosexual males in Sri Lanka?
- 3) How do the prevalence rates of the target groups compare?
- 4) What are the determinants of mental health as perceived by sexual minority and heterosexual males?

Methodology

Study design

A cross-sectional comparative study was carried out among heterosexual males and sexual minority males, above eighteen years of age living in Sri Lanka. This study used mixed methods, where a survey was used to gather quantitative data and semi-structured interviews were used to gather qualitative data.

Study population

The study population was males over the age of eighteen years, living in Sri Lanka, and who were of heterosexual and sexual minority orientations. The participants were also required to have the ability to read and write in Sinhala or English as the scales used in the study were validated in these languages only.

Furthermore, participants who identified themselves as transgender or transsexual persons were excluded from this study as literature indicates that sexual orientation and gender identity needs to be studied separately and more extensively, as challenges faced by different

groups may vary and combining these groups may lead to misinterpretation of results (Institute of Medicine, 2011).

Sampling method

A snowball sampling method, which is a type of purposive sampling method, was used to obtain a sample of heterosexual and sexual minority males. Snowball sampling is especially useful when trying to reach populations that are inaccessible or difficult to find or approach (Trochim, 2000).

Study Instruments

A general demographic background questionnaire developed by the Primary Investigator (PI), and the English and Sinhala versions of the DASS 21, PHQ and PSS were employed to gather data to achieve the objectives of the present study. All instruments were self-administered. Furthermore, a semi-structured interview schedule was used to gather qualitative data.

Data collection

Quantitative component

Data collection was carried out from July to October of 2015. The AIDS advocacy unit of the FPA (Family Planning Association) and two representatives from two partner organizations assisted in the data collection process. Additionally, an online questionnaire was designed using Google-Forms and circulated. The web link to the online questionnaire was given to the FPA and its partner organizations as well as these NGOs to be circulated among their contacts. Furthermore, the questionnaire was circulated through members of the general public using the snowball method.

Qualitative component

Semi-structured interviews were conducted with three heterosexual male participants and three sexual minority participants. The participants were randomly selected (every third name) from the list of participants who initially agreed to participate in the focus group.

The interview focused on gathering data from the answers to the following questions:

- 1) How would you describe your current state of mental wellbeing?
- 2) What do you think are the reasons for this state of wellbeing?
- 3) What are the main experiences, issues and concerns you face?
- 4) What do you feel has a positive impact on your mental health?
- 5) What do you feel has a negative impact on your mental health?

The PI met with the participants individually and conducted the interviews for approximately an hour each. The interviews were conducted at the location that holds a youth empowerment group, run by a NGO.

Data Analysis

Quantitative analysis

The data was first entered into the SPSS 20 (Statistical Package for the Social Sciences) data sheet. Initially, descriptive statistical analysis was carried out to describe the demographic characteristics of the sample, and the prevalence rates and levels of depression, anxiety and stress among the sample. Inferential statistical analysis included bivariate analysis to determine the significance of the differences of prevalence rates of depression, anxiety and stress symptoms between heterosexual males and sexual minority males.

Qualitative analysis

Principles of thematic analysis were used to analyze the data collected through the semi-structured interviews. The data was read, coded and given labels. Next, themes and sub-themes were identified, and later elaborated in context of the data and literature.

Results

Presence of depression, anxiety and stress symptoms of heterosexual males and sexual minority males according to DASS 21

A chi-squared test for association was conducted to establish if the difference in rates of depression, anxiety and stress among the two groups were significant.

Table 1.1

Differences in prevalence of depression, anxiety and stress of heterosexual males and sexual minority males

		Heterosexual males		Sexual minority males		Total		Significance
		n	%	n	%	N	%	
Depression	Present	73	37.1	94	49.2	167	43.0	$\chi^2=5.363$, df=1, p=0.021
	Absent	124	62.9	97	50.8	221	57.0	
	Total	197	100.0	191	100.0	388	100.0	
Anxiety	Present	83	42.1	102	53.4	185	47.7	$\chi^2= 4.497$, df=1, p= 0.034
	Absent	114	57.9	89	46.6	203	52.3	
	Total	197	100.0	191	100.0	388	100.0	
Stress	Present	54	27.4	88	46.1	142	36.6	$\chi^2= 13.762$, df= 1, p<0.00
	Absent	143	72.6	103	53.9	246	63.4	
	Total	197	100.0	191	100.0	388	100.0	

As presented in Table 1.1, 37.1% (n=73) of heterosexual males and 49.2% (n=94) of sexual minority males reported presence of depression symptoms. The difference in the prevalence of depression symptoms between the two groups was significant ($\chi^2= 5.363$, df=1, p=0.021). Therefore, sexual minority males were more likely to report a presence of depression

symptoms. As presented in Table 1.1, 42.1% (n=83) of heterosexual males and 53.4% (n=102) of sexual minority males reported presence of anxiety symptoms. The difference in the prevalence of anxiety symptoms between the two groups was significant ($\chi^2= 4.497$, $df=1$, $p= 0.034$). Therefore, sexual minority males were more likely to report a presence of anxiety symptoms. As presented in Table 1.1, 27.4% (n=54) of heterosexual males and 46.1% (n=88) of sexual minority males reported presence of stress symptoms. The difference in the prevalence of stress symptoms between the two groups was significant ($\chi^2= 13.762$, $df=1$, $p<0.00$). Therefore sexual minority males were more likely to report a presence of stress symptoms than their heterosexual counterparts.

Perceived determinants of mental health for heterosexual males and sexual minority males

Perceived determinants for heterosexual males

The participants resided in Colombo, were between the ages of 25-35 years and employed. While all three participants were Sinhalese, two participants were Buddhist and the other was Christian.

Table 1.2

Themes and frequencies of perceived determinants for heterosexual males

Themes	Subthemes
Struggles with identity	Managing social roles
	Finding meaningful work
Poor management of family affairs	Spending quality time family
	Taking care of parents
Struggles to find work-life balance	Finding time for healthy, leisure activities
	Giving back to the community

As shown in Table 1.2 there were three main themes that were drawn from the data from the participants. The three themes, struggles with identity, poor management of family affairs and struggles to find work-life balance were the main determinants of mental health elicited from the three heterosexual participants.

Perceived determinants for sexual minority males

The participants were homosexual, resided in Colombo and were between the ages of 25-35 years. All three participants were Sinhala and Buddhist. While two participants were employed, the third was an undergraduate student. Table 1.3 presents the themes, subthemes and their frequency drawn from the data gathered from the sexual minority participants.

Table 1.3

Themes and frequencies of perceived determinants for sexual minority males

Themes	Subthemes
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Struggles with identity	Self-acceptance Social acceptance
Lack of supportive relationships	Support from family Partner and intimate relationships
Facing discrimination and violence	Fear of harassment Discrimination in social settings

As shown in Table 1.3 there were three main themes that were drawn from the data from the participants. The three themes, struggles with identity, lack of supportive relationships and facing discrimination and violence were the main determinants of mental health elicited from the three sexual minority participants.

The qualitative analysis of data showed that there were similarities in perceived determinants of mental health between the two groups such as difficulties with identity and relationships, but there were differences in the context of how these factors influenced the two groups such as heterosexual males were concerned about spending time with their family and sexual minority males were concerned about acceptance by their families.

Discussion

The prevalence rate of depression, anxiety and stress symptoms among heterosexual males was comparatively higher than those reported by many studies conducted in Sri Lanka and globally (Ball et al., 2010; Senarath, Wickramage & Peiris, 2014; Saha et al., 2005; Hunt, Issakidis & Andrews, 2002; IRD, 2009), however, similar to a few other studies in Asia (Amin, Shah & Vankar, 1998; Gadit & Mugford, 2007; Kasi et al., 2012; Khan et al., 2007).

The prevalence of depression, anxiety and stress symptoms in sexual minorities were high, similar to prevalence rates of depression that were found in studies conducted in Jamaica and America (Rhodes et al., 2013; White et al., 2010).

The higher prevalence rate of anxiety among sexual minority males in the sample could be due to the illegal status of same-sex sexual activity in the country, discrimination and poor social support.

The high stress levels and prevalence of stress symptoms among sexual minority males compared to heterosexual males, seen in the present study may be due to sexual minorities still facing severe discrimination and stigma in Sri Lanka, and this could be a considerable stressor even on a daily basis for some of these individuals (Chandimal, 2014; Brown, 2011). Similar to this notion Meyer (2003) in a meta-analysis found that sexual minorities that live in environments that are high in prejudice and discrimination, were more likely to experience distress and show symptoms of psychiatric morbidity, while those in more accepting and integrating environments showed improved wellbeing and life satisfaction. Further, sexual minority individuals may experience feelings of conflict brought on by internalized homophobia. A study found that sexual minority individuals who felt inner conflict and were unable to express themselves wholly, experienced high levels of stress and depression symptoms (Herek et al., 1997).

There are many implications of the results found in the present study. Depression, anxiety and stress rates, and levels were considerably high for both heterosexual and sexual minority males. Mental health services other than psychiatric intervention are scarce and may not be adequate to manage these issues especially in the government sector (Samarasekare, Davies & Siribaddana, 2011; Weerasundera, 2010). Sexual minorities require such mental health services, as the present study found that they have higher prevalence rates of depression, anxiety and stress. Therefore, it is recommended that clinical psychologists, counselors and psychiatric social workers be made aware of the need of mental health services in groups such as sexual minorities, to provide them with effective services.

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A STUDY ON STRESS AND COPING STRATEGIES OF WOMEN IN LEADERSHIP POSITIONS IN THE CORPORATE SECTOR

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Abstract

Background: Stressors were part of women who were in leadership positions in corporate sector. There were no such studies conducted in Sri Lanka.

Aims: The aim was to research qualitatively to assess the sources of stress, types of stress and coping mechanisms employed among working women in the corporate sector

Methodology: Seven women from corporate sector were used to conduct a qualitative method through interviews with semi-structured open-ended questions and experience sharing was used. The data was analysed using thematic analysis.

Results: Participants gave insight in to the stressors such as work overload, work-life balance, interpersonal strain and physical environment. The coping strategies included social support, family and teams, self-care; mainly physical activities and recreation by socializing with friends.

Conclusion: Seven women who participated enjoyed the job although there are stressors. The study concluded that the mind-set of participants influenced stressors and coping strategies. Stressors are interconnected and coping strategies have supported women to deal with stressors.

Keywords

Coping Strategies, Friends, Stress, Team Support, Work-Life Balance

Introduction

Purpose

The purpose of this study was to examine the experience created by stress in the workplace, and coping strategies of women in leadership positions in the corporate sector in Sri Lanka. Second hand research revealed that there were no comprehensive studies conducted in Sri Lanka on stress and coping strategies of the women in leadership positions in the corporate sector. There are only few women who are in leadership positions in Sri Lanka especially in the corporate sector; although the workforce of women is high, when it comes to management level there are less numbers of women holding positions of leadership. This intrigued the interest in conducting this study to find out how women in leadership positions face stress and to find out their coping strategies while expanding the knowledge on stressors and coping strategies.

The aim of this research was to qualitatively assess the sources of stress, types of stress and coping mechanisms employed among working women in the corporate sector. The findings of this study will be a stepping stone to help women to learn coping mechanisms and will

support women to take this study for their future challenges, and to take the results to help their life and career.

Specific Objective

Identifying stressors and coping strategies of women in leadership positions.

General Objectives

To find out the types of stressors and the different types of coping strategies.

This study was limited to women located to Western Province who are in leadership positions in the corporate sector.

Women in Sri Lanka are 57% of the total population of the country. Out of that only 33.4% are economically active. There are no statistics of women in management but it is estimated that the figure would be below 10% of the total labour force (Women in Leadership Roles, 2018).

In the Sri Lankan culture it is most likely that women would be responsible for most of the household activities and looking after the family. In present the education level of women are higher, and women prefer working while looking after the family due to various reasons. As working women balance their family life, it sometimes creates conflict between family and work when it comes to prioritizing commitments and is seen as one of the factors that causes stress. Therefore women go through stress most of the time; nevertheless they have their own way to cope up with stress. While women are highly exposed to stress, women in leadership positions experience extra stress.

Methodology

Sample techniques

Random sampling method was used to recruit the participants. The participants were recruited by publishing an advertisement through social media for two weeks.

Research Sample / Participants

Seven women who are in a leadership position in corporate sector were recruited for the research and interviewed. Main criteria for selection was being a female, age range of 25 to 50 years, managing a team and in a leadership position, and living with a family.

Procedure

Each potential participant was contacted via telephone after their response to the advertisement and explained about the research and interview process. Thereafter email was sent with all details including the information sheet and the consent form. After confirming, their participation, interviews were scheduled according to their availability and preference. At the interview, participants were given another description of the research study and were given the information sheet and consent form, and participants were asked to sign as written

consent for participating in the study. Participants were able to ask questions prior to starting the interview. Study and the interviews were conducted by the researcher, and participants' details were confidential.

The interviews were audiotaped and to document the context of the interviews. The interviews followed a semi-structured guide that included demographic questions and questions that addressed personal stressors and coping strategies. And later they were asked to share their experience. Interviews were audio recorded and later transcribed by the researcher.

Method of Analysis

Data analysis was done within-case coding, identifying clusters of meaning across cases, and then thematic analysis. During the first step, transcripts were listened to and transcribed and each transcript was coded to identify key quotes and phrases. Thereafter, data identified the clusters of meaning with the other cases. At the final stage irrelevant data was removed, identifying overlapping categories, and finally identifying the emergent themes from the interviews.

Results

The women who worked for corporate sector had 3 to 24 years of service period in different companies and industries and all seven participants had more than 2 years of experience in the current leadership position. All seven participants had previous work experience and had worked in different companies and sectors and some had experience working in global level and working outside the country as well. All participants were educated and age range was 25 years to 48 years of age.

Nine research questions were asked. Common themes were picked with sub themes for each main theme under three categories. Categories are stressors, coping strategies and general. Perseverance stressors were also taken as findings.

Results are described using the common themes and subthemes which were identified in the interviews. One common factor which was identified was all seven participants who were interviewed enjoyed the job and job was of their choice, and they did not consider the work place as a stress. While saying that they enjoy what they were doing all said that work load is high and have quite a lot of responsibilities. All seven women said the field was their passion and loved what they do. All seven sample participants loved their job.

Three out of seven women said that being a woman has never affected them, but all said there are more responsibilities as a woman.

Identified themes are:

Category - Stressors

Theme 1 - Workload/ Role overload

All sample women participants described their workload (also defined as role overload) is high and they have a quiet a wider range of responsibilities to cover in her position.

Subthemes which were identified regarding workload were lack of time to complete the duties or the work within the working hours and the number of responsibilities or duties they have in their current leadership position. Completing all responsibilities simultaneously was difficult at times. Many worked for a nine hourly basis but with the workload and deadlines had long hours of working and taking work home in order to complete it.

Theme 2 - Work-Life Balance

The other common theme which was identified was work-life balance. All participants had the challenge of balancing their work with their personal life. Most of them said it was difficult to balance both and sometimes you tend to work more and give priority to work. Some also mentioned that they felt guilty for prioritizing work and sometimes forget about family commitments. Some sample participants also mentioned that they sometimes felt that they should leave the job in order to look after the children.

Subthemes which were identified from work-life balance were lack of family time. Most participants felt that they did not have much time to spend with the family or the husband and the other subtheme which came up from the main theme was taking work home. Most of the participants said due to the heavy workload and lack of time they take work home to complete. Some participants mentioned that they take out the stress on their husband or family members.

Theme 3 - Interpersonal Strain

The third common identified stressor was to do with occupational and personal strains. Interpersonal strain was associated with personal stress. This was identified as frequent quarrels or excessive dependency on family members, spouse and friends. When analyzing the stressors most participants mentioned that interpersonal relationship are a challenge and it makes them stressed at times.

Subthemes which were identified were that managing teams and having to keep family commitments were also part of their stressors. Most participants said having to manage a young team and to get their focus and concentration for work is a challenge. Some participants said sometimes it is easy to work alone without delegating as they tend to think about their team members concerns and having to check whether the work is completed.

Theme 4 - Physical Environment

Another stress factor which was identified commonly was that most of the participant did not have a fulltime desk job. Although they were to work nine hours at the office most of them mentioned that they had field visits, factory visits and audits outside of the workplace. Most participants mentioned though they enjoy their job sometimes having to move around is also a challenge.

While analyzing themes another subtheme was identified are field work, travelling and the place of work was challenged.

Category – Coping Strategies

The majority of participants indicated that they have adapted to work and coping up with work and managing and most of them mentioned that they do not know how they do it. Some participants have adopted problem-focused coping strategies while some have adopted emotion-focused coping strategies in dealing with stressors.

Key Coping strategies were identified under main three themes and sub themes.

Theme 1 - Social Support

All of the women interviewed reported that they have a support and help from those around them. Their answers best reflects t the positive support they received from others. Interviewees reported that there are people around them to relieve stress, who values them and who is there to talk and compare their stressors and make them happy. Most participants mentioned that creating a friendly environment at office and creating a support system by developing teams are a coping strategy.

Sub themes which were identified with regard to coping strategy are having a positive support from family, spouse and friends and and having good office teams. Most participants mentioned delegating work to the team and getting their support is one of the major factors which help them cope. Creating a friendly supportive team who understand them and are there to support was a relief. All participants mentioned that having a spouse and a family who understands them and listens to them helps them to calm them.

Theme 2 - Self-Care

Most of the participants who were interviewed said that they use self-care as a coping strategy, participants reported that they exercise, walk and workout to cope up with stress. Participant used sleeping as a relaxation method. Most participants mentioned that they do not talk about their stressors with others but they take care of themselves by getting in to various things. Few participants said they do self-talking and try to rationalize things and come up with solutions.

The subthemes which were identified with this regard were reflective practices and exercises and walking. Most of the sample participants mentioned that exercising, running and walking has helped them to relax and to have a control over the stressors.

Theme 3 - Preparation

The next common coping strategy factor which was identified was preparation. Most of the participants mentioned that getting prepared and organizing work have supported them for coping.

Subtheme which arose with regards to preparation is organizing work and delegation. Most of the participants mentioned that if you are organized your stress levels will reduce and it

supported them deal with the stressors.

Theme 4 - Recreation

It appeared that most participants who were interviewed reported that they often used recreation as a coping strategy. Sample participants reported taking recreational or leisure time or engage with activities such as playing and spending time with kids, reading as coping strategies to deal with the stressors.

Subthemes which commonly mentioned with regards to this is socializing with friends and family and going on trips or taking tours. Most of the participants reported that socializing with friends and talking to friends have supported them to deal with stress. While one participant mentioned that comparing with friends helps her to reduce her stress

Category – General

Theme 1 - Being a Woman

Some of the participants said that being a woman has supported them to get support from others whereas some of the participants said it was difficult being a woman because there are different stressors. Three participants said that being a woman has not disturbed them ever.

Subthemes which arose with regard to this was taking care of family, social expectations, working as women's responsibilities.

Theme 2 – Leadership Style

A common factor which was identified was their leadership style; it was more towards democratic style. Almost all sample participants had a close relationship with the employees and their team, sample participants tried to understand their team and manage them without demanding work. Most of the participant mentioned that each person is different therefore they need to understand that and keep the relationships in order to get the maximum potential out from the team.

Subthemes which were raised with regards to this was building a good team and having a relationship oriented leadership style without being authoritative.

In summary, it appeared to be that all stressors and coping strategies have an inter-relationship and are interconnected.

Most sample participants confirmed that there is a significant relationship with the stressors and coping strategies with the age, marital status, family, length of service and number of children. However, almost all the participants said that they have not faced any stressors with the race and religion therefore it did not matter to the participants who were interviewed. Therefore sample participants mentioned that there is relationship with the coping strategy as well.

One of the participants mentioned that being a woman that it is hard to keep boundaries with

men as men do not take women serious in her industry.

For the question which was raised about the similarities of the stressors of other sectors such as government, academics, education and non-government organizations most of them mentioned that there is a difference related to work stressors but as women personal stressors can be same or different. Most of them said they do not know as they haven't worked in other sectors.

However for the other question which was related to coping strategies of other sectors almost all of the participants said it differs from person to person and that some coping strategies can be the same, although they mentioned that they do not know as they have not worked with other sectors.

Women who participated for the research said that there can be financial stressors, transfer stressors and supervisors – management politic stressors. These stressors were the stress factors which participants have perceived.

Discussion

Most of the participants agreed that there is a relationship with the stressors and coping strategies with age, marital status, number of children, length of service experience, family and the place of work. However, all participants mentioned that race and religion do not have a relationship to stress and coping strategies, in contrast to international studies, which reported that there is a relationship.

Sample participants could not give a proper answer for the question of whether there were any similarities for stressors and coping strategies compared to government sector, education and non-government sector. Some participants mentioned that personal stressors can be similar.

Characteristics of workload and role overload were predominant throughout all interviews. Even though there were other stressors interpersonal strain was mentioned by women feeling guilty and bad for not being able to spend quality time with their spouse, kids and family and it was prominent among married women. This was one of the finding from a previous study where researcher mentioned that it was same among women in her research (Bernard P A, 2009).

Prominent coping strategy among seven women was that having a good social support, having a spouse, kids and parents who understand them and having a good support network at work as a team who will support and share work at any time.

In this study there was no significant relationship between race, religion when considering occupational and personal stressors and coping strategies in their current leadership position however few women said that being a woman is challenging in the Sri Lankan context as there were few women in the management level leadership positions, therefore it was difficult at times to work among men. According to a research conducted by Essed (1990) and Collins (1991) African American women have faced racial and gender discriminations, while having to be discriminated for socioeconomic status. This was not shown in the study which was conducted with seven women.

The seven narratives showed that there is some level of consistency and agreement with existing literature. Given the small sample size this equivalence is significant. However, it is not very clear whether these finding might be correct for a wider sample.

Conclusion

The following conclusions are based on the results of this study which was conducted with seven women who was in current leadership positions in corporate sector in Sri Lanka.

All seven women who were interviewed enjoyed their work and is a job which they have chosen. Although, the work load and responsibilities were high. This was significant finding as this was not reported in other research studies. Seven women who participated in this research had a challenge with work-life balance, however, most of them mentioned that they have a supportive spouse, family and friends as well as teams who understood them. While physical activities such as exercising, walking and running supported them to deal with work related stressors and personal stressors. Almost all seven women indicated a democratic leadership style which was more to be relationship oriented. Participants seem to build genuine bonds with their teams and understanding their challenges and to develop them.

This study revealed that there is a significant relationship related to stressors and coping strategies with the marital status, length of service, number of children and age.

Recommendations

One single small scale sampling study cannot provide adequate results for stressors and coping strategies for given stressors or identify the reason why women dropout without climbing the career ladder. Women must stop falling down their career while looking after the family commitments.

It is strongly recommended that a similar study should be carried out with a larger number of women and more representative sample and have a mixed approach of quantitative and qualitative methods to assure the validation of the study and to assure the accuracy of the results.

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ENTREPRENEURIAL INTENTION AMONG ADVANCED LEVEL STUDENTS IN COLOMBO DISTRICT, SRI LANKA: THE MEDIATION EFFECT OF ROLE MODELS

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Abstract

Entrepreneurship is not pursued as an attractive career choice by the Sri Lankans as they are more attracted to jobs. Entrepreneurial Intention (EI) of younger generation of the country is more crucial in this condition where they are the essence of the active citizen pool of the country. The main objective of this study is to find out the factors that affect EI of Advanced Level (A/L) students in Colombo District, Sri Lanka. The study includes three constructs discussed under the Theory of Planned Behaviour (TPB), which affect the EI of individuals. Further, the study efforts to identify the mediation effect of role models (RM) on the above factors when determining EI. A total of 376 students from schools in Colombo District, Sri Lanka participated in this study by responding to the structural questionnaire. Data analysis was done by correlation analysis, multiple regression analysis, and factor analysis. Findings of the study shown that attitudes towards Entrepreneurship (ATE), subjective norms (SN), perceived behavioural control (PBC) as well as role models are positively and significantly related with EI. The study also exposed that role models significantly mediate the relationships between ATE, SN and PBC with EI. Further, the study reflects that there is a positive effect on EI in terms of ATE, SN and PBC. Since Sri Lanka is having a critical issue with rising unemployment rates, self-employment is a respectable solution for the younger generation. This study adds value to the literature in the means of application of TPB in the context of Sri Lanka.

Keywords: EI; theory of planned behaviour; role models; advanced level students; mediation effect.

Introduction

Entrepreneurship is crucial to economic growth and progress, a little attention has been paid for research on factors which influence the intention of individuals to start new businesses and particularly the EIs of those who are still within the education system in Sri Lanka. Therefore, it is substantial to look at the factors influence EI in the early stage of individuals of the country and understand the possibilities of rebuilding the education system to create an entrepreneurial culture in the country. Although there are several studies on EI of university students, little has been given for secondary level school students. Since each age group of students relates to different psychological characteristics, it is essential to understand the specific needs of each age group [9] concerning the EI. With the aim of filling this gap the authors investigate the EI of Advanced Level students.

The TPB suggests that the intention which will pursue someone's behavior is affected and shaped by factors such as attitudes, subjective norms or perceived behavioral control.

Therefore, this study aims to achieve the following main objective; To find out the factors affecting Entrepreneurial Intention of Advanced Level students in Colombo District, Sri Lanka.

Sub objectives of the study are set as follows.

- To identify the relationship between Attitudes, social norms, behavioral control and Entrepreneurship and Entrepreneurial Intention of Advanced Level students in Colombo district, Sri Lanka.
- To identify the most influencing elements and mediating effects of role models which affects the Entrepreneurial Intention of Advanced Level students in Colombo District, Sri Lanka?

The research problem of the study is formulated as;

- “What are the factors such as attitude, social norms, behavioral control, and role models that have influenced the EI of Advanced Level students in Sri Lanka?” and following research questions has derived accordingly. What are the recommendations that can be suggested to improve Entrepreneurial Intention of Advanced Level students in Colombo District, Sri Lanka?

There are many arguments regarding a proper definition for entrepreneurship. Various scholars have defined the same concept by emphasizing different aspects of the concept [11]. However, for the purpose of this study, Entrepreneurship is regarded as the process of creating a creative and innovative product or business venture by taking a risk based on a proper identification of opportunities in the market place which will ultimately contribute to the economic development of a country. An Entrepreneur is the person who undertakes that entrepreneurial process by taking risk and ultimately contributes to the economic development.

EI is one approach to understand the entrepreneurial process and many studies have been showed that intentions could provide a significant direction towards selecting the type of business when they becoming entrepreneurs. For the purpose of this study, EI refers to the intention to engage in an entrepreneurial activity or start an entrepreneurial business venture as the future career by individuals.

Theory of Planned Behaviour

This Model considers human behavior as planned activity and therefore, being preceded by intention toward that behavior. The TPB suggests three conceptually independent determinants of intention: attitudes toward the behavior, subjective norms with respect to the behavior and perceived control behavior.

Explaining human behaviour is a difficult task [1]. Behavioural dispositions such as social attitude and personality traits are playing a crucial role when trying to predict the human behaviour. The TPB [1] can be used to explain the entrepreneurial behaviour which is the

result of EI of an individual. According to [1], intention is directly influenced by three independent determinants called;

- (i) Attitude towards the behaviour
- (ii) Subjective norms and
- (iii) Perceived behavioural control

Above three factors are directly affect a person's intention to execute a particular behaviour and [1] further discussed that this model can be applied in many areas of interest precisely when understanding certain behaviour. Under this study, TPB has been used to describe the entrepreneurial behaviour resulted in EI. TPB has been identified as an effective and influential model for studying and understanding EI ([5]; [8]; [9]). [6] bring out that entrepreneurship is a result of intentional and planned behaviour. Therefore, it is viable to investigate EI by using TPB.

In this setting, this study has formed following hypotheses:

- H1: There is a significant relationship between ATE and EI
- H2: There is a significant relationship between SN and EI
- H3: There is a significant relationship between PBC and EI
- H4: RM significantly mediate the relationship between ATE and EI
- H5: RM significantly mediate the relationship between SN and EI
- H6: RM significantly mediate the relationship between PBC and EI

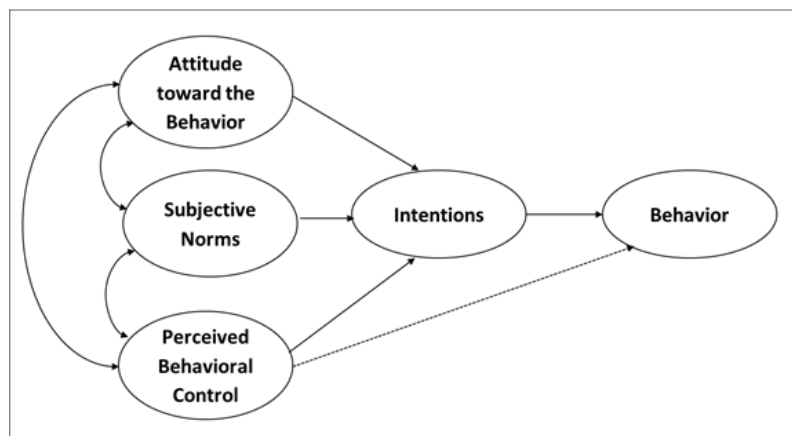


Fig. 1. Theory of planned behavior

Source: [1]

TPB and Entrepreneurial Role Models

Role models affect EIs largely because it affects attributes and beliefs such as perceived behavioral control. [6]

“Evidence from entrepreneurial role models supports the potential of intentions models for predicting new venture creation. Intentions explain conflicts in research findings such as the effects of role models and mentors on eliciting subsequent entrepreneurial behaviors” [6].

Entrepreneurial role models indirectly influenced EI through its backgrounds in the TPB [3]. Further, ATE, SN and PBC usually explain only 30 to 50 percent of total variance in EI and partial amount of the variance remains unexplained [3]. As well as the relationships among the variables are not consistent across different context and conditions. Neglecting the indirect effect of mediating and moderating variables may cause these limited explanatory power and the inconsistencies among various studies [11]. Based on these facts, the study incorporates a situational and sociocultural factor (i.e. RM) into the TPB model [3]. Accordingly, the aim of adding entrepreneurial role models to the TPB as an exogenous variable [3] is to study whether the extra variable could enrich the predictive ability of the original TPB model.

Advance Level Students

According to [24] Sri Lankan secondary education consists of two three-year cycles: junior secondary (Grade 6-8) and senior secondary (Grade 9-11). After completing the secondary cycle, students sit the General Certificate of Education (GCE) Ordinary Level (O/L) examination. According to the educational reforms implemented from 1998/99, the junior secondary cycle lasts four years (Grade 6-9). The last stage in the formal education system is the collegiate level, which comprises two years of schooling (Grade 12-13) leading to the GCE A/L examination.

Entrepreneurship in School Curriculum

Under the curriculum reforms implemented in 2007 the government introduced entrepreneurship as a separate and main subject of school curriculum called “Entrepreneurial Studies” for grade 10 and 11 at Senior Secondary level of the school education system in Sri Lanka. This has been introduced to the aim of having a drastic change in attitude of individuals through education, so that country can benefit from those individuals to gain socio-economic benefits in the future [4]. Students who study the entrepreneurship are expected to improve their capabilities in developing an entrepreneurial mindset.

Methodology

Conceptual framework provides the structure for the whole study based on literature. The researcher has adopted the integrative model of TPB based on Ajzen’s model as the conceptual framework for this study.

Fig. 2 represents ATE, SN and PBC the independent variables and EI as the dependent variable. The researcher has identified role models as a separate, independent variable

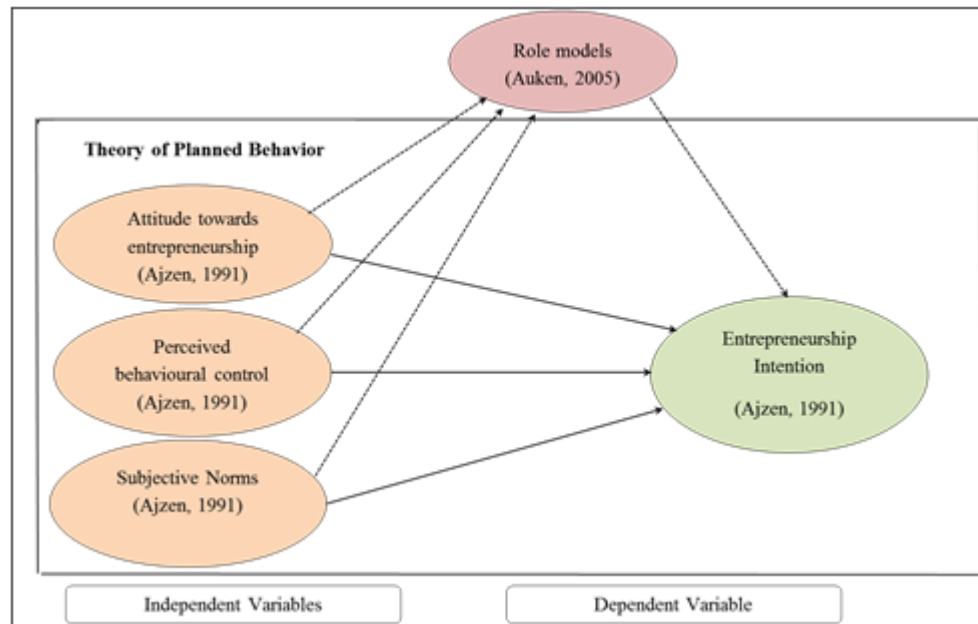


Fig. 2. Conceptual framework

Source: Adopted from [1] and altered by the authors

Results and Discussion

The summary of frequencies of respondents by their gender, grade, owning a family business and exposure to entrepreneurship education as a subject in their school life is summarized in the Table 1.

Correlation Analysis

Table 2 shows the correlation values and their significance at 0.01 levels (2-tailed test). The table shows that all independents variables are positively correlated with EI. Pearson correlation between EI and ATE shows a significantly strong positive correlation as its value is 0.684. Moreover, it shows that there is significantly moderate positive relationship between SN and EI as the correlation is 0.553. Similarly, the relationship between BC and EI is also a significant moderate positive relationship with a correlation value of 0.549. Accordingly, it indicates that the increase in positive aspects in ATE, SN and PBC tend to increase the EI of respondents under this study.

Table 11. Correlation between variables

Construct		EI	ATE	SN	PBC
EI	Pearson Correlation	1	.684**	.553**	.549**
	Sig. (2-tailed)		0.000	0.000	0.000
	N	376	376	376	376
ATE	Pearson Correlation	.684**	1	.434**	.574**
	Sig. (2-tailed)	0.000		0.000	0.000
	N	376	376	376	376
SN	Pearson Correlation	.553**	.434**	1	.404**
	Sig. (2-tailed)	0.000	0.000		0.000
	N	376	376	376	376
PBC	Pearson Correlation	.549**	.574**	.404**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	376	376	376	376

**Correlation is significant at the 0.01 level (2-tailed)

Source: Adopted from [1] and altered by the authors

Mediation effect of Role Models

Mediators are that kind of third variables which indirectly effect the relation between intendant variables (IV) and dependent variables (DV). Fig. 3 illustrates the path diagram for single mediator model.

Multiple regression analysis was run separately with mediator and without mediator in order to analyze the mediating effect and examination of differences of coefficients method [2] was used to analyze the indirect effect as shown in Table 3.

The approach indicates subtracting the partial regression coefficient derived through model 2 from the coefficient obtained through model 1.

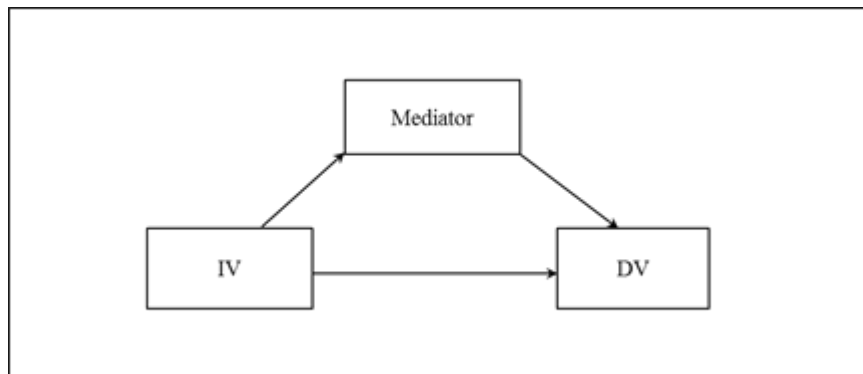
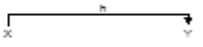
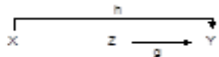


Fig. 3 Path diagram for single mediator model
Source: Compiled by the authors based on literature

Indirect effect of RM

The indirect effect can be calculated by subtracting partial coefficient values of model 2 from partial coefficient values of model 1. Table 4 represents the coefficient values of the variables with the effect of RM which are significant at ‘p values’ less than 0.05. Therefore, the RM has significantly mediated the relationships between ATE, SN, PBC and EI. As well as the relationship between RM and EI is also significant ($p < 0.05$). Analysis shows that RM has an indirect effect of minus 0.004 which is significant since the p value is less than 0.05. Further, RM has indirect effect on the relationship between SN and EI as well as the relationship between PBC and EI which are having positive values of 0.03 and 0.13 respectively. Both values are significant since the p values are less than 0.05. According to the Pearson correlation coefficient 0.684 with ‘p value’ < 0.01 it denotes that there is statistically significant strong positive correlation between ATE and EI. Therefore, the proposed relationship between ATE and EI fully supported with the empirical results of the study. Further, ATE has the most significant impact on EI of A/L students over the other factors since it has the highest correlation with EI among other factors.

Table 3. Judd and Kenny difference of Coefficients Approach
Judd and Kenny Difference of Coefficients Approach

	Analysis	Visual Depiction
Model 1	$Y = B_0 + BX + e$	
Model 2	$Y = B_0 + B_1X + B_2Z + e$	

X=Independent variable, Y=Dependent Variable

According to the results RM has mediate the relationship between ATE and EI, SN and EI as well as PBC and EI. The differences in the two regression models that ATE, SN and PBC predict EI with and without the effect of RM have showed that RM has statistically significant mediation effect on relationships between EI with ATE, SN and PBC. RM has positively affected the relationship between SN and PBC with EI whereas RM has negatively affected the relationship between ATE and EI. Previous studies of [36, 22] have supported the findings of this study showing that RM has mediate the three antecedents in TPB. However, the negative mediation effect of RM on ATE when determining EI under this study is controversial with the results of [3] since in that research all three predictors of TPB will positively mediated by RM.

Variable	Standardized Coefficients (Beta)		Indirect effect	Sig
	Model 1	Model 2		
ATE	0.465	0.469	-0.004	0.000
SN	0.284	0.254	0.030	0.000
PBC	0.168	0.155	0.013	0.000

Conclusion

Findings of the study reflect that there is a positive effect on EI among A/L students in Colombo district, Sri Lanka, in terms of ATE, SN and PBC. Since Sri Lanka is having a critical issue with rising unemployment rates, self-employment is a respectable solution for the younger generation of the country. Moreover, educators and policy makers can enhance the attitudes of students regarding entrepreneurship by paying more attention on curriculum designing with incorporating entrepreneurial attributes to them. Teachers of schools have to play an important role in creating entrepreneurial culture within the country. They can educate students about entrepreneurial careers as possible and high earning alternatives for jobs in the future. Further, the government, government organizations, non-government organizations and society at large have a responsibility to perceive entrepreneurship as an engine to economic success. The study has contributed to theoretical and methodological literature by studying mediation effect of RM with the TPB in Sri Lankan context.

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**EFFECT OF PARENTAL EMOTION REGULATION AND PARENT-CHILD
ATTACHMENT ON SRI LANKAN ADOLESCENTS' EMOTION REGULATION
ABILITY**

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Abstract

The main objective of the study was to assess whether parental emotion regulation (ER) parent adolescent attachment and temperament on adolescents' ER ability among a sample of adolescents and their parents in the Colombo Educational Zone. The cross sectional survey was conducted with a sample of 233 adolescents of the 12-14 age groups and their parents. The adolescents completed the Difficulties in Emotion Regulation Scale (DERS) and the Inventory of Parent and Peer Attachment-Revised (IPPA-R) –parent subscale (IPPA-R) and the parents completed the DERS and the Abbreviated version of the Dimensions of Temperament Survey-Revised (ADOTS-R). A significant positive relationship was found between both mother ($r=.305, p<0.01$) and father's ($r=.377, p<0.01$) emotion regulation difficulties and adolescent's emotion regulation difficulties. A significant negative relationship was also observed between attachment towards mother ($r=-.220, p<0.01$ and father ($r=-.233, p<0.01$), and adolescent's emotion regulation ability. The regression analysis indicated that parental emotion regulation difficulties and parent-adolescent attachment were predictive of adolescent emotion regulation difficulties.

Key Words: Adolescents, Attachment, Emotion Regulation, Temperament

Introduction

Emotion regulation (ER) is defined as the internal and external processes involved in initiating, maintaining and modulating the occurrence, intensity and expression of emotions (Thompson 1994, 27). Difficulties in ER has been identified as a common symptom of different psychopathologies, low academic performance, deviant behavior and low self-esteem (Petrides, Frederickson and Furham 2004, 275). In Sri Lanka, previous research has found both a low level of ER skills (Jayasekara et al 2014, 16), a high frequency of self-reported emotional problems among university students (Kathrarachhi 2001, 198) as well as a high prevalence rate of reported emotional abuse during late adolescence: 31.3% male 25.4% female adolescents (Perera, Ostbye, Ariyananda & Lelwala 2009, 13). Lack of maternal attachment has been seen to be a risk factor for emotional abuse among the youth in Sri Lanka (Fernandopulle 2000,).

Parental ER ability has been found to play a major role in the ER ability of the child. One manner in which a child's ER can be enhanced is found to be through the enhancement of a parent's ability to self-regulate (Sanders, 2008; Sanders and Mazzucchelli, 2013). Parent child attachment is another mechanism that aid in overriding developmental psychopathology even with children who have a difficult temperament (Barros, Goes & Pereira 2015, 299).

The type of culture the person belongs to i.e. whether it is independent or interdependent also influences the motivation to regulate emotions. The need for ER is given more emphasis in

interdependent cultures like Sri Lanka as opposed to independent cultures such as Europe. Despite this emphasis, there is also a high prevalence rate of poor life skills such as low self-awareness, an inability to cope with emotions and stress, and a lack of empathy among Sri Lankan youth (UNICEF 2004, 2).

For the Sri Lankan school going adolescent, family is a major factor in promoting psychosocial wellbeing. Sixty percent of the adolescents consider their family to be close to them and fifty percent consider their family to be a refuge for their problems (UNICEF 2004, 4). Therefore family based interventions are more likely to be effective in terms of promoting psychosocial wellbeing of adolescents.

Most previous research conducted related to emotional dimensions in Sri Lanka have largely focused on the topic of emotional abuse (Perera, 2009; Fernandopulle, 2000). These researches have also emphasized the need to implement strategies directed at parents to prevent emotional abuse (Fernandopulle 2000). Moreover, most research investigating familial influence on ER has focused on childhood (Morris 2007, 385). Furthermore, the influence of paternal ER has not been explored extensively (Morris 2007, 386). Therefore this research focused on both parents' influence on the ER of an adolescent sample.

The main objective of the study was to explore the relationship between parental ER, parent-adolescent attachment and an adolescent's ER.

Methods

A sample of 233 (Male=144, Female=89) school going adolescents between the age group of 12-14 (Grades 7, 8 & 9) and their parents (Male=136, Female=213) participated in this study. The sample was selected through convenience sampling. The adolescents were accessed from type AB, type C and type 2¹ schools in Colombo Educational Division. Each adolescent had at least one parent responding to the parental ER questionnaire. The parents were accessed during the parent teacher meetings. Parental consent was gained and the parents were also asked to fill in the questionnaire measuring their ER abilities. After the parents returned their questionnaires to the class teacher, the students were accessed on a separate day to fill out their set of questionnaires. The parent-child pair was identified and matched through the use of a coding system to ensure anonymity.

The Difficulties in Emotion Regulation Scale (DERS) (Gratz, 2004) and the *Inventory of Parent and Peer attachment-revised-Parent Subscale* (IPPA-R) (Gullone, 2005) were used for the study. The content and consensual validity of both scales to the Sri Lankan context were ensured prior to administration. Correlational and regression analysis were the main analysis techniques.

Results

A significant positive relationship was found between both mother ($r=.305, p<0.01$) and father's ($r=.377, p<0.01$) emotion regulation difficulties and adolescent's emotion regulation difficulties. A significant negative relationship was also observed between attachment towards mother ($r=-.220, p<0.01$) and father ($r=-.233, p<0.01$), and adolescent's emotion

¹ Type AB-Science A/L only with non-Science A/L, Type C-Non-Science A/L only, Type 2-Year 1-11 classes only

regulation ability. Father's emotion regulation ability and father-adolescent attachment was more predictive of adolescent emotion regulation difficulties than mother's emotion regulation ability and mother-adolescent attachment. The regression analysis indicated that parental emotion regulation difficulties and parent-adolescent attachment were predictive of adolescent emotion regulation difficulties.

Discussion

The first hypothesis of this study was found to be true as there was a positive relationship between parental ER and adolescent ER(Mother: *pearson* $r(208)=.305$, Father: *pearson* $r(122)=.377$). This finding was concordant with previous research findings (Eisenberg&Morris, 2002). However, contrary to previous research that found mother' ER ability to have a higher impact on adolescents' ER ability, the present study finds that, fathers' ER abilities had a greater impact on the adolescents' ER abilities(Father: $\beta=0.32, p<0.01$, Mother: $\beta=0.823, p=.526$). This finding was similar to the findings of Zeman and Garber (1996, 960).

The patriarchal nature of the Sri Lankan family could be one reason as to why the father's ER ability had such a significant impact on adolescent ER ability. Moreover, in the present sample, mothers were seen to exhibit significantly higher ER difficulties than fathers ($M=89.19, SD=18.08, r(329)=2.755, p<0.01$). This could partly be due to the fact that emotional displays are more accepted in a female than a male. Males are expected to suppress their emotions. Hence, potentially, father's playing a larger role as an emotion socialization agent might serve as a protective element promoting ER ability in Sri Lankan adolescents. This has been seen in previous research where if the father has a more stable attachment relationship with offspring, they are in turn more likely to transmit similar attachment patterns (Cowan and Cowan 2005, 282) towards their fathers. This also emphasizes the need to incorporate paternal ER training when implementing therapeutic interventions for adolescents with ER difficulties. In the current context, it is the mother who most often brings a child to mental health services. The need to incorporate the father in to this is highlighted through this research.

Adolescents of middle and lower socio economic status (*SES*) were seen to have more ER difficulties (Middle *SES*: $M=93.12, SD=18.12$; Lower *SES*: $M=103, SD=10.34$) than adolescents from higher *SES* ($M=86.93, SD=19.48$). This emphasizes the need to initiate parent and adolescent based ER interventions in type C and type 2 schools where there is a higher concentration of adolescents of middle and lower *SES*.

Findings from the current study indicated that there was a negative relationship between quality of parent child attachment and ER difficulties (Mother: *spearman* $r(225)=-.220$, Father: *spearman* $r(219)=-.233$). When considering attachment to mother and father separately, father's attachment($\beta=-.277, p<0.01$) was seen to be more important in predicting ER ability in the adolescents than attachment towards mother($\beta=.059, p=.629$). This was in contrast to previous research findings. Therefore interventions focusing on parent-adolescent attachment enhancement will benefit adolescents at risk of ER difficulties (Marvin, Cooper, Hoffman and Powell 2002, 122).

Conclusion

In conclusion external familial factors such as parental ER and quality of parent child attachment were found to be important influencing factors in the development of adolescent ER. These findings support the need to implement programs that target enhancement of parental ER and quality of parent-child attachment with a special focus on fathers as a method of improving adolescents' ER ability.

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GENDER DIFFERENCES IN SHORT MEMORY AMONG UNDERGRADUATE STUDENTS AT ICBT CAMPUS

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Abstract

Objective:

Previous researches conducted in this domain have shown contradicting findings, therefore, needs to be clarified. This study aims to comprehend the impact gender has in short term memory in both verbal and numeracy aspects and address the stereotypes circulating this gender difference.

Methodology:

A quantitative research via experiment was done under deception whilst gathering participants using volunteering sampling. The sample size was 100 Sri Lankan students, 50 males and 50 females, at ICBT Campus ranging in the age of 18 to 25. A list of 10 words and numbers were shown in two separate sessions for the participants to recall after a one minute video to distract them.

Conclusion:

The researcher hypothesized that males are better at remembering numbers and females are better at remembering words. Hence, alternative hypothesis was rejected and null hypothesis was accepted that there was no gender difference in short term memory in both verbal and numeracy aspects.

Keywords

Gender, Gender difference, Short-term memory

Introduction

Since early history, there have been ceaseless controversies on whether it is males or females that play the dominant role in various domains such as intelligence, creativity and even memory. Along with the controversies, stereotypes about gender differences circulate and are communicated down generations using media, marketing, society, language and culture as a vehicle. Some of the stereotypes are that females are better at verbal tasks and males are better at numeracy (The Guardian, 2013).

Stereotypes have shown to play a major role in life. The moment a baby is brought into the world, he/she is immediately assigned into a life of stereotypical gender identity with boys being wrapped in blue and girls in pink. They are treated differently and given toys according to their sex and this continues throughout. Eventually it becomes embedded within them and the society, in turn, influencing everyday life (e.g. stereotypes that men fix things and women do grocery shopping) including memory. These stereotypes have shown to predict the child's perception of their abilities (Bouchey and Harter, 2005) which have also discouraged women from persisting careers in mathematics and engineering.

In order to address these stereotypes and unravel the myths regarding gender differences in short term memory in both verbal and numerical aspects, an experiment was carried out at ICBT Campus among undergraduate students to investigate this very notion.

Short term memory is also referred to as the brain's post-it note or scratch pad as it has a limited capacity store which is capable of maintaining unrehearsed information for less than one minute. Whatever we think at this instant is in our short term memory. This memory is

used to carry conversation, solve a problem or look up a telephone number long enough to dial it up.

Through this study, people will be able to use their gender to their advantage when grasping and communicating information. Furthermore, this will help students understand how they can use their gender to their advantage whilst learning and opting career paths.

Methodology

The experiment's sample size included of 100 Sri Lankan ICBT students, 50 male and 50 females ranging in the age of 18 to 25 as this is the average age range that most students enter undergraduate courses in private institutions. This study was done under deception which means that they were not told that the experiment was based on short term memory as this would affect the experiment. Therefore, participants were informed that the research title was "Investigation of Language Skills among Undergraduate Students". If the participants were informed that their memory was being tested, there was a possibility that they would focus better and will be naturally tempted to process the words thoroughly. Andrade and May (2004) assume that when participants are aware that it is a memory task, they visualize the words faster rather than use their verbal short term memory; therefore, they remember the written form or visualize the text. Therefore, the most likely way to study short term memory is by catching the participants unprepared and unaware that they will be tested on the list of words and numbers.

The experiment was broken down into two sessions and carried out in groups of 20 (10 males and 10 females). The first session was to test the verbal short term memory by showing them list of 10 unrelated words and then shown a one minute video to prevent them from recalling the information, or it would be encoded in the long term memory. They were then given a paper to write the list of words that were shown to them previously. Similarly, the second session was tested with a list of 10 numbers to test the numerical short term memory. A similar experiment was done by Kumar, Jissa and Mukkadan (2013).

Whilst conducting the research, attempts were made to dissuade participants from guessing what the experiment requires them to do by using statements such as, "Please watch the video carefully as there will be questions from them" as the participants may focus on rehearsing the words and numbers from the slide which would then be investigating long term memory instead. After the experiment, a briefing session was held to reveal the true purpose to the experiment and explain the reasons behind the deception.

The data collected was analyzed using SPSS. The mean of two independent groups can be compared to assess whether they are statistically different from each other by using the independent sample t-test (Peers, 2006). This study involved carrying out two independent sample t-tests for comparing means of each gender in relation to the words recalled and numbers recalled to assess whether the independent groups (males and females) were statistically different from each other in relation to each aspect.

Results

Table 12 Group statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
No. of recalled words	Male	50	5.660	2.210	.312
	Female	50	6.280	1.565	.221
No. of recalled	Male	50	8.080	1.759	.249

numbers			Female	50	8.400	1.370	.194			
Table 13 Independent Sample t-test										
			Levene's Test for Equality of Variances		t-test for Equality of Means					
			F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval Difference
									Lower	Upper
No. of recalled words	Equal variances assumed		6.868	.010	-1.619	98.000	.109	-.620	.383	-1.380 .140
	Equal variances not assumed				-1.619	88.292	.109	-.620	.383	-1.381 .141
No. of recalled numbers	Equal variances assumed		2.872	.093	-1.015	98.000	.313	-.320	.315	-.946 .306
	Equal variances not assumed				-1.015	92.454	.313	-.320	.315	-.946 .306

As shown above in Table 1 and 2, there was no significant difference found ($t(100) = 1.619$, $p > .05$) in the number of words recalled by each gender. Likewise, there was no significant difference was found ($t(100) = 1.015$, $p > .05$) in the number of numbers recalled by each gender

Discussion

In consistent with Hyde and Linn (1988)'s meta-analysis and Goldstein, et al. (2005), this experiment also found that there was no existence of gender differences in short term memory in both verbal and numerical aspects which means that there was no superior gender dominating the verbal and numeracy domains. However, this was contradictory to the other research findings from Colley, et al. (2002) and Kumar, et al. (2013) that either females were apt at remembering words and males were apt at remembering numbers or that females had a better short term memory. These researchers assumed that biology is the reason behind this. There have been myths persistently circulating that there is a fundamental difference between men's and women's brains and that it is these differences that make one gender superior over the other in various aspects such as verbal and numerical ability. Recent breakthrough researches such as a 2015 study by researchers from Israel, Germany and Switzerland have dismissed these myths by examining 1400 people in terms of their composition and found that a very minor percentage clustered on the extreme ends of the gender spectrum of features that is "supposedly" male or female. There were some presumed features more common in females and males but majority of people clustered in the middle of the spectrum having a mosaic of these features. (Joel, et al., 2015) This means if there is supposed to be an existence

of differences then people should have absolutely only male or female characteristics not a mixture. There are sensitive men and belligerent women; callous women and emotional men. There is no typical male brain or female brain; one should appreciate the variety of the brain rather than categorizing brains as classes. It's just a mosaic of supposedly society defined "masculine" and "feminine" features that make us who we are.

Furthermore, a meta-analysis of 56 separate studies conducted by Eliot, et al. (2016). 6,726 MRIs were investigated and it was found that men's brain are indeed 10 percent larger than women's but emphasized that it corresponds to men's larger body size. This means that as men are 10 to 12 percent larger than women, therefore, their brain volume is proportional to their size difference. Bigger brain size doesn't mean men have higher IQ as according to a study of 45,000 brain scans that found no difference in the IQ of males and females regardless of brain size. Moreover, cortical thickness was found to be positively correlated to intelligence and this was found greater in females. However, researchers stress that these differences are probably to compensate for the smaller brain size and make them equal to the overall cognitive abilities of males. (Amen, 2013)

Although it was found that the hippocampus was found averagely larger in males, there were some females with a larger hippocampus and some males with a smaller hippocampus compared to an average female's (The Guardian, 2013). Chaddock, et al. (2010) found that greater the physical fitness, the bigger the hippocampus is leading to performing better at memory tasks. This means that hippocampus is flexible to change and not hardwired according to gender.

Currently, neuroscientists are beginning to speculate that the males and female brains are much similar than once assumed. Consequently, all the differences either disappear or are trivial (Eliot, et al., 2015) and these findings including the present study could possibly alter how society defines gender.

Regardless of the unceasing stereotypes in reference to gender, the present findings break the stereotypes that have persistently discouraged both genders from pursuing careers that is believed to be either a female or male domination. McCarthy (as cited in New Scientist, 2015) puts forward that people are hooked into the idea that being a "female" or "male" highly predicts their different aptitudes or career choices. Williot stated that gender stereotyping as children in ways such as girls given dolls to take care and boys given toys that challenge them, force women into caretaking professions that pays less and require less time as they have other caretaking responsibilities at home. This is why there is an over representation of females among nurses and men among CEOs, engineers and physicists. Men can be excellent caregivers as well if the environment gives them the push to be so (Telegraph, 2014).

Duetsch (2007) attests that ideologies are drawn by people on what it means to be a man or woman and it's apparent that people act consciously fully aware that they are judged according to what's supposed to be appropriate behaviour (Deutsch, 2007). The society expectations that males have better numerical ability and women have better verbal ability make people fulfill these expectations.

Interestingly, recent evidence shows that the brain structure and function alter in response to experience, therefore, any observed differences in the brain structure of males and females is due to differences in the upbringing and socialization (The Guardian, 2013). This means that

the brain is flexible to change throughout lifetime, therefore, with continuous use the muscles get larger. Although there may be psychologically or biologically differences in brain anatomy and physiology between males and females, this is not hardwired.

Hence, this research finding implies that both males and females are equally adept at verbal and numeracy aspects and that there is no need of hesitating in pursuing career choices and education. If both genders are given equal opportunities and encouragement in the education and career settings, both genders will be able to thrive in whatever they feel is their identity. Cognitive differences are not entirely inherited but are learned from what the society expects how each gender performs and can change when society changes.

Conclusion and Recommendations

As the sample size consisted of 100 participants and focused only on ICBT students in Sri Lanka, in order to generalize it to the general population, more participants need to be taken and be able to represent Sri Lanka's population. Moreover, the words and numbers used in the test could be more varied, longer and moderately difficult. As there was a risk that participants may not take the experiment seriously and turn up on two different days for two separate sessions, the study was done on the same day and time frame. It would be much better if it's done on two different days to minimize the risk of participants from guessing what the study requires them to do.

As previous researches have suggested, individual traits, preferences, careers choices, experiences and social learning can affect short term memory, this study had taken only Sri Lankans to keep the culture variable constant. The different findings of other researches may have been due to cultural difference but unfortunately, to compare the present findings, there were no studies in relation to short term memory conducted in Sri Lanka. Although, it is difficult to gather participants who have had similar experiences, effort should be taken to keep the variables constant in future researches as it's made quite clear that the brain is flexible to change with experiences regardless of gender. Future study could also gather a large sample with a wide age range to determine and clarify the interaction of gender and age in relation to short term memory.

It was hypothesized that males are better at remembering numbers and females are better at remembering words. The results have shown that the mean of the recalled numbers and words by males was not significantly different from the mean of the recalled numbers and words by females. Hence, alternative hypothesis is rejected and null hypothesis is accepted that there is no gender difference in short term memory in both verbal and numeracy aspects. Although, different studies have found different results, these findings are strongly supported by both previous and up-to-date studies. However, these findings could be more solidified and validated with future research on a larger scale, taking the limitations and improvements into consideration.

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SOCIAL MEDIA INFLUENCE ON SRI LANKAN YOUNG ADULTS' SENSE OF SELF-EXPRESSION

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Abstract

This study explores the influence of social media on Sri Lankan young adults' sense of self-expression. Bearing in mind the basic psychological needs to belong; the highly Westernized concept of self-expression was investigated in a collectivist culture. Through ten in-depth interviews, this study examines how self-expression and creativity was encouraged on social media platforms along with the types of social media they chose to express themselves through. Results of thematic analysis reveal two main themes: young adults' self-expression through development of self and with regard to others. Identity construction, fulfilment of the need to belong, the relevance of a particular social media and the creation of content is addressed with regards to self-development; while self and social image, personal voice and the influence of culture is explored in relation to social interaction. Findings from this study, which had never previously been explored in Sri Lanka, provides an understanding into the behaviour of young adults' in a collectivist culture across social media platforms and provide insights for future investigations and interventions related to practices of young adults on social media.

Keywords

Self-expression, Social media, Sri Lanka, Young adults

Introduction

The term 'self', broadly taken, is stated to be in accordance to the concept an individual has of themselves as a physical, social and moral being (Hattie, 2014). It is from this concept of 'self', that the concept of 'self-expression' extends. Self-expression is understood to mean the conveyance of an individual selfhood, through thoughts, preferences and distinct personality traits (Kim & Sherman, 2007; Kim, 2010) in is seen in a person's speech, behaviour, ideas and emotions and especially in relation to creative expressions. Self and by default self-expression is said to be "malleable" which causes self-expression to be fluid in nature.

1.1 Theoretical framework

1.1.1 Self and changes to self

With the commencement of the digital era, 'self' has changed drastically to fit the virtual frame. Today, young adults' identity construction – both physical and virtual – occurs through social interactions and the profiles that they create online. This is because self-identity is an individual's opinion of oneself and includes both personal and social identities (Stryker, 1980; Tajfel, 1981).

1.1.2 SNS and identity construction

As the digital era commenced, however, this concept of 'self' changed drastically. This is mainly through Social Networking Sites (SNS) or social media as it is generally known. SNS usage is found to cause changes to self-concept in individuals (Jones, 2015). Today, young adults' identity construction – both physical and virtual – occurs through social interactions

and the profiles that they create online. Gündüz (2017) states that SNS enable identity expression, exploration and experimentation. Livingstone (2008) explains that SNS is a tool that youth use to ‘self-display’.

1.1.3 Social belongingness on SNS and its manipulation

Points of self-identity and social belongingness also come into play here; with ‘belongingness’ being increasingly sought after online by young adults through pursuing like-minded online communities.

SNS are notoriously reputed for being ‘time wasters’ – and this is because they are. In fact, major SNS such as Facebook were designed with the ability to “consume as much of [an individual’s] time and conscious attention as possible” (McCarthy-Jones, 2018) by manipulating vulnerabilities in the human psychology. These vulnerabilities are two-fold: the need to belong and the desire for social status.

1.1.4 Self-expression, individuality and social political participation

The desire for social status has been used by businesses as a foundation for their marketing strategies as, often, individuals will purchase products which suit their self-image (“one’s conception of oneself or of one’s role” – Merriam Webster) and as a means to express their personal identity (Cătălin & Andreea, 2014). Products purchased (for example: branded products) are used to create, develop and maintain their identities.

Similarly, SNS are also used as platforms for mass communication. SNS is a channel for global change which not only creates noise but creates noise which provides an effect (Sharma, 2014).

1.1.5 Social media and narcissism

Claims of narcissism is also high as one key factor that is pushing young people towards the direction of narcissism is the internet (Twenge, 2009). This is because the internet, through SNS, constantly promotes young people to present the minutiae of their everyday lives. This has created an epidemic of narcissistic tendencies.

1.1. 6 Social media in a cultural context

With regards to culture, ‘self-expression’ is given a clear distinction. While self is paramount in Western cultures (Kim & Sherman, 2007); the same cannot be said for Eastern cultures. Individualism is rooted deep in the West whereas in Asian countries, however, collectivist cultural values have been protected and obeyed for generations.

1.2 Research objectives

With regards to Asian cultures, at present, it remains unclear how contemporary Sri Lankan young adults’ sense of creativity and self-expression is impacted and in turn influenced by different types of social media. Following research questions were examined:

RQ1: What particular types of social media do young adults choose to express themselves through?

RQ2: How does social media encourage self-expression in youth?

RQ3: How does social media encourage and nurture creativity on-line as well as off-line?

RQ4: What are the perspectives of young Sri Lankans, whose culture is collectivist, on social media and how it helps translate their sense of self-expression?

Methodology

A qualitative research design was employed in order to gain more expansive information than that which will be afforded with a quantitative method considering the open nature of the research topic. Ten Sri Lankan young adults between the ages of 18 and 25 were interviewed for the study. A convenience sampling method was used with an equal distribution of males and females in the sample – 5 boys and 5 girls. Semi-structured interviews were carried out, with the introduction and conclusion for each interview being standardised for all participants.

Table 1: Demographic characteristics/social media details of the participants

<i>Participant Number*</i>	<i>Gender</i>	<i>Age</i>	<i>Current education level</i>	<i>Facebook</i>	<i>Instagram</i>	<i>Snapchat</i>	<i>Other</i>
1	F	21	Masters in Marketing	■	■	■	
2	F	23	Bachelor of Arts in Fashion Design	■	■		
3	M	23	Bachelors in Air Transport Management	■	■		YouTube
4	F	21	Bachelors in Marketing and International Business	■	■	■	
5	F	19	Higher National Diploma in Psychology	■	■		
7	M	24	Ordinary Level examinations	■	■		Twitter
9	M	20	Advanced Level examinations	■	■	■	
10	M	21	Bachelors in Accounting	■	■	■	LinkedIn
11	F	22	Bachelors in Economics	■	■		
12	M	20	Bachelors in Economics and Mathematics	■	■	■	

The study protocol consisted of face-to-face interviews with the participants. The interviews were conducted in English and lasted 15 to 50 minutes ($M=26.4$). Interviews were recorded using mobile phones and were later transcribed into written form using Microsoft Word.

A thematic-analysis approach was used to analyse the data findings. Braun & Clarke's (2006) comprehensive, six-step guide to thematic analysis was used as a framework in analysis. This consisted of a coding process (phase 1 & 2), which were then grouped into themes (phase 3). The themes were honed (phase 4), finalized with sub-themes (phase 5) and written up in the report (Phase 6).

Results

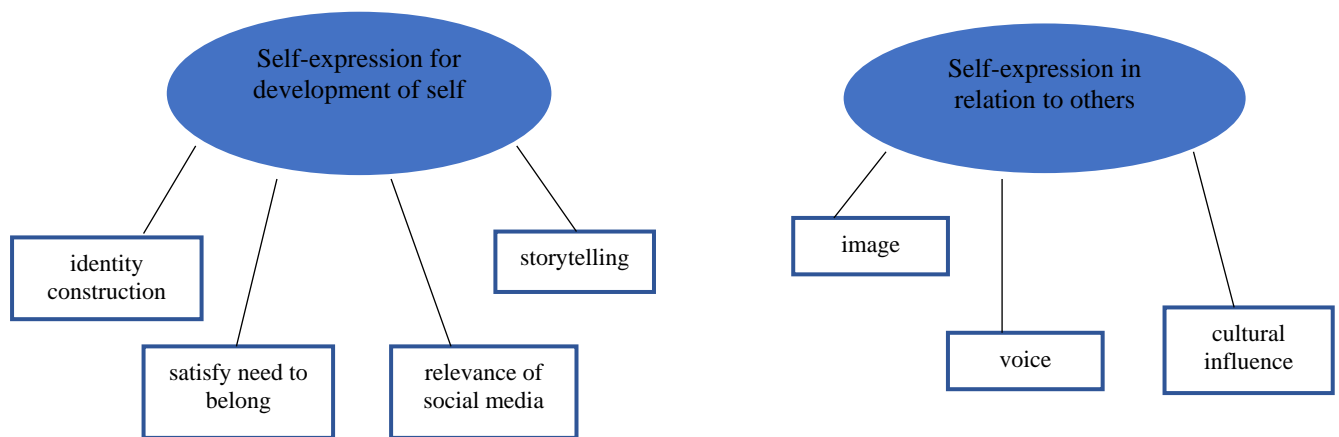


Figure 1: final thematic map, showing final two main themes

Data analysis revealed two main themes (Figure 3): Self-expression for development of self and self-expression in relation to others. The first theme addressed how participants express themselves on SNS for purposes of self-growth through four subthemes: through *identity construction*, *satisfy(ing) need to belong*, *relevance of (the) social media* and *storytelling*. The second theme presented participants' expression on SNS and how it linked to their interaction with others through three sub-themes: through creating an *image*, a *voice* and with regard to *cultural influences*.

Discussion

Among Sri Lankan youth, self-expression is cultivated as a voice in a creative, collaborative and communicative manner. The ability of young adults' to grasp the abstract concept of the research question coincides with the cultural context: self-expression is a highly Westernized concept (Kim & Sherman, 2007); whereas, this study was conducted in the East. Varying levels of difficulty is therefore seen in the young adults when answering the questions, which tie with collectivist Sri Lankan.

A positive correlation between an individual's popularity on SNS and the pressure they experience to maintain a certain image is found. This creates a false "back into high school" environment (Colier, 2014). Young adults' acknowledge that the image they have created for themselves online is a mask. It is created for purposes of a) protecting their true selves, b) experimenting with their identity and c) as a form of escapism. Social image (Tajfel, 1981) is another concept young adults' implement, as their interactions online differ/are similar to

their interactions offline. Interactions vary according to the audience that views the content they share.

Three perspectives in young adults' comparison of the East and West is found: a) those who favour the values of the collectivist culture, b) those who reject Sri Lankan culture and prefer Western ideologies, and c) those who are comfortable with the Sri Lankan culture but wish to implement certain Western concepts (such as creating more avenues for self-exploration) to help in the progression of Sri Lankan culture. SNS also promotes self-comparison and jealousy in both the real and virtual world (Boyd, 2014), and are heightened due to the accessibility, intensity and ease with which comparisons could be made in the virtual world.

The frequency and type of content created by the young adults have a positive correlation to the feedback they receive from others which echoes the theory of operant conditioning (Skinner, 1972) where individuals react positively to rewards that they receive as a result of a particular behavior. Higher rates of social anxiety in regards to compliance with cultural norms have been found in collectivist cultures (Schreier et al., 2010) which is exhibited among the young adults' through their intense fear of social judgement and rejection.

Conclusions and Recommendations

This study reveals how young adults use self-expression as a means of developing self and also interrelationships with others. The study provides a deeper understanding on how the use of SNS can impact character development and creative self-expression, combined with rich insights into Sri Lankan cultural contexts. It adds to the existing literature by exploring the implications of satisfying the basic psychological need to belong, how an image is built and how a voice is created through SNS. The insights from this study, which had never previously been explored in Sri Lanka, are useful in understanding the underlying meanings behind young adults' behaviour across social networking platforms and can be used as a reference or guiding tool for further research investigating practices of young adults on social media.

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